

Market Dominance and Quality of Search Results in the Search Engine Market: Analysis of Exploitative and Exclusionary Abuses

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Abstract

We analyze a search engine market from the law and economics perspective and incorporate the choice of quality improving innovations by a search engine platform in a two-sided model of oligopolistic internet search engine market. The modification of a two-sided market model in Armstrong (2006), which we propose, appears to be a convenient tool for the analysis of market structure, rate of innovation, pricing, and quality choices in innovative industries with network effects. In the proposed framework we analyze what issues the search engine market raises for antitrust policy: in particular, monopolization by a single company (such as Google) and exclusionary conduct by the dominant firm. Our findings show that monopoly platform results in higher prices and under-investment in quality improving innovations by a search engine relative to the social optimum. Further, we extend this analysis to an oligopoly setting with multi-homing. There we find that the dominant platform also does not have sufficient incentives to invest in quality improvements even in the presence of potential (but weaker) competitors. Finally, we analyze the conditions, under which the exclusionary behavior in the search engine market can be harmful.

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1 Introduction

Even though the search engine market is relatively young, law and economics literature is confronted with a number of important questions related to the rapid growth of online search, its concentration, and its increasing importance for our society. In this paper we analyze the implications of excessive concentration and market dominance in search engines market for different players (such as users, search engines, and advertisers) and different market outcomes (such as prices charged to advertisers and the quality of search results). We analyze what issues the search market raises for antitrust policy and whether the search market requires regulation that would prevent it from monopolization by a single company (such as Google) or from exclusionary conduct by dominant firms. The main aim of this paper is to illustrate how advanced economic models of two-sided markets can be employed to analyze possible legal antitrust issues arising in the search engine market.

The markets for search-based and online advertising have a number of specific features that set them apart from most markets. These features include network effects, double-sidedness, and high levels of R&D and innovation. Network effects often play an important role in analyzing competition in R&D intensive markets. Network effects present opportunities for enhanced consumer welfare, but also can create the potential for competitive harm and increased barriers to entry. There are certainly some positive network effects, in view of the improvement of the algorithmic results, following the increase of end users' searches and thus keywords. It is also possible to advance the existence of indirect network effects, as advertisers value more a search engine with a greater number of end users. Manne and Wright (2011) challenge nevertheless the importance of network effects: they note that network effects are 'unidirectional' as advertisers want more end users, but end users do not care about the number of advertisers (or they care negatively – having less advertisements is more appreciated).¹ On the contrary, Evans (2008) notes the existence of a positive feedback loop between the search and the advertiser sides. In any case, the potential interplay between network effects and innovation incentives in the search market must be examined (see e.g. Economides (2010) or Larouche (2009)). In this project we utilize the existing models of two-sided markets by e.g. Armstrong (2006) or Armstrong and Wright (2007) to analyze R&D efforts or investments into quality improvements by competing platforms in

¹Manne and Wright (2011) also question the link between the number of end users and the value accorded by advertisers, observing that an increase in the number of users looking only for information and not aiming to purchase a good or service may be of little value for advertisers. In any case, indirect network effects, if there are any, are already internalized by the price advertisers have to pay to the search engine, as they are charged per effective click to the advertisers' landing page. Thus, there are no external benefits in the search engine business and advertisers are in principle able to switch to another search engine without the need to be compensated for lost external benefits (Manne and Wright, 2011).

the presence of possible network effects. This allows analyzing interplay between innovation and competition incentives in the search engine market and in two-sided markets in general.

Obviously, the structure of the search engine market and its pricing/quality strategies have certain distinctive features. The search engine acts as a platform intermediating between content providers (who want users), users (who want content), and advertisers (who want users). Closely related to this structure of connections between agents is the associated pricing structure, where users/searchers enjoy the service for free², advertisers are required to pay strictly positive prices for search engine services (at least with regard to sponsored or paid links)³, and content providers are subsidized by the search engine. These features of the search engine markets call for applications of two-sided markets models as has already been recognized in Devine (2008), Evans (2010), Jeon et al. (2011), or Halaburda and Yehezkel (2011). While a positive price is only set for one of the three groups (i.e. advertisers), quality competition plays nevertheless an important role with regard to the relation between search engines and users and between search engines and content providers, by the intermediary of users (the better a search engine is, the more users it will attract and thus the more valuable it will be for content providers).

Furthermore, search engines are different from other web-sites because of their crucial gateway role. The users of search engine are more valuable from advertisers' perspective compared to the users of any other web-sites, since they have provided important information about themselves and their intentions through their search query. Search engines act as "information gatekeepers": they do not only provide information on what can be found on the web (equivalent to yellow pages), but also they are "an essential first-point-of-call for anyone venturing onto the Internet" (see Pollock (2010)). To the difference of other two sided platforms, search engines detain an important amount of information about their

²Search engines are constrained to price at zero, as imposing negative or positive prices will produce transaction costs.

³Organic or natural results are generated without involving any direct cost for the websites linked. For example, the majority of Google's income comes from sponsored links paid by the featured organization, the amount of Google's charges been calculated according to a Vickrey second price keyword auction, adjusted by 'quality factors' and conducted through Google's AdWords platform. The 'quality score' is a metric looking at a variety of factors, such as the historical 'clickthrough rate', the user's account history, the quality of the landing page (determined by Google after analysis of the relevant and original content, transparency and ease of navigation), the relevance of the keyword to the ads in its ad group, the relevance of the keyword and the matched ad to the search query, the account's performance in the geographical region where the ad will be shown. 'Quality scores' make it possible to differentiate between advertisers: an advertiser with a low quality score will have to pay more per click (high cost per click) to achieve higher search results positions than advertisers with better quality scores, as a compensation for the opportunity cost for Google of not listing higher more relevant advertisements and consequently the degradation of the quality of the search engine, as it will produce less relevant results. The quality score formula is generally opaque, as making the ranking formula accessible will make it easier for people to game the system. The rest of Google's income comes from selling advertisements in designated spaces in third-party websites, through its AdSense application.

customers and advertisers (the “map of commerce”, see Spulber (2009)). Utilizing this information allows search engines to increase the relevance of their advertisements, and increased relevance means increased value to those who wish to advertise. Hence, the quality of matching and the quality and the relevance of search results are valued not only by users of the search engine, but also by advertisers. These arguments imply that the quality of the search and the relevance of the search results play a crucial role for both consumers and advertisers.

In pursuit of quality improvements search engines invest heavily in technology improvements. Search engines are R&D intensive and the market generally displays high levels of innovation. According to Devine (2008), the search engine industry operates in an innovative environment where firms compete not only to outdo competitors on price or quality, but also to displace one another’s products entirely, if possible. In such a market, a dominant firm can acquire potentially displacing technology and thereby control future innovation, freeing itself from the burden of innovating further to maintain competitive advantage.⁴ Furthermore, according to Pollock (2010), search engines display many of the characteristics of natural monopolies, as their cost structure involves important fixed costs, such as hardware, support, updates, monitoring, but almost zero marginal costs on both the user and advertiser side of the market. This reinforces the tendency of this market to concentration.

Another example of "predatory behavior" by a dominant firm is exclusivity clauses in contracts with advertisers (see e.g. AdSense contracts with advertisers). In these cases the dominant firm may employ strategies reducing multi-homing by advertisers in the form of obstacles to the simultaneous use by advertisers of several search-based ads platforms. It has already been recognized that multi-homing by advertisers will enhance the development of scale, efficiency, and innovation for minor search platforms, while any policy aimed at limiting multi-homing creates obstacles to network effects (see e.g. Etro (2011b)).

Further, an important aspect of the internet search market is its high levels of concentration. According to recent data, in the US, Google had a market share of 66.2%, Yahoo of 16.4%, and Bing of 11.8%. In the UK, just as in many other European countries, Google had a market share of 90.83%, Yahoo of 3.21%, and Bing of 3.12%. See Pollock (2010) or Argenton and Prüfer (2011) for more detailed overviews. The basic conclusion is that a single firm (Google) is emerging to dominate the market at least in the US and in Europe. The

⁴One of the main sources of this potentially displacing technology in the search engine market is the upstream market for talented creative programmers and software developers. As illustrated by Helft (2011) (New York Times) this market is quite thin and companies like Google or Facebook are willing to pay millions for young talented engineers. If a dominant firm (e.g. Google) buys out all the valuable resources (e.g. programmers with certain skills), these valuable upstream resources would be unavailable or too costly for other search engines, which may make it impossible for them to compete in quality dimension (and might reduce the quality of the search results even further).

threat of domination and exclusionary conduct by dominant firms becomes even stronger in the search engine market, since it can result not only in excessive pricing for advertisers, but also in reduction of quality of search results, which harms both advertisers and users. Another concern is that excessive dominance in the search engine markets can harm competition in the upstream markets that are the main source of quality improving innovations in the search engine market itself.

This paper analyzes a number of specific features of the search engine market from an economic perspective and incorporates the analysis of quality improving capital investments in a two-sided model of oligopolistic internet search engine market. Our findings show that a monopoly platform results in higher prices and under-investment in quality improving innovations by a search engine relative to the social optimum. We find that there is a threat of reduction in the quality of search results, if search engine market is monopolized or dominated by a single firm (such as e.g. Google). Further, we extend the model to an oligopoly setting and analyze whether the threat of the predatory behavior, in general, and exclusionary conduct, in particular, exists in the search engine market and what are the consequences of this behavior for pricing and the quality of search results.

The results we obtain are similar to the results in Argenton and Prüfer (2011). In simple oligopoly settings they also observe that monopolization of the search engine market has negative effects on the expected average search quality, the rate of innovation, consumer surplus, and total welfare. They find that there is a strong tendency towards market tipping and, subsequently, monopolization, with negative consequences for economic welfare. As a remedy they propose to require search engines to share their data on previous searches. Presumably, this would level the playing field in the quality dimension.

In our model, which is a modification of Armstrong (2006) and Armstrong and Wright (2007) approach, we endogenize both pricing and quality decisions on both sides of the platform. In this framework we analyze legal antitrust issues arising in the search engine market, such as exploitative and exclusionary abuses, and how they influence the level of quality improving innovations. Our results are complementary to results of the oligopoly model in Argenton and Prüfer (2011), where only quality choices are endogenized.

The structure of the paper is as follows. We begin in section 2 with literature review. In section 3 we give an overview of the legal issues. In Section 4 we discuss some specific features of search engine market and introduce a model of oligopolistic internet search engine. In section 5 we employ the framework of the section 4 in order to analyze exploitative abuses. There we first compare the results under social optimum to the performance of a monopolist and show that monopoly results in under-provision of quality relative to the social optimum. Similar result holds in an oligopolistic market that is dominated by a single firm. Section 6

analyzes the consequences of exclusionary conduct by the dominant firm through the analysis of possible strategies reducing multi-homing on advertiser's side of the market. Section 7 concludes and discusses possible actions to address the above mentioned deficiencies. We argue that the evidence on increasing concentration and the theoretical results in the paper suggest that some form of intervention is needed in order to avoid exclusionary abuses and to prevent the deterioration in quality and relevance of search results.

2 Related Literature

Most of the existing literature focuses on the advertising side of search engines (see e.g. Edelman et al. (2007), Varian (2007), Ellison and Ellison (2004), Chen and He (2006), or Athey and Ellison (2011)). With their focus on advertising many of these papers see internet search as some form of improved 'yellow-pages'. In particular, search engines are seen primarily a way for consumers to find commercial services or products they want. Given the two-sided nature of search and its similarity to 'yellow-pages', the obvious analytical tools to use would be those developed in the literature on two-sided markets (see e.g. Rochet and Tirole (2003, 2006), Caillaud and Jullien (2003), Armstrong (2006), Armstrong and Wright (2007), or Gomes (2010)). The search engine business fits comfortably within this paradigm after some proper modification and adaptation of existing models and taking into account the importance of quality improving capital investments (or innovation efforts) by the platform. This point will be central to our analysis and it differentiates our analysis from much of the existing literature. The issue of quality and innovations has not been addressed in the theoretical literature on two-sided markets so far. Moreover, also surprisingly, there are very few attempts to model a search engine as a two-sided platform (exceptions are Jeon, Jullien, and Klimenko (2011), and Halaburda and Yehezkel (2011)).

Another stream of the literature looks at the importance of the quality of information provided by the search engine, but does not take into account its two-sidedness and alleged network externalities (see e.g. Pollock (2010) and White (2008)). The approach we take is also very different from Pollock (2010) and White (2008), while it still emphasizes the importance of quality considerations for the search engine market. Turning to our approach, it should be stressed that the two primary groups a search engine sits between are users and advertisers. There are many examples of markets in which two or more groups of agents interact via intermediaries or "platforms." Surplus is created when the groups interact. However, in some cases also cross-group externalities are present, and the benefit enjoyed by a member of one group depends upon how well the platform does in attracting customers from the other group. This general idea articulated in Armstrong (2006) seems to fit very

well the situation in internet search engine market with end users on the one side and advertisers on the other side, where quality of the search engine is important for the both sides. Furthermore, two-sided markets framework is convenient to analyze multi-homing by users and advertisers and the effects of strategies by dominant platform that limit multi-homing on either side of the market (see e.g. Armstrong and Wright (2007)).

Further, there is a number of articles on determination of the relevant market for on-line advertising, which highlight the differences between online and traditional advertising and also between displayed and search-based advertising, within the class of online advertising. The recent examples are Ratliff and Rubinfeld (2010), Etro (2011), Evans (2009), or Goldfarb and Tucker (2011). See also French Competition Authority report (2010). These references imply that there is no substitutability between online and traditional advertising and only limited substitutability between displayed and search-based advertising. Hence, search-based advertising can be considered as a separate market. In this paper we mainly concentrate on the market for search-based advertising, where two-sided aspect and innovation incentives aimed at increasing quality and relevance of search results play a crucial role. The efficient technology of matching adds on the one side to search queries by users on the other side is essential only for the search-based advertising segment of the market. Search-based advertising is facilitated by the search platform and, actually, can only exist on the basis of such platform.

3 Overview of the Legal Issues

Main competition issues coming from the concentration of the search engine market are strategies reducing multi-homing, leveraging, and exploitative practices. We will discuss each of them in the subsequent three sub-sections, respectively. In the formal analysis section we address the two of the above mentioned problems. Namely, we will analyze the strategies reducing multi-homing by advertisers in the form of obstacles to the simultaneous use by advertisers of several search-based ads platforms. In addition, our theoretical framework allows to address possible exploitative practices and their consequences for advertisers and users (in the form of higher prices than in a perfectly competitive market for advertisers) and deterioration of quality improving innovation efforts by a dominant search engine, which can inflict negative impact on both users and advertisers in the form of reduction in the quality and relevance of search results.

3.1 Strategies reducing multi-homing

We assume the dominant position of Google in the paid search market, because of its high market shares (more than 50%)⁵, the existence of barriers to entry in the form of network effects, and the important fixed costs related to R&D or the development and maintenance of service infrastructure. Search engines do not operate as neutral platforms but may adopt strategies to increase their revenue and thus optimize advertising and placement profits. This can be achieved by reducing multi-homing at the advertising and the end users side of the market (the two being interlinked). Strategies reducing multi-homing may take different forms.

In November 2010, the Commission decided to initiate proceedings under Article 102 TFEU against Google for a number of practices, including the alleged imposition of exclusivity obligations by Google on its advertising and distribution partners, preventing them from placing certain types of competing ads on their web sites, as well as on computer and software vendors, with the aim of shutting out competing search tools and for suspected restrictions on advertisers as to the portability of campaign data to competing online advertising platforms, again in order to limit the multi-homing of online advertising campaigns.⁶ In an opinion delivered in December 2010 on the competitive operation of online advertising, in the context of its consultative function to the French government, the French Competition Authority (FCA) noted the existence of high entry barriers in the industry and the possibility that Google might use a number of practices to increase barriers to entry and thus maintain or reinforce its dominant position in the paid search market.⁷ The FCA provided survey evidence that the privileged position of Google as a percentage of queries constitutes the main justification for opening AdWords account by advertisers. The high fixed costs of developing algorithms and hosting pages (corresponding to several hundreds of millions of Euros), the enhancement of the algorithm by the size of the search engine and the number of queries it receives, as well as Google's lead with regard to exhausting indexing on the end users' part of the market, combined with the lack of traffic on other search engines and the difficulty of launching an alternative search engine, on the advertisers' side of the two-sided market, led the FCA to conclude that the "one click away competition" argument advanced by Google does not hold, at least for the advertisers' side of the market. Relying

⁵The European Commission has cited data proving that Google has a market share for paid search in Europe of more than 95% of the market. See, J. Almunia, Competition in Digital Media and the Internet, UCL Jevons Institute Lecture, London, 7 July 2010, SPEECH/10/365.

⁶European Commission, Antitrust: Commission probes allegations of antitrust violations by Google, November 30th, 2010, IP/10/1624; Cases COMP/C-3/39.740, COMP/C-3/39.775 & COMP/C-3/39.768.

⁷French Competition Authority, Opinion No. 10-A-29, December 14, 2010 on the competitive operation of online advertising.

on its market position and the high barriers to entry, Google could thus adopt practices that would aim to marginalize or exclude its competitors in the paid search market, in particular by artificially putting up barriers to entry in the search engine or search-based ads market. These can be of contractual or technical nature. The FCA listed among these practices, the existence of exclusive agreements related to indexed content, the inclusion of exclusivity clauses in the AdSense contracts concluded between Google and the advertisers, obstacles to competing search engines by content web-sites controlled by Google, such as YouTube and obstacles to the simultaneous use by advertisers of several search-based ads platforms. One could also add input foreclosure of the upstream market of programmers and software developers by Google.

Several of these practices may fall under the scope of EU competition law, and in particular Article 102 TFEU (for both contractual and unilateral practices, although there is a possibility that Article 101 TFEU applies to the latter). It is also advisable to adopt a precautionary ex ante approach and subject to scrutiny merger activity that enhances the dominant position of Google and its capacity to reduce multi-homing.

Concerning antitrust enforcement, the exclusivity strategies adopted by Google are likely to foreclose its competitors, search engines, from an important customer base (customer foreclosure) of advertisers and thus lead to their marginalization/exclusion, the subsequent reduction of innovation in the search engine market and eventually consumer harm. We have no information on the exact magnitude of customer foreclosure that may result from Google's activities, such as the ones referred to in the complaints at the European Commission. It is nevertheless clear that a foreclosure of competing engines from an important part of the advertising market through contractual or de facto exclusivity arrangements reduces their ability to achieve the minimum efficient scale and thus to compete effectively with Google. The theory of harm (anti-competitive foreclosure) advanced in this case will be that by blocking competing search advertisers from gaining the requisite level of search traffic necessary to maintain a viable and competitive search advertising platform, Google has abused its dominant position.

These practices fall certainly within the scope of EU competition law, in particular Article 102 TFEU. In *Suiker Unie v Commission* the Court of Justice held that exclusivity may be an abuse if competitors are left with no available distribution channels through which they can market their products on a sufficiently large scale.⁸ In *British Gypsum*, the Court of First Instance held that exclusive dealing was only abusive when it applied to 'a substantial proportion of purchases'. In these circumstances, exclusivity would be 'an unacceptable

⁸Joined cases 40 to 48, 50, 54 to 56, 111, 113 and 114/73 Coöperatieve Vereniging "Suiker Unie" UA v Commission, para 486.

obstacle' to market entry.⁹ In *Van den Bergh Foods Ltd v Commission*, the Court of First Instance observed that an ice cream supplier had abused its dominant position by offering an exclusive freezer cabinet free of charge to retailers who did not have their own freezer cabinet or a freezer cabinet supplied by a competitor. The tying of 40 per cent of outlets on the relevant market was an abuse because it 'has the effect of foreclosing competitors even if there is demand for their products.'¹⁰

In its enforcement priority guidance, the European Commission has spelled out the main features of the competition analysis to be followed.¹¹ First, the Commission will have to establish the existence of an anti competitive foreclosure by looking to the position of the dominant undertaking (a super-dominant firm with high market shares undertakes a special responsibility to protect the competitive process), the position of customers and the difficulties they might have to switch or to counter the conduct of the dominant undertaking, the extent of the alleged abusive conduct (for example its duration), actual evidence of foreclosure (for example, following the adoption of such practices the market shares of the dominant undertaking have risen sharply), the existence of internal documents and other direct evidence of exclusionary strategy. According to the Commission, it is easier to establish the finding of anti-competitive foreclosure, with regard to exclusive purchasing, if the dominant firm is an unavoidable trade partner for all or most customers (advertisers here), in which case even an exclusive purchasing obligation of short duration can lead to anti-competitive foreclosure. The dominant firm has of course the ability to argue efficiencies, but it is highly unlikely in practice that these will be able to outweigh the anti-competitive effects, in particular for a firm with the dominant position of Google. The Commission's priority guidance does not provide an exact figure for assessing the degree of customer foreclosure required for the application of Article 102 TFEU. Nevertheless, the Commission's Guidelines on vertical restraints provide that for single branding practices, it is likely that they will not benefit from Article 101(3) if the foreclosure at the retail level is higher than 30% or 40% for non dominant undertakings. It follows that in the presence of a dominant undertaking, lower levels of input/customer foreclosure will be sufficient to prove an infringement of Articles 101 and 102 TFEU.

These thresholds are not substantially different from those required in US antitrust law for the application of Sections 1 and 2 of the Sherman Act. US antitrust law traditionally finds no antitrust concern if the foreclosure percentage is less than 40%, for exclusive dealing

⁹Case T-65/89 *British Gypsum*, paras 66 - 68.

¹⁰Case T-65/98 *Van den Bergh Foods Ltd v Commission* [2003] ECR II-4653 paras 159 - 160.

¹¹Communication from the Commission – Guidance on the Commission's enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings [2009] OJ C 45/2.

agreements concluded by a monopolist,¹² although there have been cases where a lower percentage of foreclosure was found sufficient for establishing antitrust liability.¹³ The Trade-Comet complaints in the US against Google might have given the occasion to US courts to clarify the interpretation of the case law with regard to single branding practices, but they were dismissed for procedural reasons.¹⁴

The plaintiff has thus an arguable case of anti-competitive foreclosure if he demonstrates a foreclosure of at least 40% of the search business from rival search advertising platforms. It will be, however, important to prove that competing advertising platforms need to have access to high-traffic websites to build scale, that is, search engines are an effective distribution method for advertising. For example, advertisers might have access to vertical or ‘niche’ search engine providers, alternative horizontal search engines, which might have a more significant market share in specific geographic markets, such as Seznam in Czech republic (outside the EU market one could cite Baidu for China, Blekko for the US, Yandex for Russia). Blocking an entire distribution channel, such as search advertising, is likely to be considered as leading to substantial foreclosure of the market. Yet, it is important to distinguish between different types of search: ‘query navigation’, where a user needs to find a specific web site which he knows or assumes to be present on the Web, should be distinguished from ‘transactional navigation’, where the user aims to reach a destination where a further market interaction will take place (Hoboken, 2012). For advertisers, it is the latest category of search which is of importance as this can lead to the purchase of a product or a service. Crane notes that Google accounts for less than half of the volume of traffic of the websites where market transactions are held (Crane, 2011). This share might be even smaller for Web sites that have developed a strong and recognizable brand, such as the big travel search sites, Expedia, Travelocity and Priceline. This is certainly an empirical question.

As we will show in the following sections, the trend towards concentration in this market may lead to consumer harm. First, a monopolist has incentives to reduce the quality of the search engine for the organic search results valued by end users.¹⁵ Second, innovation in the

¹²Jefferson Parish Hosp. Dist./ No. 2 v. Hyde, 466 U.S. 2, 7 (1984).

¹³United States v. Microsoft Corp., 253 F.3d 34, 70-71 (D.C. Cir. 2001).

¹⁴Available at <http://www.courthousenews.com/2010/03/08/Google%20opinion.pdf> According to the complaint, (I) Google entered into exclusive syndication agreements with certain high-traffic online publishers, thus foreclosing competing search advertising platforms from an important source of paid search revenue, (ii) Google restricted advertisers access to data at AdWords that would have made it easier for them to evaluate the performance of their advertising campaigns and to switch or add competing advertising platforms and (iii) Google deployed default mechanisms that make it difficult for users to select a search engine other than Google.

¹⁵Advertisements and organic search results are in fact substitutes in the sense that better search means less need to click on advertisements (and vice versa) as discussed in Pollock (2010).

market may also be affected. These results are also confirmed in presence of a dominant firm in the oligopolistic market of paid search.

3.2 Leveraging

Google or the market leader in the search engine market may also attempt to leverage its market power to enhance the market position (and market power eventually) of Internet web-sites they control (e.g. Google and the promotion of Google Maps, or Google Books). In particular, Google has diversified its activities in search related activities, such as digitizing documentary collections of certain university libraries and private editors (Google Books), offering new specialized search engines relating to News (Google News), price comparison websites (Google Shopping), maps (Google maps), videos (YouTube), the Internet browser Google Chrome, online applications (such as cloud computing) and other services and applications (including technologies for marketing and disseminating advertising, such as DoubleClick). Some of these ancillary activities may strengthen Google's position in the paid search market.

Some of the complaints leveled against Microsoft at the European Commission include allegations of leveraging. First, Google has been accused of lowering the ranking of organic search results of competing vertical search engines, such as Foundem, and of raising the ranking of its own competing services. The Commission is investigating how Google's algorithms rank search results (are the algorithms for Google's products the same as those for its competitors), or if Google has employed targeted measures, such as black-listing or white-listing of particular websites. Google opposes these allegations by putting forward the argument that it is not in its interests to bias the presentation of search results, as end users may detect this reduction of the quality of the search engine (in terms of relevance) and then turn to competing search engines. Second, the complainants allege that Google lowered the "quality score" for sponsored links of competing vertical search providers. Similar concerns have been identified by the French Competition Authority. In its Navx decision, the FCA dealt with the sudden closure of its AdWords' account by Google for violation of its content policy. The FCA considered that such closure without warning was discriminatory and non transparent and asked Google to re-establish Navx' account and to ensure the transparency of its content policy. Google proposed commitments as to the transparency of AdWords.¹⁶ In its investigation on the competitive operation of online advertising, the FCA also noted that Google and its subsidiaries participated to the Ad Words service bidding, by purchasing keywords related to their activity, thus artificially raising the cost for competing vertical search engines or competitors of Google's ancillary services and increasing the traffic on its

¹⁶French Competition Authority, decision 10-D-30.

site (and consequently its advertising revenues). This exclusionary bidding may exclude or marginalize competitors and thus constitute a competition law infringement.

The factual background of these allegations is highly imprecise and contested. For example, the existence of a bias of Google for its own services is widely debated and constitutes after all an empirical issue that will not be examined by this study.¹⁷ Should these allegations be true, however, it is likely that this might increase the web traffic of Google’s well established ancillary services, as users are more likely to click on a result figuring at the top of the rankings and subsequently to purchase services from this website (Yang & Ghose, 2010). By biasing its search results against competing vertical services, Google may thus cause their exclusion from the market, because of lower end user and advertising revenues exposure (input foreclosure). The single monopoly profit theorem will not limit the incentive of Google to proceed with this vertical input foreclosure strategy, first because Google is not charging end users for the organic search, second because the strict conditions of the monopoly profit theorem do not apply in this context (Elhauge, 2009). Consumer harm for end users will follow from the higher level of market concentration (monopoly or oligopoly) that will result from the exclusion of vertical search engines or other competing websites as well as the decrease of the quality of the search engine (in view of the substitution between organic results and sponsored results), and of lower innovation rates in the industry (see the following sections). Advertisers will also have to pay higher advertising charges, following the reduction of competition by vertical search engines and other websites, and the extension of Google’s market power.

The application of EU competition law raises interesting questions. It is possible to conceive Google’s universal search engine as an indispensable distribution tool, a sort of essential facility to which competing vertical search engines and websites should have access. For example, in *Oscar Bronner*, the Court examined if access to a home delivery distribution network was indispensable for the distribution of daily press.¹⁸ As it was previously noted, the cost structure of Google’s universal search engine is close to that of natural monopolies (important fixed costs and low marginal costs), thus making it theoretically possible for the plaintiff to prove that the creation of a universal search engine is not a realistic potential alternative and that access to the existing system is therefore indispensable. Indeed, it is clear since the case law of the Court in *Oscar Bronner* that “it is not enough to argue that it is not economically viable by reason of the small circulation” (in this case traffic of the website) to establish this new universal search platform. “(I)t would be necessary at the very least to establish [...] that it is not economically viable to create a (second universal search

¹⁷ Compare, for example, Endelman & Lockwood (2011) with Wright (2011).

¹⁸ Case C-7/97 *Oscar Bronner GmbH Co. v. Mediaprint* [1998] ECR I-7791.

platform) with a circulation (traffic) comparable to that of (Google)".¹⁹ It is clear that such evidence will be particularly difficult to bring for the plaintiff and in any case requires some concrete empirical analysis.

The recent judgment of the Court in *TeliaSonera* indicates nevertheless that proving the "indispensability" of access to the input controlled by the dominant firm might not be such a difficult condition to fulfil for plaintiffs after all, and it might not even be required for the application of Article 102 TFEU to discriminatory practices by a dominant undertaking. First, it is only a requirement for refusals to supply and not for other types of abuses, such as the supply of services or selling of goods on conditions which are disadvantageous or in which there might be no purchaser.²⁰ According to the Court, the effectiveness of Article 102 TFEU might be compromised if the limiting principles for imposing a duty to deal, proclaimed in *Oscar Bronner*, were transposed from refusals to deal to all types of abuses.²¹ At best, the Court envisions the condition of indispensability as a tool to unveil if the undertakings excluded are at least as efficient as the dominant undertaking. However, the Court accepts to examine if the practice may be capable of having anti-competitive effects on the markets concerned, even where the wholesale product/service or input is not indispensable.²² Second, there is no need to provide evidence of actual anticompetitive effects, the potential exclusion of an equally efficient competitor is a sufficient condition for Article 102 TFEU to apply. It becomes thus clear that proving the indispensability of access to the dominant firm's input collapses to proving the possibility that equally efficient competitors may potentially be excluded. The cost structure of the dominant undertaking is of course the first element to consider for price related practices. But the Court is also open to the possibility that the "level of the dominant undertaking's costs is specifically attributable to the competitively advantageous situation in which its dominant position places it", in the absence of information on the dominant firm's costs.

Another avenue is offered by some older case law where a duty to deal in a non-discriminatory manner was imposed on the dominant undertaking. The main issue raised in not the refusal of Google to grant access to its search engine,²³ but to discriminate between its own services and those of its competitors. As the Commission explains in its *Enforcement Guidance* (2009, para 76), "typically competition problems arise when the dominant undertaking competes on the "downstream" market with the buyer whom it refuses to supply", the term

¹⁹ Ibid.

²⁰ Case C-52/09 *Konkurrensverket v. TeliaSonera Sverige AB*, February 17, 2011, para. 55.

²¹ Ibid., para. 58.

²² Ibid., para. 72.

²³ One could think of applying here the classic "essential facilities" cases of *Sealink/B&I – Holyhead* [1992] CMLR 255; *Sea Containers v. Stena Sealink* [1994] OJ L 15/8.

"downstream market" referring to the market for which the refused input is needed in order to manufacture a product or provide a service. In *Sabre/Amadeus*, a statement of objections was sent to Air France for allegedly discriminating by refusing to provide Sabre (a competing Computer Reservation System owned by British Airways and American Airlines) with the same information and at the same time it was providing it to its own CRS, Amadeus.²⁴ In *British Midland v Aer Lingus*, the abuse was Aer Lingus's refusal to provide interline facilities to British Midland when the latter entered the London Heathrow – Dublin route.²⁵ British Midland could compete effectively and operate profitably over time. The refusal to supply, however, raised its costs and shrank its revenues. Aer Lingus had provided interlining facilities to British Midland before on other routes. The refusal to interline was clearly a reaction to entry aimed at protecting the dominant position on the relevant market.²⁶ The European Commission has recently launched an investigation with regard to Apple's policy to impose through its license agreement with independent developers a requirement to use only Apple's native programming tools and approved languages when writing iPhone apps, to the detriment of third-party layers.²⁷ For the Commission, this practice could have ultimately resulted in shutting out competition from devices running platforms other than Apple's. Following the launch of the investigation by the Commission, Apple removed these restrictions, restoring the use of third-party layers and so giving developers more flexibility.

Should it be proven that Google has terminated contracts and cancelled AdWords accounts for vertically competing undertakings, the practice may also fall under the classic *Commercial Solvents* jurisprudence of the Court, a case concerning refusal to supply an indispensable raw material, regarding the termination of existing supply relationships.²⁸ In *Commercial Solvents*, the Court did not require a finding of consumer harm for an abusive refusal to supply to be established but took the view that the impairment of an effective competitive structure in the EU was sufficient. In *Clearstream*, a case concerning access to the Clearstream security clearance system, which was an unavoidable business partner as the only custodian of German securities kept in collective safe custody, the Commission found that not supplying its downstream competitor, Euroclear Bank, harmed innovation and competition in the provision of cross border services and ultimately the consumers within the single market.²⁹ The Court of First Instance held that the conduct had the tendency to harm innovation and, ultimately, customers of cross-border secondary clearing and settlement ser-

²⁴ Commission, Press Release IP/00/835 (2000).

²⁵ *British Midland v Aer Lingus* [1992] OJ L96/34, para. 14 – 30.

²⁶ *ibid*, para. 26.

²⁷ Antitrust: Statement on Apple's iPhone policy changes, IP/10/1175, September 25, 2010.

²⁸ Joined cases 6-7/73, *Istituto Chemioterapico Italiano S.p.A. and Commercial Solvents Corporation v Commission* [1974] 223.

²⁹ European Commission, *Clearstream* [2009] OJ C165/7, paras 228, 231, and 232

VICES.³⁰ The standard of proof for anti-competitive effect is thus lower than that required in *Oscar Bronner* for refusals to supply (eliminating all competition on the part of the undertaking requesting access) or *Magill* and *IMS/NDC Health* for refusals to license (elimination of all competition on the market) or in *Microsoft* for refusal to provide interoperability (elimination of all effective competition).³¹ Google’s practices may thus fall under the scope of Article 102 TFEU, under any of these specific antitrust standards. The fact that this is a rapidly evolving high technology market may not play a limiting role in EU competition law enforcement and could thus defeat a claim that imposing a duty to provide access in such a context, without evidence of actual anticompetitive effects, might jeopardize the incentives of the dominant firm to innovate and thus the level of innovation in this market. As the Court noted in *TeliaSonera*, “(p)articularly in a rapidly growing market, Article 102 TFEU requires action as quickly as possible, to prevent the formation and consolidation in that market of a competitive structure distorted by the abusive strategy of an undertaking which has a dominant position on that market or on a closely linked neighboring market, in other words it requires action before the anti-competitive effects of that strategy are realized”.³² The Commission has also taken a careful position with regard to the balancing of incentives to innovate in high technology markets.

3.3 Exploitative practices to Internet users and advertisers

Exploitative practices to Internet users or advertisers (in either side of the market) may take different forms. First, the participation of Google and its subsidiaries in AdWords bidding might lead the amount of the bid not to be proportional to the value of the service but to include a forcing-out premium. This could arguably constitute an excessive pricing claim, as it might lead to higher prices than in a perfectly competitive market for advertisers. The conditions for proving excessive pricing are quite strict in EU competition law. In *United Brands*,³³ the Court recognized that excessive prices can amount to an abuse, but found that the Commission did not meet the burden of proof, as it did not consider all objective justifications for price differentials between different markets. The Court laid down the standard for finding excessive pricing as follows:

“Charging a price which is excessive because it has no reasonable relation to the economic

³⁰Case T-301/04 *Clearstream Banking AG and Clearstream International SA v Commission* [2009] ECR II-3155, para 149.

³¹Case T-69/89 *Radio Telefis Eireann v Commission* [1991] II-485 (*Magill*), appeal dismissed in Case C-241/91 and 242/91 P *Magill*; Case C-418/01 *IMS Health GmbH & Co OHG v NDC Health GmbH & Co KG* [2004] ECR I-5039; Case T-201/04 *Microsoft Corpn v Commission* [2007] ECR II-3601.

³²Case C-52/09 *Konkurrensverket v. TeliaSonera Sverige AB*, para. 108.

³³Case 22/76, *United Brands v Commission* [1978] ECR 207.

value of the product supplied would be such an abuse... The questions... to be determined are whether the difference between the costs actually incurred and the price actually charged is excessive, and, if the answer to this question is in the affirmative, whether a price has been imposed which is either unfair in itself or when compared to competing *products*".³⁴

Thus, the cost/price difference must be excessive and the price must either be unfair in itself or when compared to competing products (yardstick competition). These conditions are notoriously difficult to prove.

A more recent case may nevertheless be useful for Google's plaintiffs. In *Kanal 5*³⁵, the referring court asked whether the fact that a copyright management organization which enjoys a *de facto* monopoly in a Member State on the market for making available music protected by copyright for television broadcasts applies, in respect of the remuneration paid for that service, a remuneration model according to which the amount of royalties is calculated on the basis of the revenue of companies broadcasting those works and the amount of music broadcast, constitutes an abuse of a dominant position prohibited by art. 102 TFEU and whether the fact that another method would enable the use of those works and the audience to be identified and quantified more precisely may have an effect on that classification. The Court considered that "a remuneration model may amount to an abuse, in particular when another method exists which enables the use of those works and the audience to be identified and quantified more precisely and that method is capable of achieving the same legitimate aim [...] without however leading to a disproportionate increase in the costs incurred for the management of the contracts and the supervision of the use of musical works protected by copyright".³⁶ Should Google's plaintiffs prove that the remuneration method employed by Google in the bidding process is artificially inflated and that another neutral and cost effective method exists, they might have a workable case under Article 102 (a) TFEU.

Price discrimination among different advertisers or Internet web-sites might also constitute an additional exploitative strategy: there should be in this case evidence of a competitive disadvantage under Article 102 (c). This is easier to prove – the case law requires only that the behavior tends to distort competition, and there is no need to adduce evidence of an actual quantifiable deterioration in the competitive position of the business partners taken individually.³⁷ The reduction of competition might refer to the foreclosure of talented programmers by Google, everything that can put Google's rivals (vertical search engines and

³⁴Ibid., para. 250-252.

³⁵Case C-52/07 *Kanal 5 Ltd v Föreningen Svedska Tonsättares Internationella Musikbyrå (STIM) UPA* [2009] 5 C.M.L.R. 18.

³⁶Ibid., para. 40.

³⁷Case C-95/04 *British Airways v. Commission* [2007] 4 CMLR 22, para. 144-145.

other websites) in competitive disadvantage. One could also add the existence of consumer harm from unwelcoming advertising, but this is hard to prove as an antitrust violation.

In the remainder of the paper for the purpose of building formal model and deriving policy implications we will concentrate on strategies reducing multi-homing and exploitative practices to advertisers by the dominant search engine. One of the problems that we identify in the theoretical model of section 5 below is analysis of the impact of monopolization of the search engine market on advertisers in the form of excessive pricing and on investments in improvements of quality of search results by search engines themselves. Another problem is creating obstacles to the simultaneous use by advertisers of several search-based ads platforms. The consequences of this type of abusive behavior by Google will be analyzed in section 6.

4 The Model of the Internet Search Market

4.1 Structure of the Search Engine Market

In order to model the internet search market we first have to understand the structure of this market. As we discussed above, the search engine market has certain distinctive features related to structure, costs and pricing, which should be taken into account when building a theoretical model.

Firstly, the structure of the search engine market has a multi-sided aspect in which the search engine acts as a platform intermediating between content providers, users/searchers, and advertisers. This feature of the search engine market calls for applications of two-sided markets models.

Secondly, we discuss the pricing structure. Search engines do not directly charge users for their service but supply it for free, while content providers are actually subsidized by the search engines. Hence, in our framework we assume that search engines cannot set prices for users (whether positive or negative) but rather are constrained to price at zero. In the formal model we express it by setting $p_U = 0$. In addition, we do not model explicitly the content providers' side of the market. But rather implicitly incorporate them into the search engine technology through additional cost component. Next, similar to Pollock (2010) we assume that the pool of material made available by content providers is available to all search engines and, as such, content providers can be ignored as (strategic) agents leaving us to focus solely on the other three types (users, advertisers, and platform (or search engine) itself).

Next, we turn to the pricing structure on the advertisers' side of the market. Our approach to modeling advertisers' side of the market is simplified compared to Edelman et al (2007),

Varian (2007), Ellison and Ellison (2004), Chen and He (2006), Athey and Ellison (2011), or White (2008). Since the primary aim of our project is to concentrate on the impact of network effects and quality improving innovation efforts, we believe the advertisers' side of the market can be modeled using the general approach in Armstrong (2006). This will capture an important characteristic of this market, namely that advertisers are required to pay strictly positive prices for search engine services. In the formal model the price charged to advertisers is denoted by $p_A > 0$. Advertisers also value the quality of the search engine. However, contrary to users the marginal cost of serving one additional advertiser is strictly positive. In the formal model we denote it by $f_A > 0$. This reflects the cost of, for example, signing the contract, assisting, or arranging the auction procedures for each particular advertiser.

Finally, the important feature of the search engine market relates to technology and costs. In particular, search engines are R&D intensive and the market generally displays high levels of innovation. This innovation usually occurs within a particular software environment that determines the type of engineers (and specific skills) required. These specific skills may be scarce and very costly. In addition, considerable investment efforts are necessary for supporting, monitoring, and sponsoring content providers. This implies that running a search engine service is highly capital intensive. We will denote these investments (or innovation efforts) as k – quality improving innovation efforts. Both of these types of cost, whether related to R&D and acquiring young talented engineers, or the development and maintenance of service infrastructure and content, will be modeled as an increasing function of quality improving innovation efforts $F(k)$, with $F'(k) > 0$ for all $k \in [0, \infty)$.³⁸ At the same time the marginal cost of serving one additional user is very low and we will set it to zero, i.e. $f_U = 0$.

4.2 A Formal Model

For the purpose of modelling search engine market we adapt a modification of Armstrong (2006) two-sided market model.³⁹ Suppose there is a unit measure of agents in group- A and a unit measure of agents in group- U . We will refer to the group- A agents as advertisers and group- U agents as users. Suppose also that there are two platforms (search engines),

³⁸We do not restrict this cost function to be convex in order to capture the S-shaped returns to scale. As motivated by Etro (2011b), the combination of network effects and learning by doing induces S-shaped returns to scale in the search engine market. Hence, the first stage cost function can be approximated by the concave increasing function, while the second stage cost function can be approximated by the convex increasing function.

³⁹Motivation for the choice of the Armstrong (2006) model is discussed in the Appendix, where we provide the detailed analysis and comparison of the two seminal papers on two-sided markets by Armstrong (2006) and Rochet and Tirole (2003).

$i = 1, 2$. They each offer a service to the two groups.

Consistent with the existing literature, we assume each agent values the number of agents from the other group with whom he can interact, but not the number of agents from his own group. In particular, an agent from group $j = A, U$ obtains benefit $\alpha_j n$ by participating in a market which allows him to interact with n agents from the other group. In addition, and this is one of our main innovations, we assume that agents on both sides (both users and advertisers) value the quality and the relevance of search results or the advancement of the search technology offered by a particular engine, which we denote by k^i , $i = 1, 2$. Further, we assume multi-homing advertisers, i.e. advertisers can join either platform 1, platform 2, or both platforms if they multi-home. Similar to Jeon, Jullien, and Klimenko (2011), users are restricted to single-homing.⁴⁰

On the user side of the market platforms differ in a standard Hotelling manner.⁴¹ They are located at either end of a unit interval and users are located uniformly along the unit interval. Users incur a "transport cost" tx of travelling a distance x to the platform(s) they use (Here, $t \geq 0$). An agent located at x on the unit interval incurs a transport cost tx when joining platform 1 and a transport cost $t(1 - x)$ when joining platform 2. Possible interpretations of the transport cost in case of search engine include costs of installing the search engine browser, or the initial set-up costs that users face for learning about a new engine.

The utilities of agents are determined in the following way: if the platform i attracts n_U^i and n_A^i members of the two groups, the utilities of group- U agents and group- A agents are given by the following expressions.

The utility of a group- U agent located at $x \in [0, 1]$ when she joins platform 1 is given by

$$u_U^1(k^1, p_U^1, n_A^1) = \alpha_U n_A^1 + k^1 - p_U^1 - tx. \quad (1)$$

When the same agent subscribes to platform 2, she obtains utility

$$u_U^2(k^2, p_U^2, n_A^2) = \alpha_U n_A^2 + k^2 - p_U^2 - t(1 - x). \quad (2)$$

⁴⁰These assumptions seem to be satisfied in practice, where advertisers normally contract several search engines to maximize market coverage. While users have one favorite (most convenient) search engine, with which they have experienced best (taste specific, habit specific, or most relevant) search results.

⁴¹Similar to Armstrong and Wright (2007) or Jeon, Jullien, and Klimenko (2011) we concentrate on the case where one side views the platforms as homogenous, while the other views the platforms as heterogenous. On the users' side platforms are horizontally differentiated for two different reasons. First, they differ in terms of the way they generate search results for a given query. They may have different databases, use different algorithms for search and different ways to display search results. Second, they offer different services as portals. For the remainder of the paper we assume that in the two-sided search engine market, which involves users and advertisers, advertisers view the competing platforms as more or less homogenous (controlling for the size of the network benefits), while users have preferences for using one particular platform over the other. Hence, in the formal model we set $t_A = 0$ and $t_U = t > 0$.

The utility of a group- A agent when she joins platform 1 is given by

$$u_A^1(k^1, p_A^1, n_U^1) = \alpha_A n_U^1 + k^1 - p_A^1. \quad (3)$$

Finally, the utility of a group- A agent when she joins platform 2 is given by

$$u_A^2(k^2, p_A^2, n_U^2) = \alpha_A n_U^2 + k^2 - p_A^2. \quad (4)$$

where p_U^i and p_A^i , $i = 1, 2$, are platforms' prices to the two groups. Recall that $p_U^i = 0$, $i = 1, 2$, are set to zero, since users are served for free.⁴² While p_A^i , $i = 1, 2$ are assumed to be positive.⁴³ The parameter α_U measures the benefit a group- U agent (user) enjoys from interacting with each group- A agent (advertiser). α_A measures the benefit a group- A agent (advertiser) obtains from interacting with each group- U agent (user). The variable k^i , $i = 1, 2$, denotes the quality improving innovation efforts. Expressions in (1)-(4) describe how utilities are determined on each platform $i = 1, 2$, as functions of the numbers of agents who participate on each platform (n_j^i), network externalities (α_j^i), prices charged by each platform (p_j^i), and the amount of quality improving innovation investments incurred by the search engine (k^i), which is platform specific, but not agent specific.⁴⁴

Turning to the cost side, we assume that both platforms incur a symmetric per-agent cost f_A for group A (advertisers) and costs of quality improving capital investments $F(k^i)$, with $F'(k^i) > 0$ for all $k \in [0, \infty)$, $i = 1, 2$.⁴⁵ A symmetric per-agent cost f_U for group U (users) is assumed to be zero, $f_U = 0$. Therefore, the search engine i 's profit is given by

$$\pi^i(k^i, p_A^i) = n_A^i(p_A^i - f_A) - F(k^i), \quad i = 1, 2. \quad (5)$$

Platforms simultaneously choose prices and the level of k^i , and after observing prices and quality characteristics advertisers simultaneously decide which platform(s) to join.

⁴²Similar assumption is employed in e.g. Jeon, Jullien, and Klimenko (2011).

⁴³Again, similar to Jeon, Jullien, and Klimenko (2011), we assume that each platform charges a positive subscription fee to advertisers. Actually, Google's advertising fee is per click, which can be incorporated in our model as a multiplicative function of the number of users n_U^i and the quality of the matching technology k^i (e.g. $f^c k^i n_U^i \sim f^c k^i x$), which enters the profit function of each platform with the positive sign. However, this would make it impossible to conduct analysis with closed form solutions in the current framework. That's why we postpone this extension to future research.

⁴⁴We assume here that quality improving efforts (investments) map one-to-one to realized quality of the search engine, which is valued by users and advertisers. In general, the results of the model would go through for any increasing mapping from k^i to quality.

⁴⁵Having $F(k)$ an increasing function of k seems to be consistent with S-shaped returns to scale in the search engine market discussed in Etro (2011b). However, the approach to model the impact of quality improving efforts, k^i and $F(k^i)$, can be improved. For example, the cost of quality improving efforts can be increasing not only with k^i but also with n_U^i , since it might be more difficult to manage the engine when more queries are running. Then k^i and n_U^i should enter additively the cost function. Again, for the purpose of tractability of the current model we leave this extension to future research.

5 Analysis of Exploitative Abuses

5.1 Monopoly Case

5.1.1 Model Outline

Having established the evidence for high degree of concentration we first present the analysis for a monopoly platform in order to focus on the possible threat of abuse of dominant position by Google in the internet search engine market.⁴⁶

The model described in Section 4 will then be simplified to the following set-up. The utilities of group- U and group- A agents are determined as follows:

$$u_U(k, p_U, n_A) = \alpha_U n_A + k - p_U \quad \text{and} \quad u_A(k, p_A, n_U) = \alpha_A n_U + k - p_A, \quad (6)$$

where p_U and p_A are the monopolistic platform's prices to the two groups. Recall that $p_U = 0$. The parameter α_U measures the benefit a group- U agent (user) enjoys from interacting with each group- A agent (advertiser). We do not restrict this benefit α_U to be either positive or negative (i.e. we allow for two possible situations: users appreciate additional advertising or they only care about content and annoyed by the presence of additional advertising among the search result). We will analyze the implications of both cases when discuss the results of the model. Next, α_A measures the benefit a group- A agent (advertiser) obtains from each group- U agent (user). It is reasonable to assume that $\alpha_A > 0$, i.e. the benefit for advertiser from interacting with one additional user on the other side of the market is always positive. The variable k denotes the quality improving innovation efforts. Similar to above, expression (6) describes how utilities are determined as a function of the numbers of agents who participate (n_j), network externalities (α_j), prices charged by the platform (p_j), and the amount of quality improving innovation investments incurred by the search engine (k). Similar to Armstrong (2006) to close the demand model, we specify the numbers of participants as a function of the utilities. If the utilities offered to the two groups are u_U and u_A , then the numbers of each group who join the platform will be determined as follows

$$n_U = \phi_U(u_U) \quad \text{and} \quad n_A = \phi_A(u_A)$$

Here $\phi_U(\cdot)$ and $\phi_A(\cdot)$ represent increasing functions of utilities, with $\phi'_j(\cdot) > 0$ and $\phi''_j(\cdot) \geq 0$ for $j = A, U$.⁴⁷

⁴⁶This framework can also be applied for analysis of yellow pages directories that are often a monopoly of the incumbent telephone company. Shopping malls or nightclubs are sometimes far enough away from others that the monopoly paradigm might be appropriate.

⁴⁷This property of the ϕ -function can be interpreted as follows. Firstly, the utility of each agent depends on the number of the agents on the other side of the platform. Then convex ϕ -function can be interpreted

On the cost side, the monopoly platform incurs a per-agent cost f_A for group A (advertisers) and costs of quality improving capital investments $F(k)$, with $F'(k) > 0$ for all $k \in [0, \infty)$. A per-agent cost f_U for group U (users) is assumed to be zero, $f_U = 0$. Therefore, the monopolistic search engine's profit is given by

$$\pi(k, p_A) = n_A(p_A - f_A) - F(k).$$

If we consider the platform to be offering utilities u_U and u_A rather than price p_A and quality k , then the implicit quality offered for users $k = u_U - \alpha_U n_A$ and the implicit price for group A (advertisers) is $p_A = \alpha_A n_U + k - u_A = \alpha_A n_U + u_U - \alpha_U n_A - u_A$. Therefore, expressed in terms of utilities, the platform's profit is given by

$$\pi(u_U, u_A) = \phi_A(u_A)[\alpha_A \phi_U(u_U) + u_U - \alpha_U \phi_A(u_A) - u_A - f_A] - F(u_U - \alpha_U \phi_A(u_A)). \quad (7)$$

Next, the aggregate consumer surplus of group U is denoted as $v_U(u_U)$ and the aggregate consumer surplus of group A is denoted as $v_A(u_A)$. Following Armstrong (2006), we employ that $v_j(\cdot)$ satisfies the envelope condition $v'_j(u_j) \equiv \phi_j(u_j)$, $j = A, U$. Then welfare, which is measured by the unweighted sum of profit and consumer surplus, is given by

$$w(u_U, u_A) = \pi(u_U, u_A) + v_U(u_U) + v_A(u_A). \quad (8)$$

5.1.2 Solution and Policy Implications (Monopoly Case)

In this section we, first, present the results of the analysis of the welfare-maximizing outcome. That is we derive socially optimal price and the socially optimal level of quality improving investments. Next, we compare this result to the outcome derived in case the search engine market is monopolized by a single firm. The two contrasting results are given in propositions 1 and 2, respectively.

Proposition 1 *The socially optimal price (p_A^*) and the level of quality improving innovation efforts (k^*) satisfy*

$$F'(k^*) = (\alpha_A \phi'_U(u_U^*) + 1)n_A^* + n_U^* \quad (9)$$

$$p_A^* = f_A - \alpha_U n_U^* - \alpha_U \alpha_A \phi'_U(u_U^*) n_A^* \quad (10)$$

as participation rates grow slowly when less agents join platform on the other side, since there is little value (especially for advertisers) in using platform if they cannot reach users. Similar effect was observed in Goyal and Kearns (2012) for online social networking services.

Under opposite assumption ($\phi''(u) < 0$) the results of Proposition 3 still can hold, but only under some specific parameter values. Under assumption $\phi''(u) < 0$, the results are generally ambiguous.

Proof. Taking the FOC of expression (8) wrt u_U and substituting $v'_j(u_j) \equiv \phi_j(u_j)$ and $n_j = \phi_j(u_j)$ for $j = U, A$ we obtain

$$\begin{aligned} \frac{\partial w(u_U, u_A)}{\partial u_U} &= \alpha_A n_A \phi'_U(u_U) + n_A + n_U - F'(\cdot) = 0 \\ \Rightarrow F'(k^*) &= (\alpha_A \phi'_U(u_U^*) + 1)n_A^* + n_U^* \end{aligned}$$

Taking the FOC of expression (8) wrt u_A and substituting $v'_j(u_j) \equiv \phi_j(u_j)$ and $n_j = \phi_j(u_j)$ for $i = U, A$ we obtain the following expression. Recall also that $\phi'_A(\cdot) > 0$ and $F'(\cdot) = (\alpha_A \phi'_U(u_U) + 1)n_A + n_U$.

$$\begin{aligned} \frac{\partial w(u_U, u_A)}{\partial u_A} &= \phi'_A(u_A) [p_A - \alpha_U n_A - f_A + \alpha_U F'(\cdot)] - n_A + n_A = 0 \\ \Rightarrow p_A &= f_A + \alpha_U n_A - \alpha_U F'(\cdot) \\ \Rightarrow p_A &= f_A - \alpha_U [F'(\cdot) - n_A] \\ \Rightarrow p_A &= f_A - \alpha_U [(\alpha_A \phi'_U(u_U) n_A + n_A + n_U - n_A)] \end{aligned}$$

$$\text{Hence, at the optimum } p_A^* = f_A - \alpha_U n_U^* - \alpha_U \alpha_A \phi'_U(u_U^*) n_A^*$$

This concludes the proof of proposition 1. ■

Analysis of expression (10) shows that the optimal price offered to advertisers equals the cost of supplying service (f_A) adjusted downward (or upwards) by the external benefit (or disutility) that an extra group- A agent (advertiser) brings to the group- U agents (users) on the platform. (There are n_U users on the platform, and each one benefits by α_U when an extra advertiser joins, provided that $\alpha_U > 0$.) In particular, prices should be below cost if $\alpha_U > 0$ or they can be higher than cost (f_A) if $\alpha_U < 0$. Recall $\alpha_A > 0$, $\phi'_U(u_U) > 0$, and $n_A > 0$. Expression (10) shows some similarity with the result obtained in Armstrong (2006) except of an additional term $-\alpha_U \alpha_A \phi'_U(u_U) n_A$, which would adjust the price offered by the platform to advertisers even further down in case $\alpha_U > 0$ (i.e. when additional advertising is appreciated by users). Or wise versa, the presence of this additional term would increase the price charged to advertisers above the one specified in Armstrong (2006) when $\alpha_U < 0$ (i.e. users do not care about advertising at all and are only interested in the content). In case $\alpha_U > 0$, this additional term can be interpreted as further downward adjustment in price charged to advertisers due to positive quality improvement spillover or due to improving the fit between customers and advertisers.

Next, we move to the discussion of the results and policy implications in the situation when the search engine market is monopolized by a single firm. In the next proposition we derive the profit-maximizing price and the level of quality improving investments chosen by the monopolist.

Proposition 2 *The profit-maximizing price (p_A^m) and the level of quality improving investments (k^m) chosen in the monopolized search engine market satisfy*

$$F'(k^m) = (\alpha_A \phi'_U(u_U^m) + 1)n_A^m \quad (11)$$

$$p_A^m = f_A - \alpha_U \alpha_A \phi'_U(u_U^m)n_A^m + \frac{\phi_A(u_A^m)}{\phi'_A(u_A^m)} \quad (12)$$

Proof. Taking the FOC of expression (7) wrt u_U and substituting $n_j = \phi_j(u_j)$ for $j = U, A$ we obtain

$$\begin{aligned} \frac{\partial \pi(u_U, u_A)}{\partial u_U} &= \alpha_A n_A \phi'_U(u_U) + n_A - F'(\cdot) = 0 \\ \Rightarrow F'(k^m) &= (\alpha_A \phi'_U(u_U^m) + 1)n_A^m \end{aligned}$$

Taking the FOC of expression (7) wrt u_A and substituting $n_j = \phi_j(u_j)$ for $j = U, A$ we obtain the following expression. Recall also that in case of monopoly optimal k is characterized by $F'(\cdot) = (\alpha_A \phi'_U(u_U) + 1)n_A$.

$$\begin{aligned} \frac{\partial \pi(u_U, u_A)}{\partial u_A} &= \phi'_A(u_A) [p_A - \alpha_U n_A - f_A + \alpha_U F'(\cdot)] - n_A = 0 \\ \Rightarrow p_A &= f_A + \alpha_U n_A - \alpha_U F'(\cdot) + \frac{n_A}{\phi'_A(u_A)} \\ \Rightarrow p_A &= f_A - \alpha_U [F'(\cdot) - n_A] + \frac{\phi_A(u_A)}{\phi'_A(u_A)} \\ \Rightarrow p_A &= f_A - \alpha_U [(\alpha_A \phi'_U(u_U)n_A + n_A - n_A)] + \frac{\phi_A(u_A)}{\phi'_A(u_A)} \end{aligned}$$

$$\text{Hence, at the optimum } p_A^m = f_A - \alpha_U \alpha_A \phi'_U(u_U^m)n_A^m + \frac{\phi_A(u_A^m)}{\phi'_A(u_A^m)}$$

This concludes the proof of proposition 2. ■

Hence, we can conclude that the profit-maximizing price offered to advertisers is equal to the cost of providing service (f_A), adjusted downward by $(\alpha_U \alpha_A \phi'_U(u_U)n_A)$ the external benefit to both users and advertisers and quality improving efforts by the platform, and adjusted upward by a factor related to the elasticity of the group's participation $\left(\frac{\phi_A(u_A)}{\phi'_A(u_A)}\right)$. The difference with the results obtained in Armstrong (2006) is hiding in the second term $(\alpha_U \alpha_A \phi'_U(u_U)n_A)$. Armstrong (2006) finds it equal to $\alpha_U n_U$, i.e. only external benefit to users would have influenced the price charged to advertisers in his setting. This difference again can be attributed to the presence of additional quality improvement spillover that improves the fit between customers and advertisers and also between search results and customer's queries.

Finally, comparison of the results of Propositions 1 and 2 implies the following proposition.

Proposition 3 *Monopolization of the search engine market leads to under-investment in improvements of the quality of the search engine compared to social optimum. In addition, it leads to increase in prices charged to advertisers above socially optimal level when $\alpha_U > 0$.*

Proof. The proof of this proposition contains three steps:

1. First, for the existence of interior maximum the profit function $\pi(u_U, u_A)$ in expression (7) is assumed to be strictly concave. In this case the social welfare function $w(u_U, u_A)$ in (8) represents a transformation of this concave profit function in (7) by adding consumer surpluses of two groups $v_U(u_U)$ and $v_A(u_A)$, users and advertisers, respectively. $v_U(u_U)$ and $v_A(u_A)$ are assumed to be increasing and concave functions as well. If these (rather common) conditions on the objective functions are satisfied, then u_U^* , which results from unconstrained optimization of (8) with respect to u_U and u_A , is strictly greater than u_U^m , which results from unconstrained optimization of (7) with respect to u_U and u_A . Hence, we have that $u_U^* > u_U^m$. The same holds for $u_A^* > u_A^m$. This implies that (by monotonicity of ϕ - functions, recall $\phi(\cdot)$ functions are assumed to be strictly increasing) $n_A^* > n_A^m$ and $n_U^* > n_U^m$ as well.

2. Next, comparison of (9) and (11), taking into account that $F'(k) > 0$, $u_U^* > u_U^m$, $n_A^* > n_A^m$, and $\phi_U''(\cdot) \geq 0$, implies that $k^m < k^*$.

3. Finally, comparison of (10) and (12), taking into account that $\phi_A'(\cdot) > 0$, $u_U^* > u_U^m$, $n_A^* > n_A^m$, and $\phi_U''(\cdot) \geq 0$, implies that

$$\begin{aligned} p_A^m &> p_A^* \text{ when } \alpha_U \geq 0 \\ p_A^m &< p_A^* \text{ when } \alpha_U < 0 \text{ and } |\alpha_U n_U| > \frac{\phi_A(u_A)}{\phi_A'(u_A)}. \quad \blacksquare \end{aligned}$$

This proposition shows that monopolization of the search engine market unambiguously results in under-investment in quality improvements by the search engine platform compared to social optimum. The effect on prices charged to advertisers seems ambiguous. When the presence of advertisers on the search engine is welcomed by users (i.e. $\alpha_U \geq 0$), monopolistic search engine charges advertisers more compared to social optimum. This is an indication of exploitative abuse of dominant position through excessive pricing.⁴⁸

5.2 Oligopoly Case

5.2.1 Model Outline (One-sided Network Effects)

For analysis in this section we employ a slightly modified model of section 4.2, where network effects are present only on advertisers side⁴⁹, i.e. $\alpha_A > 0$, $\alpha_U = 0$, and the search engine cost

⁴⁸It should also be mentioned that when presence of advertisers on the search engine is not welcomed by the users (i.e. $\alpha_U < 0$), monopolistic search engine charges advertisers less compared to social optimum. This harms consumers even more since it causes further increase of unwelcome advertising.

⁴⁹It largely seems to be the case in the search engine market that only one side (advertisers) cares about platform performance on the other side. Users mainly do not care about the amount of advertising on the

function is modelled as a linear function of k , $F(k) = \lambda k$, with $\lambda \in (0, 1]$. In this setting expressions (1)-(4) will be rewritten as follows

$$u_U^1(k^1, p_U^1, n_A^1) = k^1 - tx \quad (13)$$

$$u_U^2(k^2, p_U^2, n_A^2) = k^2 - t(1 - x) \quad (14)$$

$$u_A^1(k^1, p_A^1, n_U^1) = \alpha_A n_U^1 + k^1 - p_A^1 \quad (15)$$

$$u_A^2(k^2, p_A^2, n_U^2) = \alpha_A n_U^2 + k^2 - p_A^2. \quad (16)$$

While each search engine's profit function is given by

$$\pi^i(k^i, p_A^i) = n_A^i(p_A^i - f_A) - \lambda k^i, \quad i = 1, 2. \quad (17)$$

As before, we assume that users single-home, while advertisers can also multi-home. Two search engines compete for Market Share within each group (users and advertisers). To analyze the users' choice of platform, similar to Armstrong and Wright (2007) we adopt the Hotelling model of product differentiation. Assuming that the users' market is covered this implies that the number of users participating in platforms 1 and 2 are given by expressions (18) and (19), respectively.

$$n_U^1 = x = \frac{1}{2} + \frac{k^1 - k^2}{2t} \quad (18)$$

$$n_U^2 = 1 - x = \frac{1}{2} + \frac{k^2 - k^1}{2t} \quad (19)$$

Advertisers are assumed to be heterogeneous in their fixed costs of joining each platform. Similar to Jeon, Jullien, and Klimenko (2011) we assume that they will join platform i as long as their resulting profit, $\alpha_A n_U^i + k^i - p_A^i$, exceeds the fixed cost of joining the search engine. We adopt the assumption that the fixed cost of an advertiser who joins the search engine i is distributed with constant density $f = 1$. This implies that the mass of advertisers who join platforms 1 and 2 are determined by (20) and (21), respectively.

$$\alpha_A n_U^1 + k^1 - p_A^1 - n_A^1 = 0 \quad (20)$$

$$\alpha_A n_U^2 + k^2 - p_A^2 - n_A^2 = 0 \quad (21)$$

other side of the search engine and only care about content and quality of search results. That's why for the analysis in this section we restrict our attention to the case of one-sided network effects, i.e. $\alpha_U = 0$. We leave the detailed analysis of the case with two-sided network effects to the future research. Preliminary calculations show that qualitative results and policy implications of one-sided network effects case will not change if two-sided network effects are introduced.

5.2.2 Solution and Policy Implications (One-sided Network Effects)

Now, given the profit functions in (17), we derive the following four first order conditions:

$$\begin{aligned}\frac{\partial \pi^1}{\partial p_A^1} &= \alpha_A \left(\frac{1}{2} + \frac{k^1 - k^2}{2t} \right) + k^1 - 2p_A^1 + f_A = 0 \\ \frac{\partial \pi^1}{\partial k^1} &= \frac{\alpha_A p_A^1}{2t} - \frac{\alpha_A f_A}{2t} + p_A^1 - f_A - \lambda = 0 \\ \frac{\partial \pi^2}{\partial p_A^2} &= \alpha_A \left(\frac{1}{2} + \frac{k^2 - k^1}{2t} \right) + k^2 - 2p_A^2 + f_A = 0 \\ \frac{\partial \pi^2}{\partial k^2} &= \frac{\alpha_A p_A^2}{2t} - \frac{\alpha_A f_A}{2t} + p_A^2 - f_A - \lambda = 0\end{aligned}$$

Under the symmetric equilibrium, with $p_A^M = p_A^1 = p_A^2$ and $k^M = k^1 = k^2$, where M stands for multi-homing, the solution of this system of four equations with four unknowns implies the following result.

Proposition 4 *In the symmetric equilibrium platforms will serve both sides of the market with advertisers multi-homing and users single-homing. The price to users is $p_U = 0$. The equilibrium price to advertisers is given by*

$$p_A^M = p_A^{1M} = p_A^{2M} = f_A + \frac{2\lambda t}{\alpha_A + 2t}.$$

The equilibrium quality improving innovation efforts are given by

$$k^M = k^{1M} = k^{2M} = f_A + \frac{4\lambda t}{\alpha_A + 2t}.$$

Comparative statics of the symmetric equilibrium shows:

$$\begin{aligned}\frac{\partial p_A^M}{\partial t} &> 0, \quad \frac{\partial p_A^M}{\partial f_A} > 0, \quad \frac{\partial p_A^M}{\partial \lambda} > 0, \quad \frac{\partial p_A^M}{\partial \alpha_A} < 0 \\ \frac{\partial k^M}{\partial t} &> 0, \quad \frac{\partial k^M}{\partial f_A} > 0, \quad \frac{\partial k^M}{\partial \lambda} > 0, \quad \frac{\partial k^M}{\partial \alpha_A} < 0\end{aligned}\tag{22}$$

This implies that symmetric competing search engines will charge higher prices to advertisers when there is higher degree of product differentiation, higher costs of serving advertisers, higher costs of quality improving capital investments, or when advertisers benefit less from network effects. On the other hand, in an oligopoly with high degree of product differentiation there will be no negative effect on the quality of search results. Higher fixed costs, lower cost efficiency, and lower advertisers' benefits from network effects will also imply enhanced symmetric equilibrium quality of the search results.

The analysis of asymmetric equilibria (where α_A , f_A , or λ can differ between engines, i.e. $\alpha_A^1 \neq \alpha_A^2$, $f_A^1 \neq f_A^2$, or $\lambda^1 \neq \lambda^2$) is quite cumbersome. Before we state the results, let us

discuss possible relationships between the size of the above mentioned parameters and the degree of domination of the search engine market by a single firm (such as e.g. Google). The dominant firm can benefit from the scale economies and stronger network effects. Hence, it will have lower costs of serving advertisers (i.e. lower f_A), lower costs of quality improving capital investments (or higher cost efficiency, i.e. lower λ due to experience, e.g. learning by doing effect), and may allow advertisers benefit more from network effects, implying higher α_A . Now, if we compare the outcomes in the asymmetric equilibrium the conjecture of Proposition 5 follows immediately.

Proposition 5 *In the asymmetric equilibrium $p_A^{1M} > p_A^{2M}$ and $k^{1M} > k^{2M}$ if $\left\{ \begin{array}{l} \lambda^1 > \lambda^2 \\ \alpha_A^2 > \alpha_A^1 \\ f_A^1 > f_A^2 \end{array} \right.$.*

This proposition has a number of quite important policy implications. Given that the dominant search engine (platform 2) can be characterized by lower λ , lower f_A , and higher α_A , it will offer lower quality of the search results in any of the three model variations described in Proposition 5 compared to the weak (or less cost efficient) search engine (like e.g. Bing). Hence, the impact of the market domination on the resulting quality is clearly negative. The impact on the prices charged to advertisers is similar, but appears to be welfare improving. Dominant (more efficient) search engine will always charge lower prices than non-dominant due to greater cost savings and stronger network effects.

The comparison of the strategies chosen by the dominant (more cost efficient) and non-dominant (possibly less cost efficient or weaker) search engines reveals the trade-off between enhancement of the quality of the search results and prices charged to advertisers. Dominant search engine will choose lower prices accompanied by the lower quality of the search results in order to keep its market share. While weaker non-dominant search engines (like e.g. Bing or Yahoo) will charge higher prices to advertisers, but at the same time will offer higher quality of search results in order to increase their market share by attracting more users and, consequently, more advertisers. This higher price charged to advertisers is not a problem from the competition policy point of view, since it simply reflects higher marginal costs and smaller network effects in the competitive oligopoly equilibrium for these weak search engines. However, the absence of the incentives for the dominant search engine to invest in quality improvements even in the presence of potential, but weaker, competitors should raise some concerns.

6 Analysis of Exclusionary Abuses

6.1 Multi-homing and Exclusive contracts (discussion from Armstrong and Wright (2007))

In this section we consider the use of exclusive contracts that prevent advertisers from multi-homing and its legal and welfare implications. In the case where product differentiation arises only on the user side of the market, an equilibrium exists where agents on the advertisers' side will multi-home. This case represents a “competitive bottleneck” introduced in Armstrong and Wright (2007). There platforms would compete aggressively to sign up users, charging them nothing, and make their profits from advertisers who want to reach these users and who do not have a choice of which platform to join in order to reach them. In equilibrium, advertisers are left with zero surplus.

Armstrong and Wright (2007) show that competitive bottleneck equilibria can be undermined when platforms can offer exclusive contracts to the advertisers. Exclusive contracts work by making it easier for a platform to unsettle an equilibrium with multi-homing on one side. In the absence of such contracts, a platform finds it costly to persuade advertisers to stop subscribing to the rival platform. With exclusive contracts, however, a platform can set arbitrarily high non-exclusive prices (so that advertisers never choose to multi-home regardless of the rival platform's offer) and then offer a slight price cut relative to the rival platform to attract all advertisers exclusively. The resulting positive network effect can then be exploited on the user side. When network effects are strong, this can lead to an equilibrium where all agents sign up exclusively to a single platform even though it sets high prices to both sides. Armstrong and Wright (2007) also show that exclusive deals allow the dominant platform to raise prices and profits by making it more expensive for the rival platform to employ a “divide-and-conquer” strategy.

According to Armstrong and Wright (2007), such exclusive contracts involve only **partial foreclosure**. Although the rival platform is foreclosed from one side of the market, it still has some demand from agents on the other side. This reflects the assumption of strong product differentiation on the user side. This could capture the possibility that even without any advertisers on its platform, the excluded platform still offers some services that users value. For example, the platform offers some of its own content or advertisements. Only with pure network effects (i.e. no product differentiation on either side) exclusive contacts can allow a platform to foreclose its rival fully from both sides of the market.

Armstrong and Wright (2007) have already shown that multi-homing by advertisers can be undermined if exclusive contracts are available. We extend their conclusions in the oligopoly model with quality of search results and show that, depending on the parame-

ter constellations (costs and degree of product differentiation) and on the presence and the size of network effects, exclusive contracts with advertisers can be either harmful or welfare enhancing compared to the competitive equilibrium. The implications for the search engine market are more focused. **The effect of exclusive contracts would be rather harmful in the case of the oligopolistic search engine market** dominated by a single company (such as Google). This is implied by the high degree of product differentiation,⁵⁰ low cost of serving advertisers, and the presence of substantial network effects on the advertisers side.

6.2 Solution and Policy Implications (One-sided Network Effects)

In the setting with product differentiation on only users' side and one-sided network effects exclusive contracts with advertisers by the dominant search engine appear to be welfare reducing.⁵¹ The following analysis proves this conclusion. In order to show this we compare the welfare implications under competitive equilibrium with multi-homing and the welfare implications in case when advertisers are forced to single-home on platform 1. For illustrative purposes we first analyze the pure impact of exclusivity contracts on prices and profits of the two competing search engines. In the section 6.3 we will provide a complete analysis of the impact of exclusive contracts on prices, profits, and the quality of the search results.

First, suppose that $\alpha_U = 0$. This applies to internet search engine market, where users do not care about the quantity of advertising on the search engine. Similar to Armstrong and Wright (2007), in this case, the equilibrium is described as follows.⁵²

Conclusion 6 *Let $\alpha_U = 0$. Then the equilibrium is unique and symmetric, platforms will serve both sides of the market, with advertisers multi-homing and users single-homing. The price to advertisers is $p_A^M = \alpha_A/2$ and the price to users is $p_U = 0$.*

If $\alpha_A \leq t$, each platform makes profit $\pi^{iM} = t/2 - f_A$ and total profit is $\pi^{TM} = t - 2f_A$.

If $\alpha_A > t$, each platform makes profit $\pi^{iM} = \alpha_A/2 - f_A$ and total profit $\pi^{TM} = \alpha_A - 2f_A$.

⁵⁰Google claims that other search engines are only one click away, which should imply that "transportation costs" are low and, hence, the degree of product differentiation as well. However, the relevance of the search results provided by Google, the algorithms used by Google, and its data base are very different from the other search engines. Hence, in practice it makes "transportation costs" for users very high.

⁵¹It largely seems to be the case in the search engine market that only one side (advertisers) cares about platform performance on the other side. Users mainly do not care about the amount of advertising on the other side of the search engine and only care about content and quality of search results. That's why for the analysis in this section we restrict our attention to the case of one-sided network effects. We leave the detailed analysis of the case with two-sided network effects to the future research. Preliminary calculations show that qualitative results and policy implications of one-sided network effects case will not change if two-sided network effects are introduced.

⁵²The proof of this result is just a special case of the proof of Proposition 2 in Armstrong and Wright (2007).

Next, we compare the competitive equilibrium of the Conclusion 6 with multi-homing to the configuration, where advertisers are forced to single-home on platform 1. Exclusive contracts that lure advertisers to single-home on platform 1 are characterized by the following result.⁵³

Conclusion 7 *Let $\alpha_U = 0$. Advertisers will single-home on platform 1 if prices set by the platforms 1 and 2 are given by $p_A^{1S} \leq \frac{1}{2}\alpha_A$ and $p_A^{2S} \geq \frac{1}{2}\alpha_A$, respectively.*

The platforms' profits are $\pi^{1S} = p_A^{1S} - f_A = \frac{1}{2}\alpha_A - f_A$ and $\pi^{2S} = 0$.

While total profit is $\pi^{TS} = p_A^{1S} - f_A = \frac{1}{2}\alpha_A - f_A$.

The comparison of the two results above implies that, even though the platform 1 does not lose any profits, exclusivity contracts reduce total welfare when $f_A < \frac{1}{2}\alpha_A$, since total profits are lower and advertisers on platform 1 are forced to pay the same (or just marginally smaller price), while advertisers on platform 2 are required to pay a higher price. Hence, exclusivity contracts are welfare reducing when we have high network effects on advertisers' side of the market or low cost of serving advertisers, i.e. $f_A < \frac{1}{2}\alpha_A$. The same conclusion holds when degree of product differentiation is high, i.e. $\frac{1}{2}t \geq f_A$. There is a clear relationship between the degree of domination of the search engine market by a single firm (such as Google) and the size of the above mentioned parameters. The dominant firm can benefit from the scale economies and stronger network effects. Hence, it will have lower costs of serving advertisers (i.e. lower f_A) and may allow advertisers benefit more from network effects, implying higher α_A . In addition, in spite of Google's claims that other search engines are only one click away, implying low degree of product differentiation, the relevance of the search results provided by Google, the algorithms used by Google, and its data base are very different from the other search engines. Hence, in practice it implies a high degree of product differentiation. As was illustrated in the conclusions 6 and 7, in the environment with high degree of product differentiation, low cost of serving advertisers, and substantial network effects on advertisers' side of the market, exclusive contracts appear to be welfare reducing.

7 Conclusions and Policy Proposal

Conclusions of sections 6 imply that, when the degree of product differentiation in the search engine market is high, network effects on advertisers' side of the market are substantial, and the costs of serving advertisers are low, the exclusionary practices by dominant search

⁵³The proportion of users who join platform 1 is now $n_U^1 = \frac{1}{2} + \frac{\alpha_U}{2t} = \frac{1}{2}$.

Advertisers will single-home on platform 1 if $\alpha_A n_U^1 - p_A^1 \geq 0$, $\alpha_A n_U^1 - p_A^1 \geq \alpha_A(1 - n_U^1) - p_A^2$, and $\alpha_A n_U^1 - p_A^1 \geq \alpha_A - p_A^1 - p_A^2$. Rearranging the above three inequalities implies the results in the Conclusion 5.

engines may be welfare reducing. These implications should raise concerns for antitrust authorities and the EC related to the increasing dominance of Google and its conduct towards advertisers.

Section 5 stresses similar issues. There we conclude that the threat of excessive pricing is more likely in the search engine market that is characterized by the high degree of product differentiation on the users' side. Next, analysis of asymmetric oligopoly equilibria in section 5 reveals that the dominant search engine (which normally enjoys substantial cost advantages due to economies of scale and experience, as well as stronger network effects) does not have proper incentives to invest in quality improvements even in the presence of potential, but weaker, competitors. Further, we conclude that monopolization of the search engine market by a single firm (such as Google) would lead to reduction of quality of search results compared to social optimum. In addition, it generally leads to increase in prices charged to advertisers above socially optimal level.

We argue that the evidence on increasing concentration, the current characteristics of the search engine market, and the theoretical results of the paper suggest that some form of intervention is needed in order to avoid possible exclusionary abuses by the dominant search engine and to prevent the deterioration in quality and relevance of search results.

The issue of maintaining proper quality and relevance of search results in practice is closely connected to maintaining proper quality of search algorithms, prevention of search bias and prevention of manipulation of rankings of organic search results, which by themselves maybe considered abusive. This implies that, since the incentives to maintain higher quality for dominant firm are reduced, the likelihood of the above mentioned abusive manipulation of rankings and search algorithms is higher when the search engine market is dominated by a single firm. More symmetric distribution of powers would lead to a better outcome in terms of quality. In the current situation, regulators should be empowered to have more control over quality of search results or at least develop effective instruments that would provide proper incentives for dominant firm to comply with quality standards. Imposing "search neutrality" can be a good remedy.

Another possible policy advice is related to the impact of the degree of product differentiation on the outcome of possible exclusionary conduct by dominant search engine analyzed in section 6. Reducing the degree of product differentiation on the users' side of the market maybe an effective solution in avoiding harmful effects of exclusive contracts as well as in reducing prices charged to advertisers. Similar to Argenton and Prufer (2011), the desired reduction in the degree of product differentiation can be achieved through the remedy to require search engines to share their data bases and data on previous searches. This would reduce the degree of product differentiation and level the playing field in the quality

dimension.

Finally, the third remedy that we propose is related to the impact of network effects on advertisers' side of the market. Stronger network effects seem to have negative impact for both quality of search results and the welfare implications of exclusive contracts. Limiting the size of these network effects for the stronger players and enhancing those for weaker players could be a way to improve.

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