

Prado, Tiago S.

Conference Paper

Assessing the Market Power of Digital Platforms

23rd Biennial Conference of the International Telecommunications Society (ITS): "Digital societies and industrial transformations: Policies, markets, and technologies in a post-Covid world", Online Conference / Gothenburg, Sweden, 21st-23rd June, 2021

Provided in Cooperation with:

International Telecommunications Society (ITS)

Suggested Citation: Prado, Tiago S. (2021) : Assessing the Market Power of Digital Platforms, 23rd Biennial Conference of the International Telecommunications Society (ITS): "Digital societies and industrial transformations: Policies, markets, and technologies in a post-Covid world", Online Conference / Gothenburg, Sweden, 21st-23rd June, 2021, International Telecommunications Society (ITS), Calgary

This Version is available at:

<https://hdl.handle.net/10419/238048>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Assessing the Market Power of Digital Platforms

Tiago S. Prado

Department of Media and Information
Quello Center for Media and Information Policy
Michigan State University

Paper prepared for presentation at the
International Telecommunications Society (ITS) Biennial Conference
Gothenburg, Sweden, June 21-23, 2021

DRAFT. FOR PURPOSES OF DISCUSSION.

East Lansing, Michigan, June 11, 2021

ABSTRACT

In this conceptual paper, I propose a framework for measuring the market power of digital platforms. The rise of big technology companies that act both as intermediary platforms and providers of services and goods in several markets has heightened concerns about potential economic harms brought by the concentrated structure of the digital economy. However, the operationalization of market power in the platform economy and the procedures to define which digital platforms and markets should be targeted by pro-competitive remedies, either under a competition policy framework or under a regulatory regime, remain highly contested. I demonstrate that large technology platforms can leverage their market power across markets in the digital economy to make their end users unlikely to switch to smaller competitors, even when they offer better services. Based on this analysis, I argue that market-specific approaches, such as the commonly used Significant Market Power (SMP) framework, would have limited impact in promoting competition in digital markets. I then propose a new set of tools aimed to identify the market power of digital platforms in two-sided markets and suggest some policy alternatives to harness the potential of pro-competitive remedies in the digital economy.

Keywords: digital platform, digital economy, market power, competition policy, regulation.

JEL Codes: L.12; L.13; L.41; L.44; L.51

Assessing the Market Power of Digital Platforms

1. Introduction

The internet has had positive impacts on competition, investment, and innovation in many industries. However, the rise of big technology companies, such as Google, Amazon, Apple, Microsoft, and Facebook, that act both as intermediary platforms and providers of services and goods in several markets, has heightened concerns about potential economic harms brought by the concentrated structure of the digital economy. Such developments have motivated scholars and governments from around the world to discuss pro-competitive remedies aimed to ensure that the digital economy continues to generate high and long-lasting levels of investments and innovation to support economic development and welfare increases (Crémer et al., 2019; European Commission, 2020a; U.S. House., 2020; U.K., 2020).

The list of anti-trust cases opened to investigate potential anti-competitive practices of the big tech firms (“big techs”) is extensive (Just, 2018). An additional point of concern has been the large number of early-stage startups acquired by big techs in recent years. Khan (2017) argues that a revision of competition law is needed to empower competition authorities with newer, more agile, and effective tools to combat competitive misconduct of digital platforms. On the other hand, Wheeler et al. (2020) argue that the lengthy battles fought between U.S. and European competition authorities and the big techs in the last decade have demonstrated the limitations of purely *ex-post*, anti-trust remedies to foster competition in the platform economy.

As an alternative to traditional competition policy remedies, some authors have proposed the adoption of more flexible and fast-paced *ex-ante*, regulatory remedies over dominant platforms to reduce barriers to entry and ensure a healthy environment for innovation and opportunities in the platform economy (CMA, 2020). Aligned with this view, some have

identified the framework of “significant market power,” widely used in electronic communications regulation, as a starting point for defining market power in the digital economy (Furman, 2019; European Commission, 2020a).

However, the operationalization of market power in the platform economy and the methods to define which digital platforms and markets should be targeted by pro-competitive remedies, either under a competition policy framework or under a regulatory regime, remain highly contested. For example, Morton et al. (2019) and Furman (2019) argue that the traditional conceptualization of market power, which relates to the capacity of a firm to increase and sustain prices above the competitive equilibrium, needs to be re-defined in the context of digital markets. In these new markets, retail prices are mostly zero. Competitive advantages and entry barriers are created by the accumulation and ownership of customer data as well as information about complementary players.

In this conceptual paper, I examine the forms and manifestations of market power when a digital platform has a dominant position in several digital markets. I propose a framework for measuring the market power of digital platforms and then investigate whether such platforms can leverage their market power from one market to others in the digital economy. I demonstrate that users of big platforms that hold market power in several digital markets are unlikely to switch to smaller competitors, even when they offer better services. I then propose some alternatives to harness the potential of pro-competitive remedies when the incumbent platform is dominant in several digital markets - a common scenario in the digital economy.

The remainder of the paper is organized as following. In Section 2, I present a review of the main characteristics of multi-sided, digital markets and their innate, concentrated, market structures. I discuss the role of big techs as dominant intermediaries (or gatekeepers) of two-

sided digital markets, the main sources of their market power, and review the current debate about a new definition of market power suitable to the platform economy. Although some authors suggest identifying platforms with “bottleneck power,” I argue that it is unlikely that a dominant platform will have sufficient “bottleneck power” to block the access of its consumers to other platforms.

In Section 3, I outline general utility models for internet users in markets of digital products/services and for advertisers in markets of targeted online advertisements (ads). The models can easily be extended to other two-sided markets. I then derive own-demand elasticity functions of digital platforms in both market sides as well as show how to calculate their market power. I show that the market power of a platform in a given digital market is also a function of the market-shares of the platform in other digital markets.

Section 4 discusses the design of regulatory remedies that are aimed to foster competition in the platform economy. I review and discuss the Significant Market Power (SMP) framework and its applicability to the digital economy. The SMP is widely used to foster competition in the telecommunications sector and is often considered a reference approach for promoting competition in the digital economy. Although its use is feasible in the context of digital markets, I show that adopting the traditional, market-specific, SMP framework would have limited impact in promoting competition.

Finally, in Section 5, I conclude by summing up the main takeaways of the discussion in the paper and possible next steps in this research agenda.

2. The platform economy

2.1. Two-sided digital markets

The earliest studies of two-sided markets date from the 1970s (e.g., see Rosse, 1970), with a long tradition of study among media economic scholars¹. However, this terminology and the greater attention from a variety of other fields arose during the last twenty years. Indeed, the emergence of big technology companies providing services and goods in many two-sided markets has attracted researchers from different scholarly perspectives. These scholars are primarily from economics and policy (Rochet and Tirole, 2003; Armstrong, 2006; Just, 2018); political communication (Rosen, 2011; Krämer, 2017; Gillespie, 2018; Van Dijck et al., 2018); engineering (Helmond, 2015; Spagnoletti et al., 2015); and management (Pagani, 2013; Tan et al., 2015; Parker and Van Alstyne, 2017; Cusumano et al., 2019). The evolutionary process of Internet business models can be understood as the “platformization of the Internet,” which Helmond (2015, p. 1) formally conceptualized as “the rise of the platform as the dominant infrastructural and economic model of the social web.”

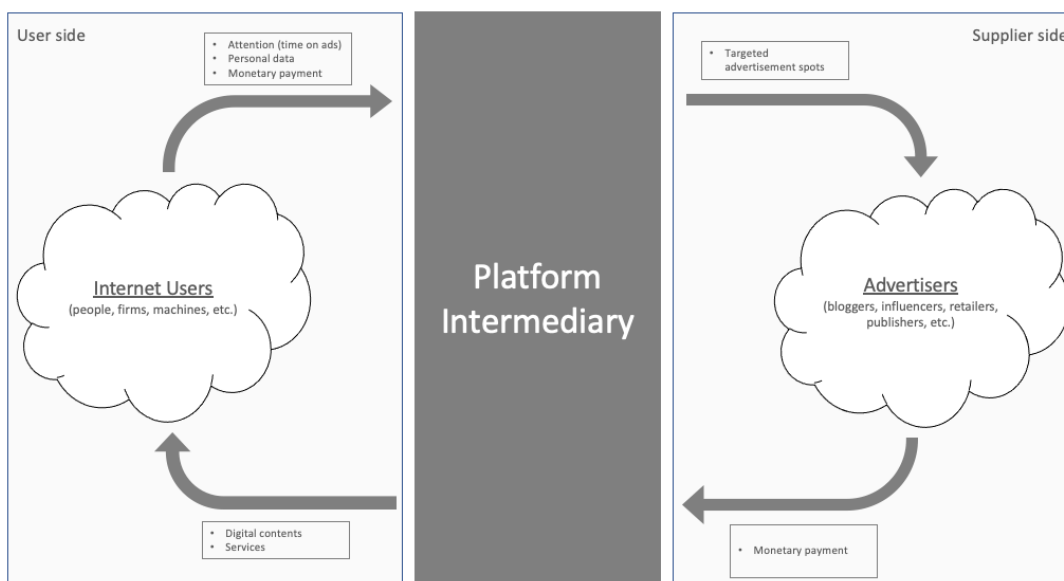
In the past twenty-five years, the huge increase in data processing and storage capacity (for example, by using technologies based on Big Data and Machine Learning algorithms) has created new business opportunities for big digital companies. More than intermediating the communication between internet users and firms, they are able to collect and process a vast amount of information about behaviors, preferences, interests, ideas, knowledge, as well as the physical and psychological traits of their billions of users around the world. Digital firms have used such information strategically, e.g., to improve their own services, develop new businesses

¹ For an early summary and review see Owen and Wildman (1992).

models, anticipate trends, understand the strategies of their competitors, launch new products and services, expand their business to promising markets, and inform risk management.

Indeed, data are the critical resource that powers the digital economy. One of the most successful strategies to monetize such data and capabilities, adopted by many digital platforms, has been the use of the information collected from internet users to show them contextual, targeted, digital advertisements (“targeted ads”) while they are online (see Figure 1). Targeted ads are offered to advertisers that purchase them with the aim to advertise their products more efficiently to people most likely to purchase them. In this business model, big digital companies act as intermediary platforms. On the user side of the market, they provide digital content and services to internet users in exchange for their attention to targeted ads, their data (personal information and digital traces), and sometimes a monetary payment (subscription price) as well. On the supplier side of the market, they offer targeted advertisement spots to advertisers of retail goods and services, who pay a monetary price per impression.

Figure 1 – Two-sided business model for the provision of targeted ads



Source: Author.

In the digital economy, many two-sided business models exist that are not ads-based (e.g., ride-sharing services, food delivery, etc.). However, the notion of internet users consuming digital contents and services through platform intermediaries in exchange for their attention, personal data, and in some cases also a monetary payment for access, is applicable to most two-sided business models.

2.2. Big techs as dominant platform intermediaries

Digital platforms run their business models at different scales. Some of them are focused on a specific, digital market, such as social media or media streaming. Thus they have limited capacity to collect data to generate revenues on targeted ads or new services (e.g., Spotify, Twitter, Snapchat, etc.). Others, especially the big techs, run their platform business models in several digital markets, such as app stores, video streaming, gaming, social media, etc., and thus have the capacity to collect or infer information about a great variety of aspects of internet users' lives.

For example, Alphabet has 93% of market share worldwide among search engines (StatCounter, 2019a), 64% among web-browsers (with its Google Chrome) (StatCounter, 2019b), and 76% among mobile operating systems (with its Android OS) (StatCounter, 2019c), without mentioning webmail, maps, online storage and video streaming markets. Similarly, Facebook has nearly 65% of market share among social media providers (StatCounter, 2019d) and 50% of market share among mobile messenger apps (Statista, 2019). Moreover, Facebook and Alphabet concentrate two-thirds of all worldwide spending for digital ads (eMarketer, 2019).

Such high market shares of some digital platforms, combined with their active acquisition of startups, have heightened concerns in many antitrust and regulatory agencies throughout the

world. According to Crémer et al. (2019), the incumbent digital platforms benefit from strong supply- and demand-side network effects (positive externalities) derived from their size and multimarket presence. Morton et al. (2019) summarize the discussions among many scholars and governmental agencies about the potential harms to consumer welfare derived from concentration in digital platforms business. Informed by several reports from regulatory authorities and several academic papers, the authors identify some harms caused by the dominance of incumbent digital platforms. According to the authors, platform dominance in ad markets results in mark-ups paid by advertisers and, consequently, higher prices of goods and services to retail consumers or lower profits to retailers in highly competitive retail markets.

Using this perspective, Pratt and Valletti (2018) consider platforms as attention brokers that have proprietary information about their users' product preferences and sell targeted ad space to retail product industries. The authors then demonstrate that the platforms' dominance in digital ad markets leads to concentration and consequently to an increase in the prices of ads. Such an effect, the authors explain, harms competition and innovation in retail markets, given that only incumbents in these markets would be able to pay the higher prices of advertisements. In other words, the higher prices of digital ads induced by the concentration in digital ads market would be an entry barrier to new and small innovators in retail markets that demand digital ads, which would have negative impacts on consumer welfare.

On the other hand, it is important to emphasize that the concentrated structure of digital markets, with a large accumulation of capital, technology, and data in the hands of few big techs, has favored the emergence of innovative digital solutions. It has met the growing demand for

efficiency and agility in the processes of production, collaboration, and communication that permeate the digital economy. These include, for example, gains of efficiency and welfare brought by Facebook's use of machine learning and artificial intelligence for the delivery of targeted ads campaigns, or even the reduction of time to obtain relevant results in searches carried out through Google. In addition, the COVID-19 pandemic and the drastic increase in the demand for digital products and services that it brought have highlighted the importance of the robust technology infrastructure provided by the big digital platforms, which were built thanks to a sustained process of capital accumulation and investments.

However, researchers and governments from different countries argue that the market power of these platforms reduces the possibility that companies with better and more innovative solutions compete and become relevant threats to the market shares of big techs. For example, there have been evidence that platforms quickly acquire startups that develop innovative solutions capable of competing and threatening their leadership (Solon, 2017; *The Economist*, 2018; Schechter, 2018).

2.3. The search for a new definition for market power to the platform economy

According to the CMA (Competition and Markets Authority) (2020), increasing competition in platform markets requires the identification of firms with market power and then the imposition of *ex-ante*, regulatory measures. The CMA explains that a regulatory (*ex-ante*) approach would be beneficial, because it produces outcomes faster when compared with antitrust enforcement and aids to oversee *ex-post*, antitrust remedies. However, there is a need to reconceptualize what is considered market power in the context of digital markets, and to design new techniques to identify such conditions among firms in digital markets (Morton at

al., 2019). For example, the report from the government of United Kingdom (Furman, 2019), states:

A key component of this system is to develop a clear legal test for the characteristics of a company's market position above which regulatory powers are appropriate – termed in this review a strategic market status. This needs to be carefully designed to identify where companies operating platforms are in a position to exercise potentially enduring market power, without granting an excessively broad scope and bringing within the bounds of regulation those companies who are effectively constrained by the competitive market. Only a small number of companies should be within the definition of a well-defined test that matches the characteristics of the sector. (Furman, 2019. p. 81)

Therefore, it is more complex to identify a firm with market power in a given digital market than to identify whether it has only a high market-share in the provision of digital services. Actually, market power or monopoly power is traditionally defined as “the ability of a firm (or group of firms) to raise and maintain price above the level that would prevail under competition” (OECD, 1993). This definition has been operationalized in many different forms throughout the world according to countries and markets idiosyncrasies.

Furman (2019) as well as the European Commission (2020) suggest that the framework of “significant market power,” widely used in the telecommunications regulatory framework, provides a good starting point for defining market power in the digital economy. Indeed, Morton et al. (2019, p. 80) agree that the “communications sector may offer the best guidance for how to approach public accountability for digital platforms.” Furthermore, in the debate about how to identify the market power of digital platforms, some scholars and governmental agencies advocate defining the concept “bottleneck power” (Furman, 2019; Morton et al., 2019). These

authors relate bottleneck power to the market position of a digital platform in which it becomes a gatekeeper, able to control the access of its competitors to the consumers.

This concept derives from the definition of firms that serve as competitive bottlenecks. It refers to a characteristic that should be attributed to a platform in which its consumers primarily single home (rely on a single platform) on one side, and retailers or advertisers multi-home (join all platforms serving potential consumers) on the other side to get access to all their potential consumers (Armstrong and Wright, 2007). In this scenario, each platform clearly acts as a gatekeeper controlling who has access to its consumers, because the only way to reach a group of consumers is to interact with the unique platform that serves them. However, if consumers multi-home or have easy means to do so (as in many digital markets today), even big, digital platforms do not serve as competitive bottlenecks. For example, internet users access a variety of media-streaming platforms every day (e.g., YouTube, Twitch, IGTV, Tiktok, Spotify, etc.) to consume different media contents, so they multi-home. Thus, although YouTube holds a clearly dominant position among media-streaming platforms and may hold market power in this digital market, it does not serve as a competitive bottleneck. To reach YouTube users, retailers and advertisers have some other options, not only in the media-streaming market but also in other digital markets (e.g. social media, search engines, etc.).

In addition, because platforms offer, in user-sided markets, digital products and services (e.g., social media applications, webmail, and maps) that are easily accessible through the internet, a position in which a dominant platform has “bottleneck power” to block the access of its consumers to other entrant platforms is unlikely. An additional issue for basing economic regulation on the identification of “bottleneck power” is that even platforms popular in only one digital market may hold such a position. Imposing pro-competitive remedies on platforms may

harm their ability to contest bigger platforms that play in several digital markets. For example, in a scenario in which Apple Music and Spotify are both considered to hold “bottleneck power” in the music-streaming market, any resultant competition policy or regulatory remedy applied on both platforms is expected to disproportionately harm Spotify, which has its main source of revenues in this market.

In the next section, I provide a new conceptual framework for assessing the market power of incumbent digital platforms that hold a dominant position in several markets. I then investigate whether such platforms can leverage their market power from one market to other markets in the digital economy.

3. Assessing the market power of digital platforms

To assess the market power of digital platforms, following the discrete choice demand model setup proposed by Berry (1994), I first outline the general, utility functions in user-side markets of digital contents and services. Then, I pick the market of targeted online advertisements (ads) as an example of a supplier-side market and derive the utility functions of advertisers. This approach allows the derivation of the demand function for digital contents/services supplied by digital platforms to internet users as well as the demand function for targeted ads supplied by digital platforms to advertisers. Then, I find the own-demand elasticities of platforms in both markets and, in each one, derive functions for calculating their market power.

The models are general in that they are applicable to any two-sided market in which, on the user-side, an intermediate, digital platform supplies digital contents/services (zero-priced or not) bundled with targeted ads and data collection procedures. The choice to study the targeted

ads market on the supplier side of the platform was made for convenience, because the supply of target ads is a well-known and extremely successful business model explored by current digital platforms. However, the models can be applicable to other supplier-side markets without loss of generality.

Assume a discrete-choice, demand setting (Berry, 1994) in which there are K_m platforms in market $m \in M$, each one providing one digital product or service j of quality $q_{k,m}$ to internet user $i \in I$, who pays $p_{k,m}$ to access it.² Bundled with j , the platform supplies $t_{k,m}$ targeted ads, expressed as the total time spent by i on ads while consuming j , and collects $d_{k,m}$ amount of information from i (e.g., digital traces, demographics, behavioral and psychological characteristics, etc.). In the advertising market $g \in G$, the platform k supplies the time gathered from each of its users of m to advertiser $a \in A$ at price $r_{k,m,g}$ per impression.³

For example, consider Google selling targeted ads to advertisers in the United States and reaching YouTube users in Germany. In this case, market m is the video-streaming market in Germany, g is the targeted ads market of the United States, i is an internet user in Germany, a is an advertiser in the United States, j is the YouTube, and k is Google. Moreover, Google charges $p_{k,m} = 0$ from i to access the YouTube, but inserts $t_{k,m}$ seconds of ads on its videos and collects $d_{k,m}$ amount of digital traces from its users. Also, Google charges $r_{k,m,g}$ from any advertiser in the United States to deliver target ads through YouTube to its users in Germany.

² Usually $p_{k,m}$ is zero in ads-sponsored, digital products/services.

³ Ad prices are typically expressed as cost per thousand or cost “per *mille*.” There are many variants for how digital ads are priced (per impression, per action, per transaction, etc.), although this does not affect the analysis carried out in this paper.

3.1. User-side Utility Model

Internet user i derives utility $U_{i,k,m}$ when it consumes j provided by k in market m .⁴ Such utility comes from the value of the quality characteristics of j , $q_{k,m}$, which are commonly related to aspects, such as the nature of the content (e.g., audiovisual, text), its theme (e.g., sports, communication, news, games, etc.), its source, its length, etc. (Prasad et al., 2003; Fan et al., 2007; Bounie et al., 2017)⁵. The amount of targeted ads bundled with j , $t_{k,m}$, is well documented in the literature of online advertisement economics. It is considered a source of disutility to digital content consumers, dependent on the nuisance cost of ads, α , and generally assumed by the literature to be constant among all internet users after controlling for their personal preferences and socio-economic condition (Dukes and Gal-Or, 2003; Prasad et al. 2003; Papies et al. 2011; Acquisti and Spiekermann, 2011; Zhang and Sarvary, 2015; Bounie et al., 2017).⁶ The homogeneity assumption of α among all internet users and platforms is further discussed and relaxed in the next subsection, where I argue that the size and reach of the platform also affect the nuisance cost of ads experienced by the platform users.

The level of information (length and diversity) collected from i while she consumes j , $d_{k,m}$, is also considered in the literature as a source of disutility, dependent on a nuisance cost of data collection, β , assumed to be constant among all internet users and platforms. However, evidence was found that internet users generally would not be able to measure this disutility, and therefore it would have no impact on consumption decisions (Tucker, 2012; Strandburg, 2013).

⁴ Because each platform k is assumed to provide one digital product or service j , we dropped the subscript j in equation 3.1.

⁵ For simplicity, the value given to quality characteristics of j is assumed to be constant among internet users, as considered in previous studies, although relaxing this assumption does not change the conclusions presented in this paper.

⁶ Tucker (2012) argues that consumers derive some benefit from being well informed about products that they most likely have interest in purchasing. However, such benefit generally is not sufficient to make positive the total utility they derive from spending time on ads, because they originally want to consume a digital content or service, not an ad.

However, recent improvements in the transparency of privacy policy among digital platforms and other internet suppliers may have resulted in an increase of the importance of privacy issues among internet users (Martin, 2018; Johnson et al. (2018); Wang and Herrando, 2019). Finally, consumer i derives disutility of paying $p_{k,m}$ to access j , dependent on her price responsiveness, γ , also assumed to be constant among all internet users and platforms. The homogeneity assumptions of β and γ are also relaxed in the next subsection.

In equation (3.1) we model the overall utility $U_{i,k,m}$, which also includes unobservable factors related to product j of platform k ($\xi_{k,m}$) that also have an impact on $U_{i,k,m}$, as well as an error term $\varepsilon_{i,k,m}$. Equation (3.2) expresses the mean utility function, which is independent of users' heterogeneity and thus is only a function of the characteristics of the digital product or service provided by platform k in market m .

$$U_{i,k,m} = q_{k,m} - \alpha t_{k,m} - \beta d_{k,m} - \gamma p_{k,m} + \xi_{k,m} + \varepsilon_{i,k,m} \quad (3.1)$$

$$\delta_{k,m} = q_{k,m} - \alpha t_{k,m} - \beta d_{k,m} - \gamma p_{k,m} + \xi_{k,m} \quad (3.2)$$

Now let us consider $s_{k,m}$ the market-share of k in market m . Assuming that $\varepsilon_{i,k,m}$ is identically and independently distributed according to a Type I extreme value distribution, Berry (1994) and Nevo (2000) have already shown that $s_{k,m}$ can be expressed in the classic *logistic* form as the probability that user i consumes j provided by k , given that she derives the mean utility $\delta_{k,m}$ from this choice.

$$s_{k,m} = \frac{\exp(\delta_{k,m})}{1 + \sum_{k=1}^K \exp(\delta_{k,m})} = \frac{\exp(q_{k,m} - \alpha t_{k,m} - \beta d_{k,m} - \gamma p_{k,m} + \xi_{k,m})}{1 + \sum_{k=1}^K \exp(q_{k,m} - \alpha t_{k,m} - \beta d_{k,m} - \gamma p_{k,m} + \xi_{k,m})} \quad (3.3)$$

Writing the market-share of k in m helps us to derive the own-demand elasticities of internet users with respect to k 's level of targeted ads, level of information collected, and price, as shown in equations (3.4), (3.5) and (3.6), respectively. The intuition behind the own-demand elasticities is that assuming α , β , and γ are constant among users and platforms, the bigger the market-share of k in m , the more inelastic is its demand to variations in $t_{k,m}$, $d_{k,m}$, and $p_{k,m}$. Because market-power is usually measured by the Lerner Index as the inverse of own-demand elasticity ($-1/\eta$) (Lerner, 1934), one may easily investigate market power of platform k in market m by exploring how market-share of k respond to variations in the levels of targeted ads, information extraction, or the access price associated with each of them.

$$\eta_{k,m}(t_{k,m}) = \frac{\partial s_{k,m} t_{k,m}}{\partial t_{k,m} s_{k,m}} = -\alpha t_{k,m} (1 - s_{k,m}) \quad (3.4)$$

$$\eta_{k,m}(d_{k,m}) = \frac{\partial s_{k,m} d_{k,m}}{\partial d_{k,m} s_{k,m}} = -\beta d_{k,m} (1 - s_{k,m}) \quad (3.5)$$

$$\eta_{k,m}(p_{k,m}) = \frac{\partial s_{k,m} p_{k,m}}{\partial p_{k,m} s_{k,m}} = -\gamma p_{k,m} (1 - s_{k,m}) \quad (3.6)$$

Such results reassemble the idea behind the Small but Significant and Non-transitory Increase in Price (SSNIP) test - a conceptual tool used extensively in competition policy and regulation to define a relevant market and assess market power.⁷ However, they are extended here to assess market power in markets where the product is zero-priced, which is the case in most digital markets. For such markets, our model suggests that price can be replaced by the

⁷ The SSNIP test was first introduced in 1982 by the U.S. Department of Justice Merger Guidelines and has been used also by competition authorities in Europe since the early 1990s. It aims to identify markets in which a hypothetical monopolist can impose profitable increases in price (above competitive levels). Coate and Fisher (2008) provide theory and practical details about the test and its applications.

level of targeted ads or the extent of information extraction and bundled with j , because both are also sources of disutility and have an impact on k 's market share. For example, holding α constant across platforms, equation (3.4) allows us to expect that a platform k that has 80% of market-share ($s_{k,m}$) in a user-sided digital market m is expected to lose four times fewer users if it doubles the time its users must spend viewing targeted ads, when compared with a smaller platform with only 20% of market-share.

3.2. Leveraging market power across user-side, digital markets

So far, we borrowed from the existing advertisement economics literature, which assumes the nuisance costs α , β , and γ are constant among users and platforms, to build a framework for assessing market power of digital platforms in ad-sponsored, two-sided markets. However, although the conclusions we have reached still hold when we relax these assumptions,⁸ an important result is found when we model nuisance costs dependent on the size and reach of platform k . It is plausible to assume that when i consumes many other services from platform k in markets other than m , her other experiences with k can enhance her experience consuming j in m . In this same scenario, because platform k might collect information from i in various other markets, it may also be able to provide better targeted ads to i and thus reduce the disutility generated by them.

As an example, an internet user who consumes many services from Google, such as Gmail, Google Drive, Google Maps, Google Chrome, and Google Search may accept having to spend more time on targeted ads when watching videos through YouTube than through a

⁸ Berry et al. (1995) and Nevo (2000) show that when the heterogeneity of consumers' tastes (their nuisance cost or sensitivity to prices) is considered, own-demand elasticities are still negatively related to the level of prices and the inverse of firms' market-share ($1 - s_{k,m}$), integrated throughout a distribution of consumer tastes.

smaller platform, because the user is more engaged with Google and thus has higher switching costs. Also, because Google collects information from the internet user through different digital services, it may recommend videos and show ads more relevant to the user, which potentially increases the utility of YouTube to the user with respect to a smaller platform.

To model such heterogeneity and thus analyze its implications for the assessment of the market power of digital platforms, let us consider the nuisance costs α_k , β_k , and γ_k , which are marginal disutilities now dependent on which platform provides j . For simplicity, we model the size and reach of platform k as the natural logarithm of the sum of its market-share in all user-side digital markets other than m times the number n of different digital markets where k is present other than m ($S_{k,-m} = \ln(1 + n \sum s_{k,-m})$). Such a measure denotes the relative number of users of k in markets other than m and the variety of information that k extracts from i that is not associated with the consumption of j . Equations (3.7), (3.8) and (3.9) provide general forms of such nuisance costs.

$$\alpha_k = \alpha_0 - \alpha_1 S_{k,-m} \quad \text{with } \alpha_k \geq 0 \text{ for } \forall S_{k,-m} \quad (3.7)$$

$$\beta_k = \beta_0 - \beta_1 S_{k,-m} \quad \text{with } \beta_k \geq 0 \text{ for } \forall S_{k,-m} \quad (3.8)$$

$$\gamma_k = \gamma_0 - \gamma_1 S_{k,-m} \quad \text{with } \gamma_k \geq 0 \text{ for } \forall S_{k,-m} \quad (3.9)$$

The intuition behind the equations above is that the disutilities experienced by i when she has to spend $t_{k,m}$ of her time on ads, share $d_{k,m}$ of her private information, and pay $p_{k,m}$ to access j are attenuated by the fact that platform k (the provider of j) is a well-known digital platform from which i most likely already consumes many other digital services and with which

she shares much information. In other words, we argue that internet users would be more tolerant of spending time watching ads and having their information collected from incumbent digital platforms than from new entrants into market m . As a consequence, an incumbent platform k can sustain profitable levels of $t_{k,m}$, $d_{k,m}$ and $p_{k,m}$ above the competitive equilibrium and proportional to its size and reach in the digital economy. Equations (3.10), (3.11) and (3.12) show how the level of market power $\Omega_{k,m}$ of digital platform k in market m can be leveraged by the extent of k 's presence in other digital markets.

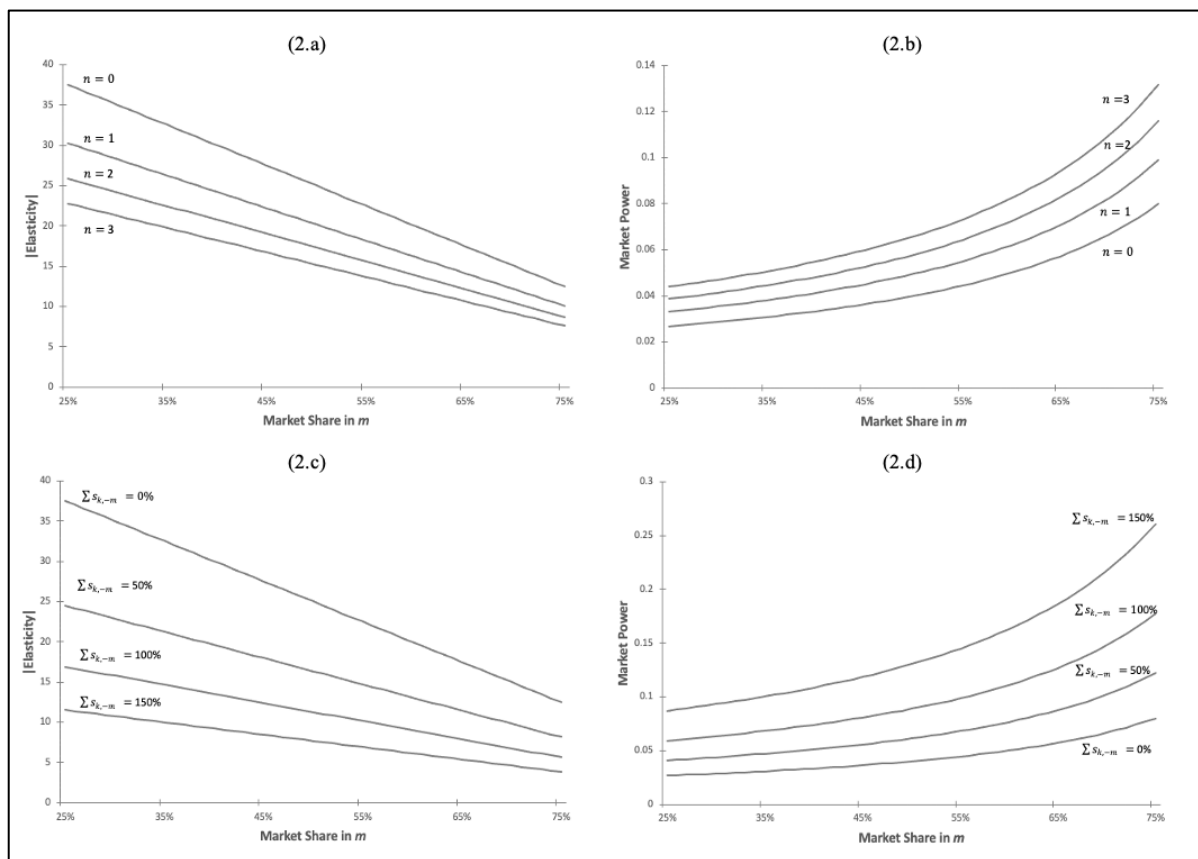
$$\Omega_{k,m}(t_{k,m}) = \frac{-1}{\eta_{k,m}(t_{k,m})} = \frac{1}{(\alpha_0 - \alpha_1 s_{k,-m}) t_{k,m} (1 - s_{k,m})} \quad (3.10)$$

$$\Omega_{k,m}(d_{k,m}) = \frac{-1}{\eta_{k,m}(d_{k,m})} = \frac{1}{(\beta_0 - \beta_1 s_{k,-m}) d_{k,m} (1 - s_{k,m})} \quad (3.11)$$

$$\Omega_{k,m}(p_{k,m}) = \frac{-1}{\eta_{k,m}(p_{k,m})} = \frac{1}{(\gamma_0 - \gamma_1 s_{k,-m}) p_{k,m} (1 - s_{k,m})} \quad (3.12)$$

The equations above allow us to conclude that the greater the presence of platform k not only in m but also in digital markets other than m , the more inelastic is its demand with respect to any increase in $t_{k,m}$, $d_{k,m}$, or $p_{k,m}$, and thus the greater its market power is in digital market m . Figure 2 illustrates such effects, showing that, assuming α_1 , β_1 or γ_1 greater than zero, the bigger the number of different digital markets other than m where the platform k is present (n) and the bigger its total market-share in those markets ($\sum s_{k,-m}$), the lower its demand elasticity in m and the bigger its market power. Indeed, we can see that a platform with great presence in other markets but low market-share in m may even have a lower demand elasticity and a bigger market power in m when compared with a platform with a bigger market-share in m but without presence in other digital markets.

Figure 2 – Elasticity and market power plots in market m



Source: Author.

Such results show that the dominant position of an incumbent digital platform in other markets can be leveraged to market m , allowing the incumbent platform to sustain higher levels of ads, data collection, and prices when compared with new entrants. A second conclusion is that when a big digital platform is actually the newcomer in a digital market, instead of competing in terms of the levels of quality, ads, data collection procedures, and access price, such a platform may set the same levels chosen by its competitors and still gain a market share. The implications

for such results to set effective, *ex-ante*, regulatory remedies to foster competition in digital markets is further discussed in Subsection 4.3.1.

3.3. Advertiser-side Utility Model

Advertisers, framed herein as consumers in the supplier side of the intermediary platform k , derive utility from purchasing targeted ads sold by digital platforms and having their products and services seen by the platform users most likely to pay for them. Such utility is a function of the visibility of the advertisement minus the price the advertiser pays for it (Bonnie et al., 2017). Consider the advertising market $g \in G$, where the platform k supplies a unit fraction of the time $t_{k,m}$ of i to advertiser a at price $r_{k,m,g}$. The utility of advertiser a can be modeled as a function of the quality of the targeted ad offered by platform k in market m ($\sigma_{k,m}$), the market share of k in m ($s_{k,m}$), and the price that the platform k charges a in a 's geographic market g to show the ad to user i of market m ($r_{k,m,g}$).

The quality of the targeted ad referred to here is not related to the content characteristics of the ad but rather to the ability of platform k effectively to target the ad towards potential consumers of the product or service advertised by a among its users of market m . The dependence on $s_{k,m}$ comes from the fact that the greater the universe of users of platform k in market m , the greater the chances of finding potential consumers for a .

Intuitively, $r_{k,m,g}$ would also depend on $\sigma_{k,m}$ and $s_{k,m}$, because the higher the visibility (quality and reach) of the targeted advertisement the higher the costs of producing the target ad. However, because the platform business model creates high economies of scale and scope for the intermediary platforms (Cr mer et al. (2019)), we assume here that $r_{k,m,g}$ is exogenously defined by the platform according to the level of competition it faces on ads market g . Moreover, we

consider the quality $\sigma_{k,m}$ dependent on the amount and diversity of information $D_k = d_{k,m} + d_{k,-m}$ that platform k collects from its users in market m and in all other user-sided markets where k is present. Below we sum up the overall utility function $U_{a,g,k,m}$, which also includes unobservable factors related to characteristics of the targeted ads shown by the platform k to users in market m ($\xi_{k,m}$), which may also impact $U_{a,g,k,m}$, as well as an error term $\varepsilon_{a,g,k,m}$.

$$U_{a,g,k,m} = \sigma_{k,m} - \phi r_{k,m,g} + \varepsilon_{a,g,k,m} \quad (3.13)$$

$$\sigma_{k,m} = \theta_0 + \theta_1 D_k + \theta_2 s_{k,m} + \xi_{k,m} \quad (3.14)$$

$$U_{a,g,k,m} = \theta_0 + \theta_1 D_k + \theta_2 s_{k,m} + \xi_{k,m} - \phi r_{k,m,g} + \varepsilon_{a,g,k,m} \quad (3.15)$$

Similar to the scenario described in the Subsection 3.1, let us consider $s_{k,g}$ the market-share of platform k in market g . Assuming that $\varepsilon_{a,g,k,m}$ is identically and independently distributed according to a Type I extreme value distribution, equation (3.16) expresses $s_{k,g}$ in its classic logit form. This represents the probability that advertiser a chooses ads from k knowing the average utility derived from the ads provided by k . Equations (3.17), (3.18), (3.19) and (3.20) provide the derived, own-demand elasticities of a with respect to the level of information D_k that platform k extracts from its users, its market-share $s_{k,m}$, and its price $r_{k,m,g}$.

$$s_{k,g} = \frac{\exp(\theta_0 + \theta_1 D_k + \theta_2 s_{k,m} - \phi r_{k,m,g} + \xi_{k,m})}{1 + \sum_{k=1}^K \exp(\theta_0 + \theta_1 D_k + \theta_2 s_{k,m} - \phi r_{k,m,g} + \xi_{k,m})} \quad (3.16)$$

$$\eta_{k,g}(D_k) = \frac{\partial s_{k,g} D_k}{\partial D_k s_{k,g}} = D_k (1 - s_{k,g}) [\theta_1 - \theta_2 \beta s_{k,m} (1 - s_{k,m})] \quad (3.17)$$

$$\eta_{k,g}(D_k) = \frac{\partial s_{k,g} D_k}{\partial D_k s_{k,g}} = D_k (1 - s_{k,g}) [\theta_1 - \theta_2 (\beta_0 - \beta_1 s_{k,-m}) s_{k,m} (1 - s_{k,m})] \quad (3.18)$$

$$\eta_{k,g}(s_{k,m}) = \frac{\partial s_{k,g} s_{k,m}}{\partial s_{k,m} s_{k,g}} = \theta_2 s_{k,m} (1 - s_{k,g})] \quad (3.19)$$

$$\eta_{k,g}(r_{k,m,g}) = \frac{\partial s_{k,g} r_{k,m,g}}{\partial r_{k,m,g} s_{k,g}} = -\phi r_{k,m,g} (1 - s_{k,g})] \quad (3.20)$$

The derived own-demand elasticity functions presented above provide important insights for the identification of platforms with market power in the market of advertisement. Equation (3.17) shows us that the higher the market-share of a platform among users of market m , the more inelastic is its demand among advertisers of market g with respect to a decrease in the level of information D_k that k has from its internet users. Similar, and more important, the larger k 's market-share is among advertisers on market g , the more inelastic is its demand for decreases in D_k and the larger its market power among advertisers. These results suggest that asymmetric measures aimed at reducing the market power of digital platforms on the ads market should also target increasing competition in market m , because the market-share of the platform in that market plays an important role in lowering its demand elasticity in market g . Actually, when we allow β to vary across platforms (see equation 3.18, where I plugged equation 3.8 to equation 3.17), such asymmetric measures should address reducing the market power of platform k not only in the user-side market m but in all user-side markets where k is dominant.

Moreover, equations (3.19) and (3.20) show that the larger k 's market-share among advertisers of market g , the more inelastic its demand with respect to variations in the price $r_{k,m,g}$ or in the level of market-share k holds among internet users of m . Hence, an approach similar to the SSNIP test could also be applied by regulators in the ads market to identify platforms with market power. Indeed, one could assess the impact on the demand of platform k in response to a small but significant non-transitory variation in the level of information that the platform has from users I , or the amount of market-share it has on m , or even in the price of the

targeted ads offered by k in market g . The implications of these results for setting effective ex-ante regulatory remedies to foster competition in the supply of targeted ads are discussed further in Subsection 4.3.2.

4. Regulatory tools to promote competition in the platform economy

4.1. Competition policy vs. regulatory remedies

There have been many debates around the world on how to address concentration in digital markets by fostering entry in both the business of platform intermediation and user-sided digital markets. The list of antitrust cases opened to investigate potential, anti-competitive practices of the big, digital platforms such as Google, Facebook, and Amazon is extensive (Just, 2018). One of the most recent case in the United States was opened by the Department of Justice against Google in the market of online searches (U.S. Department of Justice, 2020).

Also, the concern about the large number of early stage, competing startups acquired by the big techs arose in recent years. Competition authorities in the EU and the United States have recently begun to analyze the digital platform acquisitions in the last ten years of several startup companies, which received no scrutiny by competition authorities (U.S. Federal Trade Commission, 2020a). Recently, the U.S. Federal Trade Commission sued Facebook for anticompetitive behaviour and called for breaking-up the platform (U.S. Federal Trade Commission, 2020b). The lawsuit claims that Facebook has engaged in a strategy of acquiring potential rivals to eliminate threats to its monopoly in social media market.

Khan (2017) argues that a revision of competition law is needed to empower antitrust agencies with newer, more agile, and effective tools to combat the competitive misconduct of digital platforms. Indeed, the competitive challenges brought by the high market shares of digital

platforms was the subject of intense debate recently in the Subcommittee on Antitrust, Commercial, and Administrative Law of the Committee on the Judiciary of the U.S. House of Representatives. The Subcommittee released a report with recommendations to reform competition law in light of the challenges imposed by concentration in digital markets (U.S. House, 2020).

However, the lengthy, competition policy battles fought against the big techs in the last decade in the United States and in the EU demonstrate the limitations of purely *ex-post*, anti-trust remedies to foster competition in the platform economy (Wheeler et al., 2020). These authors argue primarily that antitrust remedies, although welcomed, are not fast enough to secure competition in extremely dynamic digital markets. Therefore, they would benefit from *ex ante*, regulatory remedies to effectively discourage competitive misconduct in the short term. Indeed, intervention in competition law is triggered not by market power per se, but by evidences of its abuse. On the other hand, in regulation, intervention is not contingent on an abuse but merely on the identification of market power (although it is implicit that an abuse might occur, absent regulations).

The claim for the establishment of a regulatory regime over digital markets is also endorsed by the CMA (2020) and Morton et al. (2019). They added that the limited-scope nature of antitrust cases would have little potential to solve structural competition issues. Moreover, both authors also questioned the capacity of generalist judges to deal with complex, conduct remedies and enforcement mechanisms required to address the abuse of market power by digital platforms. They argued that an empowered, specialized, regulatory agency could be more effective in acting *ex-ante* to prevent such abuse.

Governments in different countries have presented proposals for the adoption of pro-competitive, *ex-ante*, regulatory remedies to reduce barriers to entry and ensure a healthy environment of innovation and opportunities in the platform economy. For example, the United Kingdom government, informed by the CMA (2020), proposed the creation of a dedicated, regulatory unity for digital markets with powers to define which digital platforms have market power and to establish *ex ante*, regulatory remedies to foster competition (U.K., 2020).

Recently, within the framework of discussions to establish a new, legal framework for digital services (the Digital Services Act - DSA), the European Commission launched a public consultation about the creation of a new, regulatory agency of digital platforms. The new agency would have powers for both requesting and collecting information from platforms and for establishing and enforcing *ex ante*, regulatory measures. These measures would include data sharing, interoperability, and greater transparency in contractual relations, inspired by the regulation model of the telecommunications industry (European Commission, 2020a). Morton et al. (2019) also provide several examples of regulatory measures to encourage competition in digital markets, also borrowed from the telecommunications industry. The authors urgently consider the need to empower a regulatory agency to identify platforms with market power and to impose *ex ante*, regulatory measures, such as those proposed by the European Commission.

On the other hand, controversy has evolved about whether old, utility-based competition, *ex-ante* remedies should be used to deal with highly innovative, dynamic, and interrelated digital markets dominated by few big digital platforms. In the following subsection, I briefly review the competition, regulatory framework most widely used to foster competition in the telecommunications industry worldwide, namely the Significant Market Power (SMP) regulatory

framework. I then discuss its applicability to the platform economy in light of the economic modeling for assessment of market power in the platform economy outlined in Section 3.

4.2. The Significant Market Power (SMP) regulatory framework

The most influential and widely adopted conceptual framework of market power adopted in the telecommunications industry are the guidelines of the European Commission to telecommunications market analysis and assessment of SMP, firstly released in 2002 and updated in 2018 (European Commission, 2018a). They were even recommended by the United Nations' specialized agency for harmonization of digital policy and regulation (ITU, 2016). To set a scope for *ex-ante* competition regulation, the framework defines that a firm has market power if "it enjoys a position equivalent to dominance, that is to say a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers and consumers" (European Commission, 2018a, p.7).

Furthermore, the European Commission recognizes that, although the level of market share represents a useful first indication of market power, it does not suffice to characterize that as a dominant position. Instead, the Commission considers that the identification of market power also requires a thorough assessment of the firm's ability to impose constraints on its competitors in the medium term. This suggests that market dynamics matter and that a forward-looking approach is needed to assess the firm's ability to sustain its market share. The guidelines of the European Commission suggest non-exhaustive criteria to identify SMP, and several countries inside and outside the EU have adopted them. They include the existence of barriers to entry, control of infrastructure not easily duplicated, ease or privileged access to capital, vertical integration, presence of high economies of scale, and scope in service provision, among others.

According to the same guidelines, to assess the existence of a firm with SMP, it is fundamental to start by clearly defining a relevant retail market where such conditions will be analyzed. Once the relevant retail market has been defined, the existence of SMP is verified using the already mentioned criteria. If SMP is identified, the need to apply regulatory remedies to its upstream wholesale market is analyzed to guarantee fair access to wholesale inputs for all players competing in the retail market. According to the guidelines, to define a relevant market, two dimensions of analysis should be conducted: a geographic dimension analysis and a product dimension analysis. Identification of such dimensions aids in setting the boundaries of the relevant market where the existence of a firm with SMP would be analyzed.

The geographic dimension comprises an area where the conditions of competition are sufficiently homogeneous and can be distinguished from neighboring areas (European Commission, 2018a, p. 8). Areas in which the conditions of competition are heterogeneous do not constitute a uniform market. Based on such criteria, geographic dimensions have been set that range from as small as the limits of a city to an entire state or country, dependent on the characteristics of the product and the market structure.

The product dimension comprises

(...) all products or services that are sufficiently interchangeable or substitutable, not only in terms of their objective characteristics, their prices or their intended use, but also in terms of the conditions of competition and/or the structure of supply and demand in the market in question. Products or services that are only interchangeable to a small or relative degree do not form part of the same market. (European Commission, 2018a. p. 6)

The product dimension is analyzed by defining the retail product and investigating the existence of demand-side substitutability and supply-side substitutability. Demand-side substitutability refers to “the extent to which customers are prepared to substitute other services or products for the service or product in question,” whereas supply-side substitutability “indicates whether suppliers other than those offering the product or service in question would switch their line of production in the immediate-to-short term or offer the relevant products or services without incurring significant additional costs” (European Commission, 2018a, p. 5). The lack of substitutability on both sides delineates the boundaries of the relevant market.

A practical and widely adopted test of demand-side and supply-side substitutability is the application of the SSNIP test, a traditional tool borrowed from competition policy by telecommunications regulators. The test basically measures the response of consumers and suppliers to a small but significant and non-transitory increase in the price of a given product or service, assuming that the prices of all other products or services will remain constant. The result helps to determine whether substitutable products exist and, if so, where the boundaries of the relevant product market should be delineated.

The next subsection discusses the applicability of the conceptual framework of SMP and *ex-ante*, wholesale regulation in the digital economy.

4.3. Applying the SMP framework to the platform economy

The applicability and effectiveness of the traditional, regulatory tools borrowed from the telecommunications industry to promote competition in the digital economy are analyzed separately for each side of the platform economy. First, I review the applicability of the SMP

framework to foster competition against dominant platforms in user-side, relevant, digital markets. I then do so for supplier-side, relevant, digital markets.

4.3.1. Applying the SMP framework in user-side, digital markets

The assessment of relevant product market, demand-side, substitutability is the first step in setting the boundaries of a relevant, product market, and it is somewhat straightforward. For example, although there are social media services provided for general purposes (e.g., Facebook) as well as for specific purposes (e.g., LinkedIn), which may be considered product differentiation in the same, relevant product market, it is clear that other services, such as video-streaming, webmail, etc., do not serve the same purpose or substitute for social media services.

On the other hand, limits to supply-side substitutability are not as clearly possible to delineate. The technology infrastructure built by suppliers of digital services, such as video-streaming and webmail, are costly. Yet, a large, digital platform that is not yet exploring one of these markets can take advantage of its already installed huge ICT infrastructure and big base of users to quickly and successfully launch service in a new, relevant product market. Easy examples are Apple's launch of its music and video-streaming services (Apple Music and Apple TV+), or Amazon's launch of its video-streaming platform under its Prime service. However, apart from a few handful of big tech platforms, the quick launch of a large-scale digital service able to compete against those provided by incumbent digital platforms is not feasible for most companies. In addition, considerable limits to supply-side substitutability exist in most digital markets.

The traditional SSNIP test would be applicable straightforwardly for digital services that require a monetary payment for access. For example, the demand response for a small but significant and non-transitory increase in the price of a Netflix subscription can be assessed (as

shown in equation 3.12). However, when the digital service or product is zero-priced, a modified approach of the SSNIP test is required. Morton et al., (2019, p.66) suggest the use of a quality-adjusted price for each service, when the price to access the service is set zero. For those authors, quality could be related, e.g., to the level of utility derived by internet users from the use of the service.

In line with such an idea and informed by the arguments developed in Section 3, I propose the use of two additional tests aimed to also analyze the response of the demand to a small but significant, non-transitory increase in typical sources of disutilities other than price. They are the level of targeted ads bundled with the service and the amount of private data collected from the user by the platform while it is being used (a SSNIA and a SSNID test, respectively, where A accounts for targeted ads and D for data collection). Such tests could be operationalized like the traditional SSNIP test, and their expected results should be governed by the demand-elasticity functions derived in Chapter 3 (see equations 3.10 and 3.11).

A relevant geographic market dimension could also be set for a given relevant product market as the one that comprises the internet users located in the jurisdiction of a concerned, regulatory authority. Such an approach has been used widely in antitrust cases in Europe when the litigation involves services provided by big digital platforms. For example, one can refer to the German competition authority Bundeskartellamt review of Facebook's potential, anticompetitive conduct in the relevant market of social media (Bundeskartellamt, 2019), as well as the European Commission's review of alleged, competitive misconduct by Google Shopping (European Commission, 2017).

Once a relevant market has been defined, the next step is to identify a firm with market power in such a relevant market. For this, the criteria provided in Subsection 4.2 still apply. In

addition to an easy analysis of market-share among the users of social media services,⁹ most of the big tech platforms have accumulated enormous, sunk assets related to technological infrastructure to provide digital services for millions of internet users. Moreover, they have experienced supply- and demand-side network effects (positive externalities) derived from their size and multimarket presence. They also have economies of scope and scale to differentiate their services or to bundle them with new ones, and they have easy access to capital (Crémer et al., 2019).

However, as first introduced in Chapter 3, *ex-ante*, pro-competition, regulatory remedies to tackle SMP of a big tech in one specific, relevant digital market may not assure enough incentives to entry, when the incumbent platform is present in several other markets, which is a common scenario in the digital economy. As suggested by the general demand, elasticity functions derived in Subsection 3.2 (see equations 3.10, 3.11 and 3.12), big digital platforms leverage their market power across different digital markets. They thus experience a more inelastic demand with respect to the level of target ads, data collection, and price of their products. In other words, the fact that these platforms provide many different services to internet users makes the users less likely to switch to services provided by entrant firms, even when they provide a superior quality.

Moreover, Morton et al. (2019) argue that platform consumers have bounded rationality. For example, consumers are most likely to use the default apps pre-installed in their smartphones, access only the first search results they are shown, and incautiously agree with terms and conditions that allow platforms to collect, process, and extensively use their private information. According to the same authors, consumers make these non-rational decisions because of inherent

⁹ The EU guideline established that under 40% of market-share dominance is unlikely; between 40% and 50% of market-share, there is risk of dominance; and above 50% of market-share, dominance is presumed (European Commission, 2018b).

behavioral biases, such as discounting the future too much and being too optimistic. Such behavioral attributes of internet users aid in diminishing the efficacy of any pro-competitive regulation in one specific digital market.

For example, a user of a social media service provided by a dominant digital platform that also provides other digital services to its users, e.g., payment services, e-commerce solutions, and digital or text-messaging services, would experience high costs to switch to a new social media provider, unless this new provider was another big player that also offered many other services to the user. In another example, an incumbent platform such as Google, which has large market-shares in many digital markets, should have a more inelastic demand for its video-streaming service (YouTube) when compared with its competitors. Therefore it should be able to keep its level of market-share stable even when it is identified as with SMP and subjected to *ex-ante* remedies to diminish switching costs and entry barriers, such as interoperability, data portability, and data sharing.

In an practical example, users that are really used to accessing YouTube to watch videos, and also to using several other Google services like webmail, web browser, search engine, maps, cloud, etc., would be resistant to switching from YouTube to a smaller video streaming platform in which they have no previous experience. Finally, because Google collects data from the user in many digital markets, even in the presence of *ex ante* regulation only in the video streaming market, the big platform can still provide a better (tailored) service to the user. Thus, Google can charge more for the service, include more target ads, and/or collect more data from the users without seeing them switch to its competitor.

To tackle the market power of big digital platforms and so foster competition in user-side, digital markets of the platform economy, a multi-market, coordinated analysis is needed. First, the

SMP regulatory framework should be adopted and include the definitions of all relevant digital markets through the use of tools such as the SSNIP, the SSNIA and the SSNID tests, and the identification of platforms with SMP in each digital market. Then, pro-competitive, *ex-ante*, regulatory remedies should be applied to target a digital platform in all relevant markets where it was identified as holding market power. Such an approach may be a first step in neutralizing the aforementioned advantages of incumbent big techs to acquire market share even without offering better services when compared with their competitors. For example, this approach would allow competitors to benefit from information collected by the incumbent platform not just in one market but in all markets where the platform is present. Non-discrimination across markets may also be better guaranteed under this approach. For example, Google should be prevented from discriminating against a competitor of YouTube in Google Search.

4.3.2. Applying the SMP framework in advertiser-side, digital markets

A set of products can be identified in relevant markets of targeted digital ads. It is possible to establish the limits to demand-side and supply-side substitutability with respect to them. For example, for demand-side substitutability, advertisement products that cannot be customized to target a specific audience of interest or have no means to be delivered to it can be defined as beyond the boundaries of the relevant market. There are different formats of targeted ads possible for purchase to reach a given audience. They include a banner in a website, a post on a user's timeline, or a short video to be watched before or in the middle of a video-on-demand. They can be considered as product differentiation inside the same market in which slots of targeted ads are sold by competing platforms that reach the same, well-defined audience of internet users.

The definition of limits to supply-side substitutability is even more straightforward. This is because few digital platforms have a huge presence in user-side markets to quickly launch a targeted-ads service to offer in advertiser-side markets. Thus, a group of firms can be defined in such a way that no other would be able to provide targeted ads to a given audience, because of a lack of information about that audience of internet users or because there are no means to deliver the ads due to a small participation in the digital markets mostly consumed by that audience.

To define a relevant product market, the traditional SSNIP test would be perfectly applicable in digital advertiser markets, given that the product in this case were always positively priced. For example, one could analyze the demand response for a small but significant and non-transitory increase in the price of a given targeted digital ads service, such as Google AdSense or Facebook Ads Manager, as shown in equation 3.19. Furthermore, consider that the products in this market are not only differentiated by price but also by the level of customization allowed (a function of the level of data collected by the platform from its users in user-side, digital markets). They also vary by the size of the audience possible to be reached (a function of the platform level of presence in the user-side, digital market of interest to most advertisers). Therefore, a modified approach of the SSNIP test that accounts for factors that have an impact on the demand for targeted ads other than price should be used.

Informed by the targeted-ads, demand-elasticity functions derived earlier in this paper (see equations 3.18 and 3.19), I propose the use of tests to analyze the response of the demand to a small, but significant, non-transitory decrease in the amount and variety of data owned by the supplying, incumbent platform from its users in user-side, digital markets, and in its market-share in user-side, digital markets (a SSNDD and a SSNDM test, respectively, where DD denotes a decrease in data collected and DM denotes a decrease in market-share in user-side digital markets.)

A geographic dimension can also be set for advertiser-side, digital markets, for example one that comprises advertisers located in the jurisdiction of a concerned regulatory authority. In fact, the aim of any regulatory authority in charge of promoting competition in the supply of targeted ads would be to increase the options of targeted ads platforms available to the advertisers under its jurisdiction. The advertisers, as well as the countless number of brick-and-mortar firms that hire advertisers to run their digital marketing campaigns, are actually the customers in these digital markets seeking for more competition against digital platforms (Prat and Valletti, 2019).

The next step would be to identify a firm with market power in such advertiser-side, relevant markets. For this, the criteria provided in Subsection 4.2 still apply. The analysis starts with market-shares in the relevant market of analysis and a number of different, user-side, digital markets in which the incumbent's platforms and their levels of market are present. For example, a digital platform with a big market share in a given, relevant market of targeted, digital ads experiences strong network effects from its network size on the other side of the platform, where it gathers the private data and attention of internet users through the provision of retail digital services. It also derives economies of scope to offer a widely customizable, target ads service, because of the great amount of data it owns and its strong capacity to generate information from it using costly, technological infrastructure accumulated through the years.

Nevertheless, no *ex-ante*, regulatory remedy would have significant impact in promoting competition against an incumbent platform in advertiser-side, digital ads markets if it were not enforced jointly with remedies to lower its dominance in user-side, digital markets. For example, if a competitive entrant had been granted access to the same level of private information of internet users typically owned by the biggest digital platforms, that entrant would be unable to deliver targeted digital ads to internet users. The entrant would need to be strongly represented in the user-

side, digital markets through which the digital ads are delivered to internet users. In a similar way, an entrant platform with access granted to deliver targeted ads to a large base of users, but with no or limited information from them in return, would be unable to compete effectively with incumbent digital platforms in advertiser-side markets, regardless of their price, because of its limitations to offer a highly customizable ads platform.

Therefore, to foster competition in advertiser-side, targeted ads markets of the platform economy, efforts are required to diminish the market power of incumbent, digital platforms in both user-side and advertiser-side markets. First, the SMP regulatory framework should be adopted, with the definition of all relevant digital markets through the use of tools, such as the SSNIP, the SSNIA and the SSNID tests in the user-side markets (as detailed in the previous subsection) as well as the SSNIP, the SSNDD, and the SSNDM tests in an advertiser-side, relevant market of interest. Then, pro-competitive, *ex-ante*, regulatory remedies should be applied to target incumbent platforms in all user-side and advertiser-side relevant markets where they have operation.

Such an approach might focus on granting the means to entrant platforms offering a highly customizable targeted ads platform for a competitive price, through which advertisers might reach a large audience comparable to the one reached through incumbent platforms. This would compensate the advantages that the current incumbent platforms have, which are derived from the enormous amount of data collected from their immense user bases of internet users in several user-side, digital markets.

5. Conclusion

In the era of digital platforms, it has proven to be a challenge to ensure that consumers continue to derive benefits from consuming digital goods and services. The list of anti-trust cases opened

to investigate potential anti-competitive practices of the big techs is long. Concerned governmental bodies and scholars around the world have been debating alternatives to foster competition in the digital economy and avoid the exercise of market power by almost omnipresent, digital platforms. A review of traditional, competition policy tools and the creation of a regulatory regime over digital markets have been proposed by many stakeholders. However, in either approach, the procedures for identification of firms with market power in digital markets remain highly contested.

In this paper I proposed a framework for measuring the market power of digital platforms. The proposed economic model shows that platforms can leverage their market power across markets in the digital economy and make their end users unlikely to switch to smaller competitors even when they offer better services. Based on this analysis, I proposed and discussed some policy alternatives to harness the potential of pro-competitive remedies in the digital economy. Most important, when applied with some adaptations, I concluded that the SMP framework remains relevant to the examination of markets on the user side and supplier side of digital platforms.

In user-side markets, the traditional SSNIP test can be applied to digital services that require a monetary payment for access. However, when the digital service or product is zero-priced - a common scenario in digital markets - modified versions of this test should be used to analyze the response of the demand to small but significant non-transitory increase in the level of targeted ads bundled with digital content (SSNIA test) and the amount of private data collected from the user (SSNID test). Moreover, I argued that market-specific, pro-competition remedies may not assure enough incentives to entry. First, behavioral attributes of internet users diminish the expected benefit of switching to other suppliers. Second, incumbent platforms that are present in several digital markets experience a more inelastic demand with respect to the level of targeted

ads, data collection, and the price of their digital products and services. To capture these characteristics of platform markets with large players, a multi-market, coordinated analysis is needed. Big digital platforms will have to be targeted by pro-competitive remedies in all markets in which they are present.

For supplier-side markets, I focused on the market of targeted ads, although the results are generalizable to other aspects of supplier strategy. I concluded that the SSNIP test applies, but that other tests are also needed to assess the response of the demand to a small but significant non-transitory decrease i) in the amount and variety of internet users' data owned by the supplying incumbent platform (SSNDD test), and ii) in the incumbent platform's market-share in user-side, digital markets (SSNDM test). However, I argued that no *ex-ante*, regulatory remedy would have significant impact in promoting competition if it were not enforced jointly with remedies to lower its dominance in the digital markets of the user side of the incumbent platforms.

An important topic not covered in this paper that may benefit from future research is the design of a set of concrete, regulatory remedies to prevent the exercise of market power by digital platforms. An additional topic is the study of what institutional framework would be more suitable to foster competition in the digital economy without discouraging innovation and investments (e.g., a specialized regulatory authority, a traditional competition authority, or an empowered telecommunications regulatory authority). A third topic is the investigation of the extent to which national, pro-competitive measures towards digital markets would require international cooperation among competition authorities and regulators to be effective.

References

- Acquisti, A., & Spiekermann, S. (2011). Do interruptions pay off? Effects of interruptive ads on consumers' willingness to pay. *Journal of Interactive Marketing*, 25(4), 226-240.
- Armstrong, M. (2006). Competition in two-sided markets. *The RAND Journal of Economics*, 37(3), 668–691.
- Armstrong, M., and Wright, J. (2007). Two-sided Markets, Competitive Bottlenecks and Exclusive Contracts. *Economic Theory*, 32(2), 353–380. <https://doi.org/10.1007/s00199-006-0114-6>.
- Berry, S. T. (1994). Estimating Discrete-Choice Models of Product Differentiation. *The RAND Journal of Economics*, 25(2), 242. <https://doi.org/10.2307/2555829>
- Berry, S., Levinsohn, J., & Pakes, A. (1995). Automobile prices in market equilibrium. *Econometrica: Journal of the Econometric Society*, 841-890.
- Bounie, D., Valérie, M., & Quinn, M. (2017). Do you see what I see? Ad viewability and the economics of online advertising. *Ad Viewability and the Economics of Online Advertising*. Available at <https://www.lcii.eu/wp-content/uploads/2017/02/Bounie-Morrisson-Quinn-Ad-viewability-and-the-economics-of-online-advertising.pdf>.
- Bundeskartellamt (2019). Case Summary: Facebook, Exploitative business terms pursuant to Section 19(1) GWB for inadequate data processing. *Bundeskartellamt*. B6-22/16. Bonn. Germany. Retrieved on December 3, 2020 from https://www.bundeskartellamt.de/SharedDocs/Entscheidung/EN/Fallberichte/Missbrauchsaufsicht/2019/B6-22-16.pdf?__blob=publicationFile&v=4.

- CMA (2020). Online platforms and digital advertising: Market study final report. Competition and Markets Authority. Retrieved on December 3, 2020 from <https://www.gov.uk/cma-cases/online-platforms-and-digital-advertising-market-study#final-report>.
- Coate, M. B., & Fischer, J. H. (2008). A practical guide to the hypothetical monopolist test for market definition. *Journal of Competition Law & Economics*, 4(4), 1031–1063.
<https://doi.org/10.1093/joclec/nhn007>
- Crémer, J., Montjoye, Y.-A. de, Schweitzer, H. and Directorate-General for Competition - European Commission (2019). Competition policy for the digital era. Retrieved from http://publications.europa.eu/publication/manifestation_identifier/PUB_KD0419345ENN.
- Cusumano, M. A., Gawer, A., and Yoffie, D. B. (2019) *The Business of Platforms: Strategy in the Age of Digital Competition, Innovation, and Power*. Harper Business.
- Dukes, A., & Gal-Or, E. (2003). Negotiations and exclusivity contracts for advertising. *Marketing Science*, 22(2), 222-245.
- eMarketer (2019). Global Digital Ad Spending 2019: Digital Accounts for Half of Total Media Ad Spending Worldwide. eMarketer. Retrieved from <https://www.emarketer.com/content/global-digital-ad-spending-2019>.
- European Commission (2017). Summary of Commission decision of 27 June 2017 relating to a proceeding under Article 102 of the Treaty on the Functioning of the European Union and Article 54 of the EEA Agreement (Case AT.39740 — Google Search (Shopping)). *Official Journal of the European Union*. 2018/C 9/08. Retrieved on December 3, 2020 from [https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52018XC0112\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52018XC0112(01)&from=EN).

European Commission (2018a). Communication from the Commission: Guidelines on market analysis and the assessment of significant market power under the EU regulatory framework for electronic communications networks and services. Official Journal of the European Union. C 159. Retrieved from <https://ec.europa.eu/digital-single-market/en/news/guidelines-market-analysis-and-assessment-significant-market-power>.

(2018b). Commission Staff Working Document: Accompanying the document “Communication from the Commission: Guidelines on market analysis and the assessment of significant market power under the EU regulatory framework for electronic communications networks and services”. SWD (2018) 124 final. Retrieved from <https://ec.europa.eu/digital-single-market/en/news/guidelines-market-analysis-and-assessment-significant-market-power>.

European Commission (2020a). Digital Services Act package – ex ante regulatory instrument of very large online platforms acting as gatekeepers. European Commission. Law. Public Consultation. Brussels. Belgium. Retrieved on December 3, 2020 from <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12418-Digital-Services-Act-package-ex-ante-regulatory-instrument-of-very-large-online-platforms-acting-as-gatekeepers>.

(2020b). Progress Report: Work stream on Measurement & Economic Indicators. Expert Group for the Observatory on the Online Platform Economy. European Commission. Brussels. Belgium. Retrieved on December 3, 2020 from <https://ec.europa.eu/digital-single-market/en/news/commission-expert-group-publishes-progress-reports-online-platform-economy>.

- Fan, M., Kumar, S., & Whinston, A. B. (2007). Selling or Advertising: Strategies for Providing Digital Media Online. *Journal of Management Information Systems*, 24(3), 143–166.
<https://doi.org/10.2753/MIS0742-1222240305>
- Furman, J. (2019). Unlocking Digital Competition: Report of the Digital Competition Expert Panel. Retrieved from
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/785547/unlocking_digital_competition_furman_review_web.pdf.
- Gillespie, T. (2018). *Custodians of the Internet: Platforms, Content Moderation, and the Hidden Decisions That Shape Social Media*. Yale University Press.
- Helmond, A. (2015). The Platformization of the Web: Making Web Data Platform Ready. *Social Media + Society*, 1(2), 205630511560308. Retrieved from
<https://doi.org/10.1177/2056305115603080>.
- International Telecommunications Union (2016). ITU-T Recommendation D.261: Regulatory principles for market definition and identification of operators with significant market power – SMP. Retrieved from <https://www.itu.int/rec/T-REC-D.261-201610-I>.
- Johnson, V. L., Kiser, A., Washington, R., & Torres, R. (2018). Limitations to the rapid adoption of M-payment services: Understanding the impact of privacy risk on M-Payment services. *Computers in Human Behavior*, 79, 111–122. <https://doi.org/10.1016/j.chb.2017.10.035>
- Just, N. (2018). Governing online platforms: Competition policy in times of platformization. *Telecommunications Policy*, 42(5), 386–394.
- Khan, L. (2017), "Amazon's antitrust paradox," *Yale Law Journal*, 126(3), 710-805.

- Krämer, B. (2017). Populist online practices: the function of the Internet in right-wing populism, *Information, Communication & Society*, 20:9, 1293-1309, DOI: 10.1080/1369118X.2017.1328520.
- Lerner, A. P. (1934). "The Concept of Monopoly and the Measurement of Monopoly Power". *The Review of Economic Studies*. 1 (3): 157–175. doi:10.2307/2967480.
- Martin, K. (2018). The penalty for privacy violations: How privacy violations impact trust online. *Journal of Business Research*, 82, 103–116.
<https://doi.org/10.1016/j.jbusres.2017.08.034>.
- Morton, F. S.; Bouvier, P.; Ezrachi, A.; Jullien, B.; Katz, R.; Kimmelman, G.; Melamed, A. D. & Morgenstern, J. (2019). Report. Committee for the Study of Digital Platforms. Market Structure and Antitrust Subcommittee. Chicago, IL, University of Chicago, Stigler Center for the Study of Economy and State.
- Nevo, A. (2000), A Practitioner's Guide to Estimation of Random-Coefficients Logit Models of Demand. *Journal of Economics & Management Strategy*, 9: 513-548.
<https://doi.org/10.1111/j.1430-9134.2000.00513.x>.
- OECD (1993). Glossary of industrial organization economics and competition law. Paris: Organization for Economic Co-operation and Development. Retrieved from <http://www.oecd.org/regreform/sectors/2376087.pdf>.
- Owen, B. M., & Wildman, S. S. (1992). *Video Economics*. Cambridge, MA: Harvard University Press.
- Pagani, M. (2013). Digital Business Strategy and Value Creation: Framing the Dynamic Cycle of Control Points. *MIS Quarterly* (37:2), pp. 617–632.

- Papies, D., Eggers, F., & Wlömert, N. (2011). Music for free? How free ad-funded downloads affect consumer choice. *Journal of the Academy of Marketing Science*, 39(5), 777-794.
- Parker, G., and Van Alstyne, M. (2017). "Innovation, Openness, and Platform Control," *Management Science* (in Advance:October), pp. 1–18.
- Prasad, A., Mahajan, V., & Bronnenberg, B. (2003). Advertising versus pay-per-view in electronic media. *International Journal of Research in Marketing*, 20(1), 13–30.
[https://doi.org/10.1016/S0167-8116\(02\)00119-2](https://doi.org/10.1016/S0167-8116(02)00119-2)
- Prat, A., & Valletti, T. M. (2018). Attention Oligopoly. *SSRN Electronic Journal*. Retrieved from <https://doi.org/10.2139/ssrn.3197930>.
- Rochet, J.-C., and Tirole, J. (2003). Platform Competition in Two-Sided Markets. *Journal of the European Economic Association*, 1(4), 990–1029.
<https://doi.org/10.1162/154247603322493212>.
- Rosen, J. (2011). The Deciders: The Future of Privacy and Free Speech in the Age of Facebook and Google. *Fordham Law Review*, 80, 1525.
- Rosse, J. N. (1970). Estimating cost function parameters without using cost data: Illustrated methodology. *Econometrica*, 38(2), 256-275.
- Schechter, A. (2018). Google and Facebook's "Kill Zone": "We've Taken the Focus Off of Rewarding Genius and Innovation to Rewarding Capital and Scale". ProMarket. Chicago, IL, University of Chicago, Stigler Center for the Study of Economy and State. Retrieved on December 3, 2020 from <https://promarket.org/2018/05/25/google-facebooks-kill-zone-weve-taken-focus-off-rewarding-genius-innovation-rewarding-capital-scale/>.
- Solon, O. (2017). As tech companies get richer, is it 'game over' for startups? *The Guardian*. Retrieved on December 3, 2020 from

<https://www.theguardian.com/technology/2017/oct/20/tech-startups-facebook-amazon-google-apple>.

Spagnoletti, P., Resca, A., and Lee, G. (2015). “A design theory for digital platforms supporting online communities: a multiple case study,” *Journal of Information Technology* (30:4), pp. 364–380.

StatCounter (2019a). Search Engine Market Share Worldwide - November 2019. StatCounter: GlobalStats. Retrieved from <https://gs.statcounter.com/search-engine-market-share>.

_____ (2019b). Browser Market Share Worldwide - November 2019. StatCounter: Global Stats. Retrieved from <https://gs.statcounter.com/browser-market-share>.

_____ (2019c). Mobile Operating System Market Share Worldwide - November 2019. StatCounter: Global Stats. Retrieved from <https://gs.statcounter.com/os-market-share/mobile/worldwide>.

_____ (2019d). Social Media Stats Worldwide - November 2019. StatCounter: Global Stats. Retrieved from <https://gs.statcounter.com/social-media-stats>.

Statista (2019). Most popular global mobile messenger apps as of October 2019, based on number of monthly active users (in millions). Statista. Data retrieved from <https://www.statista.com/statistics/258749/most-popular-global-mobile-messenger-apps/>.

Strandburg, K. J. (2013). Free Fall: The Online Market's Consumer Preference Disconnect. *University of Chicago Legal Forum*: Vol. 2013, Article 5. Available at: <http://chicagounbound.uchicago.edu/uclf/vol2013/iss1/5>.

Tan, B., Pan, S. L., Lu, X., and Huang, L. (2015). The Role of IS Capabilities in the Development of Multi-Sided Platforms: The Digital Ecosystem Strategy of Alibaba.com. *Journal of the Association for Information Systems* (16:4), pp. 248–280.

The Economist (2018). Into the danger zone: American tech giants are making life tough for startups. Business. June 2nd 2018 Edition. Retrieved on December 3, 2020 from

<https://www.economist.com/business/2018/06/02/american-tech-giants-are-making-life-tough-for-startups>.

Tucker, C. E. (2012). The economics of advertising and privacy. International journal of Industrial organization, 30(3), 326-329.

U.K. (2020). Policy paper: Response to the CMA's market study into online platforms and digital advertising. Retrieved on December 2, 2020 from

<https://www.gov.uk/government/publications/government-response-to-the-cma-digital-advertising-market-study>.

U.S. Department of Justice (2020). Justice Department Sues Monopolist Google For Violating Antitrust Laws: Department Files Complaint Against Google to Restore Competition in Search and Search Advertising Markets. Justice News. Department of Justice. Office of Public Affairs. Retrieved on December 3, 2020 from <https://www.justice.gov/opa/pr/justice-department-sues-monopolist-google-violating-antitrust-laws>.

U.S. Federal Trade Commission (2020a). FTC to Examine Past Acquisitions by Large Technology Companies: Agency Issues 6(b) Orders to Alphabet Inc., Amazon.com, Inc., Apple Inc., Facebook, Inc., Google Inc., and Microsoft Corp. Federal Trade Commission: Press Releases. Washington, DC. Retrieved on December 3rd, 2020 from

<https://www.ftc.gov/news-events/press-releases/2020/02/ftc-examine-past-acquisitions-large-technology-companies>.

(2020b). FTC sues Facebook for illegal monopolization: Agency challenges Facebook's multi-year course of unlawful conduct. Federal Trade

Commission: Press Release. Washington, DC. Retrieved on December 12th, 2020 from <https://www.ftc.gov/news-events/press-releases/2020/12/ftc-sues-facebook-illegal-monopolization>.

U.S. House. (2020). Investigation of competition in digital markets: Majority Staff Report and Recommendations, Subcommittee on Antitrust, Commercial and Administrative Law of the Committee on the Judiciary. Washington, DC: U.S. House of Representatives.

Van Dijck, J., Poell, T., & De Waal, M. (2018). The platform society: Public values in a connective world. Oxford, UK; New York: Oxford University Press.

Wang, Y., & Herrando, C. (2019). Does privacy assurance on social commerce sites matter to millennials? *International Journal of Information Management*, 44, 164–177.
<https://doi.org/10.1016/j.ijinfomgt.2018.10.016>

Wheeler, T., Verveer, P., & Kimmelman, G. (2020). New digital realities; new oversight solutions in the U.S. The case for a Digital Platform Agency and a new approach to regulatory oversight. Discussion Paper, Shorenstein Center on Media, Politics and Public Policy, Harvard University.

Zhang, K., & Sarvary, M. (2015). Differentiation with user-generated content. *Management Science*, 61(4), 898-914.