Yale *Tobin Center for Economic Policy*

Digital Regulation Project

More Competitive Search Through Regulation

Policy Discussion Paper No. 2[†]
May 20,2021

[†] The Tobin Center for Economic Policy at Yale hosts the papers of the Digital Regulation Project as a way for some of the world's leading economists and regulatory experts to present policy recommendations, based on their relevant research and expertise. The Tobin Center does not take policy positions and therefore the content does not represent the positions of the Tobin Center or Yale University.

More Competitive Search Through Regulation[2]

Authors:[3,4,5]

Paul Heidhues, DICE, Heinrich-Heine University Düsseldorf
Alessandro Bonatti, Massachusetts Institute of Technology
L. Elisa Celis, Yale University
Gregory S. Crawford, University of Zurich
David Dinielli, Omidyar Network
Michael Luca, Harvard University
Tobias Salz, Massachusetts Institute of Technology
Monika Schnitzer, Ludwig-Maximilians-University Munich
Fiona M. Scott Morton, Yale University
Katja Seim, Yale University
Michael Sinkinson, Yale University
Jidong Zhou, Yale University

[2] This is the second of several papers prepared by or forthcoming from the Digital Regulation Project, a collaborative effort of experts in economics and regulation in the United States, the UK, and the European Union, who have studied, and are committed to the improvement of, competition in digital markets. The first such paper addressed consumer protection regulation for online markets and digital platforms.

[3] Authors' full titles and conflict disclosures can be found in Appendix 1.

[4] The authors thank Abby Lemert, B.S.E., M.Sc., M.A., Yale Law School Class of 2023. Ms. Lemert lent her considerable technological expertise to the conception and drafting of this paper. Her precise research, judgment, and editing helped shape the authors' ideas into this final form.

[5] Omidyar Network and the James S. and James L. Knight Foundation have provided funding and other support for this paper and other forthcoming papers relating to regulation of digital platforms and markets. Omidyar Network employs one of the authors of this paper.

Introduction

This paper identifies a set of possible regulations that could be used both to make the search market more competitive and simultaneously ameliorate the harms flowing from Google's current monopoly position. The purpose of this paper is to identify conceptual problems and solutions based on sound economic principles and to begin a discussion from which robust and specific policy recommendations can be drafted.

Google holds a monopoly in general search that is overwhelming and durable. A lawsuit recently filed in the United States by a coalition of thirty-four state attorneys general alleges, for example, that "[c]lose to 90 percent of all internet searches done in the United States use Google. No competing search engine has more than 7 percent of the market, and, over the past decade, no new entrant in the general search market in the United States has accounted for more than 1 percent of internet searches in a given year."[6] Google's monopoly in search extends beyond the United States. Google Search's share in the European Union, for example, has hovered at or above 90 percent for years.

Monopoly in search can harm consumers in several ways compared to a setting with multiple search engines and/or a more dynamic "Schumpeterian" market. Monopoly can lower the quality of search services experienced by users, reduce innovation in search, and permit leverage of market power into other developing markets where innovation can be harmed. Monopoly in search advertising can raise prices and lower quality in that market as well. End users can be expected to pay above competitive levels in attention and data for the services they receive, and, in the long run, they will bear the burden of the overcharges paid by advertisers who pass those through to retail prices. Experience and economic theory show that a monopolist is insulated from normal pressures to improve quality and innovate. Google's search results in response to commercial queries often do not provide results that are best for consumers, and instead assist in preserving its own market power. This market power allows Google to extract rents both from end users (in the form of attention and data) and from advertisers (in the form of cash payments), which has distributional consequences.

Google's search monopoly is of particular concern because of the critical gatekeeping role internet searches play in end users' access to information about, and purchases from, the entire economy. Additional harms may also arise when consumers overwhelmingly use only a single

[6] *See* Complaint at ¶ 4, State of Colorado et al. v. Google LLC, No. 1:2020cv03715 (D.D.C. filed Dec. 17, 2020).

channel to procure information about the noncommercial world, including information relating to public health, current events, and other critical bodies of knowledge.[7]

In an ideal world, authorities would address competition concerns in the search market holistically, with a single set of related interventions that would, simultaneously (1) remediate the conduct and market conditions that have facilitated Google's monopoly; and (2) establish rules of the road designed to jump start entry and innovation and to prevent the re-emergence of a single dominant firm in the future. But there already is a patchwork of ongoing efforts by various enforcement authorities in various jurisdictions that could make it difficult as a practical matter for any single authority to impose an integrated scheme of that sort. Different authorities may impose various interventions at different times. We therefore propose a "menu" of interventions – grounded in uncontested economic principles – designed so that regulators can select those interventions that best address market conditions as they exist when it is time to impose them.[8] The menu of interventions takes seriously the allegations that Google has violated the law in building and/or maintaining its monopoly but they do not as a general matter depend on any conclusion of illegality. The problems apparent in the search market ought to be fixed, regardless of their origins and regardless of whether Google violated the law in contributing to them.

Among the efforts already undertaken are a number of government antitrust cases against Google in search. We discuss the EU and US cases briefly here. The European antitrust cases, which began in 2010, focus on two types of search conduct: (a) Google's tactics to ensure that its search engine and related apps appear as the defaults at the various access points by which users access search engines; and (b) Google's manipulation of search results to advantage its own specialized services (shopping, in that case) – over those of rivals. The two US search lawsuits (both filed in 2020) make similar allegations to those in the previous EU suits, while also emphasizing that the small, specialized search engines Google has disadvantaged are (individually or collectively) a competitive threat to Google's general search engine.

The remedies imposed by the European Commission (EC) in its search case (the "Google Shopping" case and the "Android" case) appear to have been largely ineffective; they have not lessened Google's monopoly position or led to more entry and competition in search.[9] Perhaps partially as a result, the EC recently proposed regulations, the Digital Markets Act, that will be

---

[7] *See, e.g.*, Carole Cadwalladr, Opinion, *Google Is Not 'Just' A Platform. It Frames, Shapes, and Distorts How We See the World*, GUARDIAN, Dec. 11, 2016, https://www.theguardian.com/commentisfree/2016/dec/11/google-frames-shapes-and-distorts-how-we-see-world (explaining how Google's algorithm serves up Holocaust denial sites in response to queries about the Holocaust, because those are the most likely to be "clicked"); Farhad Manjoo, *Search Bias, Blind Spots, and Google*, N.Y. TIMES, Aug. 31, 2018, at B1, https://www.nytimes.com/2018/08/30/technology/bias-google-trump.html (explaining how Google's algorithm exacerbates existing biases by serving up results that reflect those biases, simply because they exist widely on the web, *e.g.*, linking the query "black girls" with results containing the word "angry").

[8] This paper sometimes uses the term, "regulator," even though a court might impose some of the remedies we propose, and a regulator might impose others, depending on a variety of factors including idiosyncrasies of local law and the state of the market at the time of imposition.

[9] *See* Michael Ostrovsky, *Choice Screen Auctions,* (STANFORD U. & NBER, Working Paper, Nov. 7, 2020), https://web.stanford.edu/~ost/papers/csa.pdf. *See also* Simon van Dorpe & Leah Nylen, *Europe Failed to Tame Google. Can the U.S. Do Any Better?*, POLITICO, Oct. 21, 2020, https://www.politico.com/news/2020/10/21/google-europe-us-antitrust-431036; 2018 O.J. (C 9) 11 ("Google Shopping case"); 2019 O.J. (C 402) 19 ("Android case").

applicable to "gatekeeper" digital platforms, presumably including Google Search. The US antitrust cases, if they are successful, also will require remedies, and it is possible the United States will follow the EU by turning to regulation as an additional solution. Given the established problem in both jurisdictions – monopoly in search – and the tools that governments are using to effect change, it is both timely and prudent to think creatively and specifically as to what particular interventions could make the market for general search more competitive. We look, in particular, for regulatory interventions that would be relatively low cost and high benefit, and those that lower entry barriers and support innovation.

These interventions would lower barriers to entry through divestitures, prohibitions on contractual restrictions, and mandatory licensing of key data. We briefly explain the economic foundation for each remedy and why economic theory predicts it will increase competition. We also provide the downside, or risk, to the remedies. We note that among this menu, different authors of this paper may prioritize different remedies above others, according to their perception of the relative magnitudes of the pros and cons of each. Not all authors would implement every proposal. However, every proposal we list has a valid economic foundation and is viewed as worthy of policy consideration by the group.[10] Indeed, we feel the problem of establishing competition in search is sufficiently difficult that it will require adopting most, rather than one or two, of the ideas below. A further caution is that the relative efficacy and cost of these proposed solutions could change as market conditions and business practices change.

> ***Summary of the menu of options****: The goal of regulating Google in the general search market is to restore competition and increase the surplus enjoyed by consumers. The regulations proposed here create conditions that are conducive to successful entry and that limit leveraging of Google's position in search into other activities. The regulator should:*
>
> *(1) Prohibit Google (or other dominant search engines if they arise) from purchasing exclusive default positions at search access points or deploying other contractual restrictions that have the effect of favoring Google's search engine, whether through prominence or default status;*
>
> *(2) Prohibit Google from creating or enforcing contracts that give Google control over the design of the home screen or require preinstallation of a bundle of Google apps ("MADAs");*
>
> *(3) Prohibit Google from licensing its suite of GMS Apps only to manufacturers who agree not to "fork" Android into a competing operating system ("Anti-Fragmentation Agreements");*
>
> *(4) As an alternative to (2) and (3), require Google to divest the Android ecosystem into an independent entity, and require the elements of the ecosystem to be licensed on an unbundled basis at a uniform per device price that is FRAND;*

[10] In addition, the implementation of some proposals may obviate the need for others. For example, if Google is required to divest Android (proposal #4), then it no longer would be necessary for a regulator to police Google's Android-related contractual restrictions (proposals # 2 & 3).

(5) Mandate that Google license its web index at FRAND rates;

(6) Mandate that Google license its click and query data at FRAND rates;

(7) Restrict practices that disadvantage small and nascent competitors by requiring that at least 50 percent of space on initial results screens be devoted to non-monetized results;

(8) Prohibit Google from engaging in any form of self-preferencing in the ranking or display of those non-monetized results;

(9) Undertake enhanced merger pre-notification and review;

(10) Ensure Google does not monopolize voice-activated search or other products comprising the "Internet of Things" by prohibiting exclusive defaults and considering mandated interoperability of such devices with various search engines;

(11) Conduct ongoing oversight in the public interest to maintain healthy competition on a level playing field by protecting data and digital security, preventing harmful discrimination, and combatting fraud and deception.

Background

What is general search?

General search is an online service whereby a search engine supplies links to content from the internet in response to a user query. General search engines perform three primary actions in providing this service: collecting data from the entirety of the public web and some proprietary sources, indexing these data, and then applying an algorithm that ranks results for users. For example, the query, "Marie Antoinette" could produce a variety of search results, *e.g.*, a Wikipedia page about Marie Antoinette, a review on rottentomatoes.com regarding a film about her life, or images of Marie Antoinette on display at the National Gallery in Washington DC. The user is likely to receive a list of museums and galleries if she enters "portraits of Marie Antoinette," and that list might feature local museums if the search engine is aware of her location.

General search is a product market for purposes of economic and antitrust analysis. Other methods of information discovery are not reasonable substitutes for general search services for web users. No other online or offline tool provides users the breadth of information, convenience, or speed a general search engine provides. Google and Bing are the only at-scale English language search engines that have their own web indices. Google's market share in general search services in the US has grown from 70 percent in 2007 to over 85 percent in 2019.[11] A more recent study indicates that over 90 percent of searches in the United States occur

[11] *See* Complaint at ¶ 26, State of Colorado et al. v. Google LLC, No. 1:2020cv03715 (D.D.C. filed Dec. 17, 2020).

on a Google property.[12] Bing, Google's closest competitor in the general search market, receives only 7 percent of general search queries in the United States.[13]

There is a second, related market called "specialized" or "vertical" search. These services facilitate searches in a narrow area such as travel or home repair. Specialized search providers do not generally provide answers to queries outside their commercial segment. A search about Marie Antoinette on a specialized travel site, for example, might provide information about tours of sights with historical connections to her life, but likely would not provide links to reviews of a movie about her life because that is not directly related to travel.

For consumers, therefore, general search engines are distinct from specialized "vertical" providers and occupy a different product market. However, Google itself has identified specialized search as a nascent competitive threat to general search.[14] If not hindered, many of these smaller search providers could expand beyond their narrow niche into related, or broader, areas and become the starting point for a larger group of searches. Or such specialized search engines could, collectively, come to provide an alternative service to a single general search engine, just as a small-town "Main Street" with a broad variety of independent shops competes with Walmart.

What is the economic model for general search?

Two distinct categories of users interact with general search engines. The first is the end users of the service. These are the people who access the engines through their laptops or mobile or voice-activated devices and enter search queries. General search engines currently offer their services to end users through a barter transaction: data and attention in exchange for search services. Today, no one pays cash to use a search engine. Advertisers, however, do pay cash to present advertisements to end users. But advertising is not the only potential funding model a

---

[12] *See* George Nguyen, *Now, More than 50% of Google Searches End Without a Click to Other Content, Study Finds,* SEARCH ENGINE LAND, https://searchengineland.com/now-more-50-of-google-searches-end-without-a-click-to-other-content-study-finds-320574#:~:text=The%20update%20includes%20data%20from,clicking%20through%20to%20any%20results.

[13] *See* Complaint at ¶ 26, State of Colorado et al. v. Google LLC, No. 1:2020cv03715 (D.D.C. filed Dec. 17, 2020).

[14] The Wall Street Journal in 2015 published portions of a 2012 FTC staff memo recommending that the FTC bring an enforcement action against Google. A version of the internal memo – including only the even-numbered pages – had been released inadvertently in responses to a Freedom of Information Act request. That leaked memo analyzed internal documents that showed that Google, even a decade ago, identified specialized search as a competitive threat to its general search engine. This example summarizes the concern that specialized search could "disintermediate" Google's lock on end users, specifically with respect to searches that easily can be monetized. *See* Brody Mullins, *Inside the Antitrust Probe of Google,* WALL ST. J., March 19, 2015, https://www.wsj.com/articles/inside-the-u-s-antitrust-probe-of-google-1426793274. *See also, The FTC Report on Google's Business Practices* http://graphics.wsj.com/google-ftc-report/ at 18 (quoting unsourced Google document).

> Vertical search is of tremendous strategic importance to Google. Otherwise the risk is that Google is the go-to place for finding information only in the cases where there is sufficiently low monetization potential that no niche vertical search competitor has filled the space with a better alternative.

search engine could use; an entrant could, for example, operate on a subscription model or charge a price per search and attract consumers that prefer those terms.[15]

Advertisers are willing to pay for the opportunity to present advertisements to end users because user queries often reveal purchasing interest or even intent. Many users who query "mountain bike," for example, may be considering purchasing a mountain bike or traveling somewhere with mountain bike trails. Bike manufacturers and outdoor travel companies therefore view such users as high value advertising targets; their queries suggest "purchase intent" for the goods or services the advertisers offer. Advertisers, accordingly, pay search engines to place ads alongside the "organic results" the search engine displays in response to user queries, in hopes that the users will see and click on their ads.

The fact that users do not pay cash for search on Google does not alter the fact that the general search barter exchange is of enormous size and economic significance. Likewise, it does not remove the billions of daily interactions between end users and search engines from regulatory scrutiny. General search facilitates a massive amount of commerce, both by linking consumers to businesses offering products and services and by acting as a critical advertising venue for those same businesses. Each year, advertisers pay Google as much as $40 billion to place advertisements on its search engine results page (SERP).[16]

What economic concerns does concentrated power in the general search present?

More competition in general search should encourage the creation of higher quality services to end users and higher quality services at lower prices to advertisers. Less competition should lead to the opposite.

Furthermore, general search engines serve a gatekeeper function to the vast stores of information, opinions, analyses, and images available on the web.[17] In the past, consumers looking for information (commercial or otherwise) might have consulted their encyclopedia or atlas or fold-out map. They might have posed their question to a librarian, consulted the yellow pages, viewed products in a local store, or reviewed the classified ads in their local paper. Today we use search engines – operated by private companies for profit – to steer us to virtually everything we want to know, including the places to spend our money. Search engines have made the search for information much more efficient, but it is not healthy that one company serves as the conduit and gatekeeper for such a large proportion of searches.

We note that while more competition in general search will deliver many good outcomes to consumers and advertisers – *e.g.*, low prices, innovation, choice, and quality – it will do a better job of this in an environment in which there are strong consumer protection "rules of the road." As with weights and measures and ingredient labels that notify consumers what they are

[15] A former Google engineer is developing a subscription-based search engine called Neeva. *See* Daisuke Wakabayashi, *A Former Google Executive Takes Aim at His Old Company With a Start-Up*, N.Y. TIMES, June 19, 2020, https://www.nytimes.com/2020/06/19/technology/google-neeva-executive.html.
[16] *See* Complaint at 4-5, United States v. Google LLC, No. 1:20-cv-03010 (D.D.C. filed Oct. 20, 2020).
[17] As of 2019, search traffic accounts for nearly 30 percent of all global web traffic. J. Clement, *Global Website Traffic Distribution 2019, By Source*, STATISTA, Nov. 3, 2020, https://www.statista.com/statistics/1110433/distribution-worldwide-website-traffic/.

purchasing, consumers and advertisers must be able understand what they are both giving up and getting so they can make good choices. For example, one search engine might harvest personal data and track a user while another does not; users should be aware of those differences when they choose a search engine. Consumer protection regulation is needed alongside more competition in this sector.

Why is it important to consider market interventions now?

There are multiple government enforcement actions that could affect the way Google is required to conduct its search business going forward. The US Department of Justice, in concert with multiple states, has sued Google for monopolizing search. A separate cohort of states has filed a separate lawsuit, also alleging that Google has monopolized search. These lawsuits appear to seek some of the same remedies we discuss here, such as banning Google from entering agreements to secure exclusive default positions. But the initiating documents in these lawsuits – in the US these are called Complaints – provide only broad outlines, rather than blueprints, for possible remedies.[18] This is typical, as the parties and the court generally would not consider remedies until after liability is established. In its antitrust cases, the European Commission has fined Google a total of more than $10 billion because of Google's multiple violation of law. But, in what many commentators have deemed an error, the EC allowed Google essentially to design its own behavioral remedies. None of the changes Google adopted has undercut Google's monopoly position or significantly lowered barriers to entry. Meanwhile, the European Commission has released draft regulations that likely would govern Google and its search business, among others.[19]

In order to enact regulations and bring the lawsuits successfully to an end, governments need practical solutions to make the general search market more competitive and better serve consumers. Whether the setting is one of a remedy at the end of an antitrust trial and/or regulation administered by a sector-specific agency, the same problem of insufficient competition is present. Moreover, it would be particularly valuable to future consumers if these remedies were designed so that Google – the current monopolist – is not simply replaced by a new monopolist. The remedies should aim to generate and preserve conditions that allow the market to support multiple effective general search engines going forward.

The paper offers both general and specific ideas of regulations that would facilitate entry and competition in the general search market. We follow the modern approach of "pro-competitive regulation."[20] That is, we describe regulations that do not seek to impose policies like price, quality, and product design for dominant firms, but rather focus on lowering barriers to entry and reducing impediments to multihoming by users of platforms. The goal of pro-competitive regulation is to find a way to increase competition and innovation in this monopolized market.

---

[18] The Department of Justice Complaint against Google, for example, requests that the court "[e]njoin Google from continuing to engage in the anticompetitive practices described herein and from engaging in any other practices with the same purpose and effect as the challenged practices." Complaint at 57, United States v. Google LLC, No. 1:20-cv-03010 (D.D.C. filed Oct. 20, 2020).

[19] *See Proposal for a Regulation of the European Parliament and of the Council on Contestable and Fair Markets in the Digital Sector (Digital Markets Act)*, COM (2020) 842 final (Dec. 15, 2020).

[20] This is in contrast to the usual type of utility regulation used for natural monopolies.

The ideas below are designed to create conditions that allow for a larger number of search engines to thrive and compete for users and advertising dollars.

Basic assumptions:

Our proposals assume the following:

First, we take it as established that Google has a monopoly,[21] and that more competition would benefit both consumers and advertisers. Although Google's market power may be injurious to consumers regardless of how it was created, we further assume that the allegations of anticompetitive conduct in the multiple US and EU antitrust cases are broadly correct. Because the ongoing antitrust lawsuits in the US will likely take years to reach judgment, we consider adopting procompetitive regulation even prior to (and regardless of) any judicial adjudication of Google's conduct and any punitive measures that may come out of such proceedings; our objective is purely improving competition in search.

Second, we assume the power to regulate in the jurisdiction adopting the remedy. The EU recently has announced it will be creating new regulations of "digital gatekeepers." Similarly, many academics, advocates, and policymakers have argued that digital platforms pose new and idiosyncratic dangers to the US economy, democracy, and health and safety, and therefore deserve a specialized regulator.[22] We take no position on whether the authority to regulate digital platforms should rest in new, specialized agencies, or be established through some other method. But we do assume for purposes of this paper that there is regulatory authority and expertise *in some agency, legislative body, or court* sufficient to perform the various oversight and enforcement functions we propose.

Proposals

We now describe each proposal and its economic foundation in detail. The first four proposals are designed to end Google's ability to leverage market power, including market power resulting from its ownership and control of Android, into a monopoly position in search. Google has imposed entry barriers in search through contractual restrictions tied to control of the Android operating system. There is no issue, as a matter of economics, with Google charging a monetary fee for Android, and indeed, it is entitled to earn a financial return on the business. The discussion highlights that there are many less anticompetitive ways to sell/barter Android than the system currently in use.

Google has the power to impose restrictions tied to the use of the Android OS because, in the US, there are only two commercially viable mobile OSs. Apple owns one of the two mobile operating system, iOS, which it deploys on its vertically integrated devices but does not license

[21] We use "monopoly" in the sense that Google has a very high market share and significant related market power in various geographic markets globally, not that it literally is the only provider of general search services.
[22] For examples of recent policy papers discussing a digital regulator, *see*, *e.g.*, Fiona Scott Morton *et al*., Report of the Committee for the Study of Digital Platforms, Market Structure and Antitrust Subcommittee (George J. Stigler Ctr. for the Study of the Economy and the State), University of Chicago Booth School of Business ed., 2019); TOM WHEELER, PHIL VERVEER, & GENE KIMMELMAN, NEW DIGITAL REALITIES; NEW OVERSIGHT SOLUTIONS (Shorenstein Center at the Harvard Kennedy School of Government ed., 2020).

to third parties. Google governs the authoritative version of the other – Android – which it does license. Google, therefore, has a monopoly in the licensable mobile OS market. Handset makers other than Apple *must* use the Android operating system, or they have no handset to sell. This market power gives Google the ability to impose anticompetitive conditions on licenses of Android.[23]

1. *Prohibit Google (or other dominant search engines if they arise) from purchasing exclusive default positions at search access points or deploying other contractual restrictions that have the effect of favoring Google's search engine, whether through prominence or default status*

Google Search has obtained and maintained dominance largely by contracting for, or purchasing, exclusive default positions on handsets from original equipment manufacturers (OEMs). OEMs that wish to use Android are required to install Google Search as the default at all "search access points." Because Google does not control iOS, it must pay for those default positions on iPhones; Google pays Apple between $8 and $10 billion per year to be the default search engine on iOS mobile devices.[24] These required default arrangements, when enforced by a dominant search engine, block entry by competitors, are anticompetitive on their face, and should be prohibited. They guarantee scale to Google Search while denying it to rivals. Because Google Search is dominant, these arrangements do not effectuate or advance competition on the merits with respect to either end users or advertisers. To the contrary, they foreclose it.

A wealth of social science demonstrates that defaults powerfully influence consumer behavior,[25] including research specifically in the context of defaults related to "options" offered by digital platforms.[26] These studies and data indicate that consumers rarely change default settings. This observation takes on special significance in connection with general search. A single consumer interacts with a variety of "access points" to general search; she may have multiple browsers on her laptop and on her handheld device or notebook. The toolbars of each of these devices also is an access point. It is unrealistic to expect consumers to change defaults at some or all of those access points – despite the fact that the action may not seem difficult to perform on its face.[27]

---

[23] A basic version of Android, the Android Open Source Project (AOSP), is, as the name suggests, open source and freely available for any developer to fork and use. Google governs the AOSP. The official version of Android which is licensed by Google, however, is known as Google Android and is not the version of Android available from the AOSP. Google Android contains some features over and above the AOSP which are developed by Google and kept proprietary.

[24] *See* Complaint at ¶ 26, State of Colorado et al. v. Google LLC, No. 1:2020-cv-03715 (D.D.C. filed Dec. 17, 2020).

[25] *See*, *e.g.*, Jon M. Jachimowicz et al.,*When and Why Defaults Influence Decisions: A Meta-Analysis of Default Effects*, 3 BEHAVIOURAL PUBLIC POLICY 159, 174-177 (2019).

[26] *See*, *e.g.*, HANA HABIB ET AL., AN EMPIRICAL ANALYSIS OF DATA DELETION AND OPT-OUT CHOICES ON 150 WEBSITES, AN EMPIRICAL ANALYSIS OF DATA DELETION AND OPT-OUT CHOICES ON 150 WEBSITES (2020), https://www.ftc.gov/system/files/documents/public_events/1548288/privacycon-2020-hana_habib.pdf; THORSTEN JOACHIMS ET AL., ACCURATELY INTERPRETING CLICKTHROUGH DATA AS IMPLICIT FEEDBACK (2005), HTTPS://WWW.CS.CORNELL.EDU/PEOPLE/TJ/PUBLICATIONS/JOACHIMS_ETAL_05A.PDF.

[27] Google's shopworn assertion that "[c]ompetition is just one click away" is wrong and unfounded, with much user interface design research demonstrating that changing defaults comes with heavy cognitive loads and switching costs, also evidenced by Google's willingness to pay billions for default positions. *See*, *e.g.*, *Google—Competition Is*

This point applies to Google Search directly, and Google Search when packaged with the Chrome browser as the default. Without practical access to consumers through these access points, a competing search engine will be hard pressed to gain scale.

Search is a service for which scale provides outsized returns to quality. Search algorithms "learn" how to provide relevant results for particular queries in part by observing how searchers interact with the results the algorithm serves up. Users' choices of what result to click on and the next action after that click "teach" the search engine which results are most responsive. This scale/quality feedback loop is especially important with respect to rare search queries. For very common queries, even a relatively unpopular search engine will have enough users to learn which answers are best in a short-enough time period. For rare searches, however, only a search engine with many millions of users will see a particular query with sufficient frequency to allow the algorithm accurately to predict what results are most relevant. A search engine with massive scale, such as Google, is more likely to provide relevant results in connection with these sorts of rare queries.

Therefore, the quality of search results provided by a search engine with substantial scale in a given type of query will generally be of higher quality than the results of search engines that have not achieved similar scale. Creating the conditions for a competitive market in search, therefore, requires an environment that allows new entrants quickly and efficiently to achieve scale.

A second, and important, input into search quality is the algorithm responsible for choosing how to rank and display the results. New entrants are likely to arrive with good ideas for improved quality or desirable differentiation through their algorithms. If the new entrants are able to attain scale in accordance with their merit, they may be able to achieve a quality level that would create competition for Google.

A search engine could innovate and compete in other ways as well. Imagine, for example, that a group of engineers decides to enter the market with a new, "privacy-preserving" search engine that does not track user queries and does not serve targeted ads based on those queries. What is our entrant's business plan for entering on mobile devices? It could invest extraordinary amounts in marketing, but it would face two significant and potentially insurmountable barriers to growing its business, no matter how attractive its product might be to consumers. All Apple access points are subject to exclusive default agreements with Google. All access points on handsets relying on the Android OS are – as described below – subject to exclusive default agreements with Google. Our entrant would have to convince customers to type in its address each time they searched, or manually change the default search engine on their device, on the browser they use, or they would have to change their browser. The knowledge and effort required to do this, combined with the power of the default mean that few users will do so.[28]

Just One Click and 27 Billion US Dollars Away, TECH @ CLIQZ (Dec. 22, 2019), https://0x65.dev/blog/2019-12-22/google-competition-is-just-one-click-and-27-billion-us-dollars-away.html; Eric Johnson *et al*., *Defaults, Framing and Privacy: Why Opting-In is Better than Opting-Out*, 13 MARKETING LETTERS 5, 5-15 (2002).

[28] *See* DOJ Complaint, *supra* note 17; Lena V. Groeger, *Set It and Forget It: How Default Settings Rule the World,* PROPUBLICA, July 27, 2016, https://www.propublica.org/article/set-it-and-forget-it-how-default-settings-rule-the-

Evidence demonstrates that defaults are very powerful even in settings where switching is intuitive and simple.[29]

The entrant has, for all practical purposes, no options. And if it can't reach consumers and gain sufficient scale to allow its algorithm to "learn" its way to high quality, how will consumers benefit from its pro-competitive privacy innovations? Clearly, given Google's market power in search, its exclusive default positions must be prohibited, whether those defaults are achieved through contracts to directly make itself the default search provider or contracts to more indirectly capture search access points by requiring prominent placement of Chrome and other Google apps that channel traffic to Google.

Some observers assert that eliminating exclusive contracts will not change Google's market share because Google has the highest quality, so consumers will continue to choose it overwhelmingly. There are two responses to this argument. First, if it is taken as true, there is no reason *not* to disallow the contracts given that they are redundant. Second, although it is impossible to predict with any degree of precision how much the current equilibrium would be disrupted by new entrants with effective scale and, thus, quality, the disruption could be substantial. Economic theory cannot predict precisely what will transpire when the contractual restrictions are removed. The key is that, when it is possible for entrants, OEMs, and consumers alike to make a new choice, entry will be stimulated.

There are clues in the case of Google Search that such new, high-quality entry might materialize. In Fall 2020, the US DOJ challenged Google's exclusive default contracts with Apple.[30] Days after the DOJ complaint was filed, news reports indicated Apple was well along in development of its own search engine. Apple reportedly had even poached the former head of Google's search business, who apparently is at the helm of these efforts.[31] It may be that if Google cannot pay Apple to use Google's search engine, Apple will seek revenues from search by entering with a differentiated product of its own. There are also other high-quality rivals in a good position to expand when they are able to do so. Microsoft's Bing continues to compete. DuckDuckGo, a general search engine which emphasizes user privacy, already has an estimated 80 million monthly users as of November 2020.[32] Neeva is a new search engine in development that will be supported by subscription payments, rather than targeted advertising.

---

world; Steffen Altmann & Paul Heidhues et al., *Defaults and Donations: Evidence from a Field Experiment*, 101 REV. OF ECON. & STAT. 808 (2019); Ä Löfgren et al., *Are Experienced People Affected by a Pre-Set Default Option—Results from a Field Experiment*, 63 J. ENV'T. ECON. & MGMT. 66 (2012).

[29] There are clear design alternatives that OS owners could use to make changing default search providers much easier and more user-friendly. For example, as part of an antitrust remedy, the European Union required Google to offer users a choice of default search provider using a "choice screen" listing various general search providers upon initially setting up their handset. *See* Alison Griswold, *Privacy-Focused Search Engine DuckDuckGo Is the Big Winner of Google Europe's Android Auction*, QUARTZ, Jan. 9, 2020, https://qz.com/1781609/google-shares-results-of-european-android-choice-screen-auction/.

[30] *See* Michael Potuck, *UK Regulators Could Break Up Apple and Google's Billion-Dollar Search Engine Deal*, 9TO5MAC, July 1, 2020, https://9to5mac.com/2020/07/01/uk-regulators-could-break-up-apple-and-googles-billion-dollar-search-engine-deal/.

[31] *See* Sam Shead, *Apple Reportedly Steps Up Effort to Build Google Search Alternative*, CNBC, Oct. 28, 2020, https://www.cnbc.com/2020/10/28/apple-steps-up-effort-to-build-google-search-alternative.html.

[32] *See How Many People Use DuckDuckGo?*, DUCKDUCKGO Q&A (2020), https://spreadprivacy.com/how-many-people-use-duckduckgo/. This remains a small number in comparison to Google's billions of monthly users.

The regulator, however, would have to monitor efforts to evade such a prohibition. It is entirely foreseeable that Google might find ways to "strongly incentivize" OEMs to make Google Search the exclusive default through, for example, discounts or bonus features on other critical and popular apps.[33] Google also could achieve much the same result by insisting that Google Search is listed at the top of any upfront selection screen through which consumers could select their default search engine. Finally, Google could achieve the same result by ensuring prominence of the Google Search app, or through requiring the preinstallation and prominence of Chrome and then making Google Search the default search engine on Chrome. The regulator should have full access to all written agreements between Google and OEMs, which should be filed as a matter of course, as well as the ability to interview people at Google who are knowledgeable with the workings of those agreements to preclude circumvention.

Accordingly, the initial step for a regulator is to prohibit Google (or other dominant search engines if they arise) from purchasing exclusive default positions or other preferential positions at search access points. We note that the European Commission required this of Google beginning in 2018, and yet search market structure has remained essentially unchanged.[34] Therefore, we view this regulation as a starting point, but insufficient on its own to achieve competition in search.

2. *Prohibit Google from creating or enforcing contracts that give Google control over the design of the home screen or require preinstallation of a bundle of Google apps ("MADAs")*

Google in addition uses a series of interlocking and self-reinforcing agreements – all of which are premised on its control of the Android operating system – to force handset OEMs relying on the "official" version of the Android OS to install a suite of Google's most popular apps, such as the Google Play Store and Google Maps and Chrome. These popular apps contain "search access points" which default to Google Search. Licensing the official Android and installing Google's popular apps come with contractual requirements that OEMs display Google apps prominently on the home page and make them the exclusive defaults on their handsets. In these ways, Google Search leverages its monopoly in the Android operating system, through its suite of apps, to obtain default positions at various search access points on Android handsets, thus cementing and protecting its monopoly position in search. This section describes these contractual restrictions. There is another category of restrictions referred to as Anti-Forking Agreements that also depend on Google's control of Android and that operate to protect its monopoly in Search in a similar way. We discuss this second category of Android-related restrictions in the following section.

By way of background, the basic version of the Android operating system is perpetual open source, meaning that anyone can copy and use it ("fork it") for free with a license from the

[33] *E.g.*, Gmail, Google Maps, or Google Drive

[34] *See* Natasha Lomas, *Europe's Android 'Choice' Screen Keeps Burying Better Options,* TECHCRUNCH, Mar. 8, 2021, https://techcrunch.com/2021/03/08/europes-android-choice-screen-keeps-burying-better-options/. We address the limitations of behavioral remedies such as this later in the paper.

Android Open Source Project.[35] But in order to license a package of proprietary applications and services known as Google Mobile Services (GMS Apps), Android developers must be running the *official* version of Android approved by Google, rather than their own "forked" version of the operating system.[36] The suite of GMS Apps includes valuable apps like the Google Play Store, Chrome, Gmail, and Google Maps, making it essential for any OEM hoping to sell devices. Consumers expect access to Google Play Store and other Google applications that provide standard functionalities for their handset.

The license for the official Android OS – though it comes without a monetary cost – requires a licensee to agree to two forms of contractual restrictions. These contractual restrictions historically appeared in what are called "anti-fragmentation agreements" (AFAs) which are explained in more detail below. At a high level, AFAs lock manufacturers into using Google's official version of Android, prohibiting "forking" (making modifications to the Android OS) by threatening to withhold the entire suite of GMS Apps.[37] Once Google has, through its AFAs, made it mandatory that OEMs use official Android OS rather than a "forked" version, it then imposes Mobile Application Distribution Agreements (MADAs, explained below) requiring its licensees to install the full suite of GMS Apps, display them prominently, and make Google Search the exclusive default at all search access points.[38]

MADA terms vary, but generally require OEMs to install the entirety of the GMS suite of apps. They dictate the placement of those Google apps to ensure prominence on the home screen.[39] These requirements provide a tremendous competitive leg up to various Google apps such as Gmail and Google Maps that are preinstalled and prominently placed: an end user is much more likely to use Google Maps than a competing map provider if Google Maps already is installed and visible.

Because the OEM barters for GMS Android, rather than paying a monetary price, the markup is more difficult to see. The OEM gets an operating system, a bundle of apps, and possibly a share of search revenue, and these all help to lower the cost of the handset to the consumer. However, the OEM is not able to monetize these default positions itself, which it could do if there were multiple search engines, if it were free to choose, and if it could bargain with each one. Instead,

---

[35] *See* DAVID BASSALI ET AL., YALE UNIVERSITY, THURMAN ARNOLD PROJECT, PAPER SER. NO. 5*,* GOOGLE'S ANTICOMPETITIVE PRACTICES IN MOBILE: CREATING MONOPOLIES TO SUSTAIN A MONOPOLY 7, [hereinafter *TAP Student Paper*], https://som.yale.edu/sites/default/files/DTH-GoogleMobile.pdf. *See also* European Commission Press Release MEMO/16/1484, Antitrust: Commission Sends Statement of Objections to Google on Android Operating System and Applications (Apr. 20, 2016) ("Android is an open-source system, meaning that it can be freely used and developed by anyone to create a modified mobile operating system (a so-called 'Android fork').") [hereinafter *Press Release*].

[36] The purported justification for this restriction is to ensure that apps are compatible with the operating system. *TAP Student Paper*, *supra* note 34, at 8; *Press Release, supra* note 34 ("To date, Google has not been able to show [objective justification] in relation to the restrictions in the "Anti-Fragmentation Agreements".).

[37] *TAP Student Paper, supra* note 34, at 8; *Press Release, supra* note 34 ("The Commission has found evidence that Google's conduct prevented manufacturers from selling smart mobile devices based on a competing Android fork which had the potential of becoming a credible alternative to the Google Android operating system.").

[38] *See* TAP Student Paper, *supra* note 34, at 10. *See also* Complaint at ¶ 119, State of Colorado et al. v. Google LLC, No. 1:2020cv03715 (D.D.C. filed Dec. 17, 2020).

[39] *See TAP Student Paper, supra* note 34, at 9-12. *See also* Ben Edelman*, Secret Ties in Google's 'Open' Android*, Feb. 12, 2014, https://www.benedelman.org/news-021314/#mada.

Google takes in trade most of the search revenue. Its outsized bargaining power with OEMs and wireless providers is evidenced by the fact that Google appears initially to have offered some of these firms a generous revenue share – 40% to Sprint, for example. Google then sought to "renegotiate" many of these arrangements through a strategy termed "Change the Rules/Get a Better Deal." Of course, the new "deals" were better for Google, but not for its partners. Google reduced Sprint's revenue share to 32% just one year later (in 2011), for example.[40] This exercise of monopoly power has been difficult to measure because bundling masks the true value of the various elements of the bundle.

Comparison with Apple, a handset maker that has its own OS, can help quantify Google's rent-seeking. Other OEMs' lack of bargaining power can be compared to the strong bargaining power of Apple, because Apple does not need the Android operating system; nor does it need many of the GMS Apps given its own high-quality equivalents. In exchange for an exclusive default position in search in Apple's iOS, Google pays Apple a revenue share that amounted to an estimated $8 to $12 billion in 2020.[41] Google Search ad revenue on *all* Apple devices is reported to be $25B.[42] That figure includes both mobile and desktop search ad revenue. Given that roughly 60 percent of online searches are conducted on mobile devices, we estimate that Google's ad revenue attributable to mobile searches could be as much as $15 billion (60% of $25 billion).[43] This would mean that Google is paying between 53 and 80 percent of its search ad revenue generated on Apple mobile devices to Apple. The large payment to Apple demonstrates two points. First, the monetary value of default positions in search access points on OEM's handsets is high, and in a competitive market, that revenue increase (or subsidy) to OEMs would be passed on to consumers through lower handset prices.[44] Secondly, the value to Google of ensuring that no other search engine enters to serve that traffic is large. These facts imply that a competing search engine could generate substantial revenue on iOS (whether Bing or a new Apple search engine, or another entrant) and therefore competition is possible.

---

[40] *See* Leah Nylan, *The government's lawyers saw a Google monopoly coming. Their bosses refused to sue.*, Politico (March 16, 2021), https://www.politico.com/news/2021/03/16/google-files-mobile-search-market-475576. It is safe to assume that Google has lowered the revenue share percentages even further in the following years.

[41] *See* Daisuke Wakabayashi & Jack Nicas, *Apple, Google, and a Deal that Controls the Internet,* N.Y. TIMES, Oct 25. 2020, https://www.nytimes.com/2020/10/25/technology/apple-google-search-antitrust.html.

[42] *See* John Koitsier, *Apple Could Cost Google $15B by Buying DuckDuckGo, Analyst Says*, FORBES, June 8, 2020, https://www.forbes.com/sites/johnkoetsier/2020/06/08/apple-could-cost-google-15-billion-by-buying-duckduckgo-analyst-says/?sh=6e736c5d1920.

[43] *See* Jonathan Griffin, *What Percentage of Searches Are Conducted on Mobile Devices?*, THE SEARCH REVIEW, Feb 19, 2020, https://www.thesearchreview.com/60-percent-online-searches-mobile-devices-07212/. One of the reasons this estimate is rough is that end users tend to perform certain types of searches on mobile devices – nearest donuts, for example – and other types of searches on desktops – retirement planning, for example. And different types of search ads generate different amounts of revenue. As a result, mobile search ads may generate more, or less, revenue on average than desktop searches.

[44] Google's payments to Apple may or not be passed through to consumers in the form of lower handset prices, in part because Apple faces no competition in the sale of handsets that run on its proprietary iOS.

As explained in the European Commission's Android case[45] and elsewhere,[46] Google has exercised this power, derived from its control of Android and the suite of GMS Apps, to maintain the monopoly of its search engine. Because EU enforcement actions found the MADA restrictions to be illegal, in recent years Google has designed additional methods to achieve the same results (with some geographic carve-outs). Google has migrated some of these contractual restrictions into other forms of bilateral agreements with manufacturers and mobile carriers. It also has migrated many of its proprietary application programming interfaces (APIs) out of the Android OS and into Google's own apps. App developers rely on these core APIs to ensure their apps function on users' handsets. Manufacturers therefore *must* install certain Google apps in order to ensure the device will function with third-party apps, but in order to install the apps, the manufacturer must agree to various contractual restrictions. The result is a leveraging of the official Android OS and the suite of GMS Apps to protect Google's default search exclusives and thus, Google's search monopoly.

As with the prohibition on purchasing exclusive default positions, the regulator will need full access to Google's contracts with OEMs in order to monitor and enforce this prohibition. Google's own behavior in the wake of the EU enforcement action demonstrates the multiplicity of ways Google could attempt to avoid a simple restriction on requiring the installation of Google apps as a matter of contract.

3. *Prohibit Google from licensing its suite of GMS Apps only to manufacturers who agree not to "fork" Android into a competing operating system ("Anti-Fragmentation Agreements")*

To circumvent Google's MADA restrictions, an entering search engine could theoretically build an entirely new OS and related ecosystem, including its own app store. It could then approach an OEM, convincing the OEM to manufacture devices that would run its OS and incorporate its new search engine at all access points, which would guarantee scale to the new search engine.

But to be competitive, the new search engine and OEM also would have to convince app makers to design versions of their apps compatible with the new OS and app store. That simply is not practical if the OS is very different from Android. Whereas creating a new OS from scratch would engender this hurdle, an OS created from a forked version of Android likely would not. The forked OS would be very similar to Android and would thus result in a low cost for app developers to port their apps to the new OS. Forking of open-source Android is the most realistic way to launch a new OS and a new search engine together that *might* allow the new search entrant to evade Google's search exclusives.

---

[45] *See* European Commission Press Release IP/18/4881, Antitrust: Commission Fines Google €4.34B For Illegal Practices Regarding Android Mobile Devices to Strengthen Dominance of Google's Search Engine (July 18, 2018) ("Since 2011, Google has imposed illegal restrictions on Android device manufacturers and mobile network operators to cement its dominant position in general internet search.").

[46] *See* FIONA SCOTT MORTON & DAVID C. DINIELLI, OMIDYAR NETWORK, ROADMAP FOR A DIGITAL ADVERTISING MONOPOLIZATION CASE AGAINST GOOGLE (2020), https://omidyar.com/wp-content/uploads/2020/09/Roadmap-for-a-Case-Against-Google.pdf. *See also* Complaint, United States v. Google LLC, No. 1:20-cv-03010 (D.D.C. filed Oct. 20, 2020).

But Google has taken careful steps to block this path to market as well. As described above, Google historically has entered contractual arrangements with manufacturers that build mobile devices utilizing the official Android called "anti-fragmentation" or "anti-forking" agreements (AFAs). Making or marketing a handset that uses such a "forked" version of Android would bring swift consequences, as defined by the AFAs: all the handsets made or marketed by that manufacturer lose access to the vital Play Store – and therefore lose most of their market value. This is the equivalent of excommunication from the Android ecosystem for the OEM. By using its market power over the official Android in this way, Google prevents OEMs from entering with an operating system that would compete with the official Android. Indeed, an OEM entering through the forking method would have to be one that has no current Android business to lose. For this reason, the AFA contracts block entry into mobile operating systems by the most qualified entrants, the ones who already make handsets.[47]

In general, anti-forking restrictions within an open-source project need not be harmful to consumers. For example, as the Android OS develops and deploys updates, it could be important for the consumer experience of that those updates are effective on all authorized versions of the device. Small variations could degrade functionality and limit interoperability with apps that had been designed to work with the official OS. But rules to maintain the quality of one OS need not prevent entry of a differentiated rival OS.

The AFAs, as described above, force OEMs to use the official Android. With that accomplished, the MADAs then condition the official Android license on the installation of a suite of Google apps as well as Google Search as the exclusive default at all access points.

Recent reconfigurations of interlocking contractual restrictions

Google began reconfiguring the interlocking contractual restrictions in 2017 during the pendency of the European investigation into its Android-related restrictions.[48] The lawsuit filed by the U.S. DOJ in Fall 2020 describes these changes—in particular the changes Google has made since the European Union issued its decision in Summer 2018—as well as the current state of these interlocking restrictions. These allegations make clear that Google's nesting agreements, along with other conduct described below that reinforces these agreements, continue to operate to protect Google's search monopoly. These allegations also make clear how difficult it will be to police a prohibition on Google's anti-forking agreements, given that Google can find, and has found, myriad ways to achieve the same or similar results through other contractual machinations. They also underscore the need for the regulator to have real-time access to Google's contracts with OEMs.

Among the recent changes made by Google to this contractual regime are the following: first, Google has moved the prohibition against forking into agreements called Android Compatibility Commitments (ACC). The ACCs permit OEMs to build and sell handsets and components to third parties that fork but appear to be more anticompetitive in other regards. The ACCs extend

[47] For similar reasons, app developers design their apps only for the standard version of Android, lest they too be barred from operating on the standard Android OS. The anti-forking restrictions therefore inhibit competition in the app market as well.
[48] *See* Complaint at 23-26, United States v. Google LLC, No. 1:20-cv-03010 (D.D.C. filed Oct. 20, 2020).

Google's technical compatibility requirements for Android to tablets and emerging technologies such as smart TVs, watches, and automotive devices. This can be seen as a move by Google to capture default positions on emerging search access points in "Internet of Things" devices. Significantly, the ACCs contain geographic carveouts that we understand to permit forking in the European Union, but not elsewhere.[49]

Another recent change is the location of the express requirement that manufacturers set Google as the default general search engine for all key search access points. These requirements had previously appeared in the MADAs, discussed above, but Google has been migrating them into a new sort of agreement: search revenue sharing agreements (RSAs). Through these agreements, Google remits a portion of its search revenue to OEMs and carriers that make Google Search the preset default at all access points.

The revenue sharing agreements would *seem* to give OEMs a choice: receive a share of the search revenue in exchange for making Google the exclusive default, or elect *not* to receive a share of the search revenue and avoid being forced to make Google the exclusive default. But that choice is illusory. OEMs that install any Google app must enter a MADA, and the MADAs, as noted, require installation of an entire suite of GMS Apps and features, including those that are the search access points most frequently used by consumers: Chrome, Google Search app, Google Search widget, and Google Assistant. The result is that, even if the OEM doesn't enter a revenue share agreement, it still must preload all the important Google search access points (albeit perhaps not on an exclusive basis). Thus, these new agreements leverage market power as effectively as the originals. Prohibiting these restrictions would require the regulator to monitor this changing web of contracts nearly in real time. For this reason, we include divestiture as proposal (4) below in place of the behavioral restrictions in (2) and (3).

4. *As an alternative to (2) and (3), require Google to divest the Android ecosystem into an independent entity, and require the elements of the ecosystem to be licensed on an unbundled basis at a uniform per device price that is FRAND*

In theory, the prohibition of anticompetitive contracts facilitates entry as well as expansion by small incumbents. But in practice, Google has demonstrated that ownership of Android gives it the ability to evade these contractual prohibitions to protect its dominance. Therefore, the imposition of the behavioral proposals (2) and (3) above may not be sufficient, even with vigorous oversight by a regulator, to prevent Google from leveraging Android to block entry in search. A structural solution may be necessary. We propose that the regulator require Google to divest control of its Android operating system, the Play Store, Chrome, and key APIs into an independent regulated organization.

A. Existing evidence of evasion

The story of Qwant, a French general search engine startup that promised to offer search without tracking its users, provides an example of why a simple prohibition on Google's "take one, take all" contractual bundling requirement can be easily evaded.

[49] It is not clear to us that forking in order to create a new OS for a single device or even a set of devices would be financially viable if the OEM can sell those devices only in a limited geographic area.

Google initially complied with the European Commission's prohibition on bundling by continuing to offer Google Android, Google Search, and Chrome "for free" on a nonexclusive basis, while continuing to group the Play Store, Gmail, Maps, and YouTube in a separately licensable bundle.[50] Given the new landscape, Qwant sought opportunities to obtain default positions on handsets. According to public reporting, Qwant was well on its way to securing a deal with Huawei (which manufactures handsets reliant on Android) to be the exclusive default search engine on Huawei handsets sold in certain European territories.[51]

Google's response was simply to begin charging a $40 license fee per handset – only in Europe – for the Play Store, Gmail, Maps, YouTube, etc. app bundle that previously had been without charge. It then offered a discount on the purchase price of the bundle, but the discount came with the requirement that Google Chrome and Search be pre-installed as defaults. Although public reporting on the precise size of the discounts is scant, it appears that they roughly equaled the new $40 license fee. By setting the discount equal to the license fee, Google essentially enabled manufacturers to continue accessing its application suite for free, conditioned on keeping Google as their default search engine. In practice, the economic effect of Google's policy changes was a $40 per device penalty for any OEM that elected to make a rival search engine the default on its handsets. This tactic operated as an obvious and significant disincentive for OEMs to install any search engine other than Google as the default. It foreclosed immediate entry by Qwant, the rival search engine. Google could only take this step to deny scale to Qwant because it controlled Android.

An exasperated spokesperson for Qwant explained the situation this way: "[I]f I want, for example, [the default position on] 10 million smartphones, the [OEM] has to pay $400M to Google. Do you really think they will pay $400M to Google just to install Qwant?"[52]

Google's treatment of Qwant reflects the fact that unbundling as a general matter is almost impossible to police in a time frame that is useful to rivals. Formal or implicit contracts between Google and handset makers for any of the many other services offered by Google could be used recreate the bundle, as Google has demonstrated.

B. Google moves the key APIs out of Android

In addition to rearranging and renaming its contractual restrictions, Google has made technical design choices that buttress the contractual blockade, despite the 2018 EU decision and remedies. Apps – both Google apps and third-party apps – rely on APIs to interact with the Android OS and with other apps on Android devices. APIs are small blocks of code that enable app creators to access the functionalities of the handset and operating system, such as using GPS

---

[50] *See* Natasha Lomas, *Google Tweaks Android Licensing Terms in Europe to Allow Google App Unbundling – For a Fee,* TECHCRUNCH, Oct. 16, 2018, *https*://techcrunch.com/2018/10/16/google-tweaks-android-licensing-terms-in-europe-to-allow-google-app-unbundling-for-a-fee/.

[51] *See* Natasha Lomas, Google Still Claimed To Be Blocking Search Rivals on Android, Despite Europe's Antitrust Action**,** TECHCRUNCH**,** Dec. 18, 2018**,** https://techcrunch.com/2018/12/18/google-still-claimed-to-be-blocking-search-rivals-on-android-despite-europes-antitrust-action/**.**

[52] *Id*.

data or turning the phone camera's light on and off. Many APIs, as a general matter, used to reside within the Android open-source code base, meaning they would be freely available to anyone developing a forked version of Android. But in recent years, Google has chosen to migrate many of those APIs and other functionalities out of open-source Android and into Google's own ecosystem of proprietary apps.[53] Because third-party app developers still rely on these APIs to access core functionalities in the handset and OS, OEMs are forced to install Google's proprietary apps (with their critical search access points) if they want third-party apps to be fully functional on their devices. The functionality of these third-party apps is now mediated through proprietary Google apps rather than through the open-source Android OS. Key APIs which Google has made proprietary include those that facilitate "push notifications," the ability to make in-app purchases, or access to data from Google Maps, and others.[54]

Today, if a government requires a change to the "Android" contracts, that no longer fully covers Google's source of market power. By placing key APIs into the Google apps, Google can again force OEMs to install Google apps along with their built-in search access points and the accompanying contractual restrictions. Because of its control of Android and the related ability to deny interoperability, Google has the power to devise nearly endless ways to recreate the contractual blockade that the EU case aimed to dismantle. Google's market power flows from the fact that it holds a monopoly in the licensable OS – *i.e.*, Android – and can construct an ever-changing web of contractual provisions around it, and make design changes to it, that allow Google to maintain its search monopoly.

C. Open-source governance as a model for an independent non-profit Android

The discussion above illustrates the importance and difficulty of policing Google's use of Android-related contractual restrictions and API design choices to protect its search monopoly by denying scale to rivals.[55] Given these problems, a structural remedy is more likely to succeed in removing these contractual barriers to entry.[56] The regulator should require that the Android Open Source Project (AOSP), the official Android OS, Google Play Store, and key APIs that generate market power (we call this the Android ecosystem) be divested into a free-standing, independent regulated organization. A regulator must ensure that the divested intellectual property includes all the elements of the Android ecosystem that Google controls that are necessary to permit successful functioning of third-party apps. Google cannot be permitted to retain any levers – such as proprietary APIs – that it can use to force installation or adoption of its own apps that incorporate Google Search or trigger anticompetitive contractual restrictions.

---

[53] *See* Ron Amadeo, *Google's Iron Grip on Android: Controlling Open Source by Any Means Necessary,* ARS TECHNICA, July 21, 2018, https://arstechnica.com/gadgets/2018/07/googles-iron-grip-on-android-controlling-open-source-by-any-means-necessary/.

[54] *See* Complaint at 24, United States v. Google LLC, No. 1:20-cv-03010 (D.D.C. filed Oct. 20, 2020).

[55] We note, for example, that the EU decision, in addition to prohibiting the specific contractual restrictions that were found illegal, additionally ordered Google "to refrain from any measure that has the same or an equivalent object or effect as these practices." European Commission Press Release IP/18/4881, Antitrust: Commission Fines Google €4.34B For Illegal Practices Regarding Android Mobile Devices to Strengthen Dominance of Google's Search Engine (July 18, 2018).

[56] Google, if it were to retain ownership and control of Android, could engage in other methods to harm rivals as well. For example, it could design features that interoperate better with its own family of apps (Gmail, Maps, etc.) than with competing apps. *See* Cory Doctorow, *Tech Trustbusting's Moment Has Arrived,* PLURALISTIC.NET, Feb. 20, 2021, https://pluralistic.net/2021/02/20/escape-velocity/#trustbusting-time.

It is clear that Google no longer should control the AOSP or the related levers it has used to maintain its search monopoly, but the obvious follow-up question is where the valuable Android ecosystem should reside. Because of the enormous market power that such an organization would hold, it must be regulated to prevent the exercise of that market power and support entry in search. It would be insufficient, indeed, perhaps counterproductive, to divest the Android ecosystem to a rival corporation that has the very same incentives to exercise and leverage market power. The challenge is conceiving of an independent entity or consortium that (1) could hold these properties and license them in ways that encourage new entry; (2) would continue to be incentivized to innovate and improve the properties; and (3) be regulable or otherwise subject to government oversight.

We have considered a number of models. One attractive solution is to transfer the Android ecosystem to a neutral non-profit entity that maintains the Android ecosystem as an open-source project, the mission of which is the promotion of consumer welfare through innovation and low costs. This entity would require strict structural barriers to ensure that it is not captured by any particular firm or constituency, including some form of ultimate oversight by regulators. Free riding is a potential problem with such a solution, in that firms may be hesitant to contribute to the open-source ecosystem because they know that the value of their contributions can benefit rivals.

But there is evidence that such an entity can be successful in these regards, despite the potential for free riding. The Linux Foundation is the largest and best-known example of a neutral non-profit dedicated to open-source governance. Founded in 2000, the Linux Foundation's original mission was to standardize development of Linux, an open-source operating system that is now the world's most widely used open-source software.[57] Over the last 20 years, the Linux Foundation has expanded from supporting a single project, the Linux kernel, to supporting over 450 of the most important open-source projects.[58] The vision of the Foundation is to "unlock[] the power of open technology to drive shared innovation for the collective benefit."[59] If a divested Android ecosystem were held in an organization with a mission similar to this vision, consumers and developers could benefit. Many firms and other entities contribute to the development of Linux, both by supporting the Linux Foundation financially and also by assigning manpower to write code for the open-source project. We do not see any reason why, for the same reasons, device manufacturers and software developers would not find it worthwhile to participate in the development of Android.

Because it operates using open-source governance and has non-profit status, the Linux Foundation provides a model of a structural remedy that could reliably end the market power Google has exercised through its control of Android. We note that there could be other host organizations and organizational forms that would make an equivalently good remedy, as long as

[57] The Linux Foundation defines itself as "a neutral, trusted hub for developers to code, manage, and scale open technology projects." The Foundation aims "to democratize code and scale adoption." Linux Foundation leadership includes "experts in technology management, business, legal, marketing, and ecosystem development – all focused on open technology." LINUX FOUND. "ABOUT" (2021), https://www.linuxfoundation.org/en/about/.
[58] *See* LINUX FOUND., ANNUAL REPORT 2020 at 1 (2020), https://www.linuxfoundation.org/wp-content/uploads/2020-Linux-Foundation-Annual-Report_120520.pdf.
[59] *See* LINUX FOUND., *supra* note 56.

the three conditions above are met. Oversight of the AOSP and all the relevant assets could be transferred from Google to a new neutral non-profit designated for this purpose (*i.e.*, an "Android Foundation"). This independent nonprofit would have a governance structure similar to that of the Linux Foundation but with the addition of a role for the regulator to provide ultimate oversight.

As noted, the Google Play Store and any core APIs Google currently deploys through its proprietary applications must also be divested from and turned over to this neutral non-profit. The regulator and the Android Foundation will determine which of Android's APIs are "core APIs" that belong in the open-source Android ecosystem rather than in one of Google's proprietary apps. Whether Chrome is sufficiently integrated with Android that it must be divested also is an open question. The code underlying the operating system, the Google Play Store and any core APIs would be made open source along with the AOSP, and control over them given to the Android Foundation, ensuring continuity of functionality in consumer handsets.

An app store offering a robust assortment of useful and popular apps is a necessity for a modern mobile OS. The Google Play Store would become the "Android Play Store," an open-source app store governed by the Android Foundation. The official Android OS and the Android Play Store would be licensed separately. This Android ecosystem should be made available under a linear tariff at a FRAND rate established by the foundation and approved by regulators. The FRAND rate would be set to reflect the value of the technology and allow investment in innovation and R&D, including hiring or incentivizing developers to maintain and improve the ecosystem.

An OEM could install the official Android OS and the Android Play Store but would not be required to do so. Nor would the license for the OS depend on whether the store was pre-installed. The fee to sell an app through the Android Play Store would be, again, a FRAND rate. In this setting, an OEM could bargain for a revenue share of whatever search engine it chooses to pre-install. Google would no longer be able to withhold the operating system or the Google Play Store or API interoperability in order to extract search revenues. Google would only be able to threaten to withhold the service it is selling, namely, search. OEMs would consider whether the incremental quality of Google Search was worth the revenue share it demanded. Of course, a higher subsidy earned by the OEM lowers its marginal cost of providing the incremental consumer with a handset. We expect handset prices to fall when costs fall, benefiting consumers.

The Android Foundation would certify authorized Android handsets. The foundation could also be made responsible for ensuring compatibility of apps listed within the open-source app store. It would certify that any app in the authorized store worked on the official Android OS to ensure quality and reliability for users. Google should be prohibited from forking the newly open-source projects for a fixed term, perhaps five years (although it would be free to, and encouraged to, continue to innovate through the open-source version, the AOSP). This limitation will prevent Google from quickly replicating its current strategy using a new variant of Android and will prohibit confusion around what constitutes authorized Android. Google would be free to develop another operating system, not based on Android, at any time, as this would represent welcome additional competition in the mobile OS market. Any other private company that was dissatisfied with the innovation path of the open-source Android ecosystem would be free to develop a

forked Android ecosystem of its own. In this way the ability to innovate would be protected, while the innovator would always face competition from the "original" Android. Throughout, the regulator would maintain oversight to ensure the open-source Android Foundation acted in the public interest and neutrally with respect to corporate interests.[60]

The cost of this remedy will include the transaction cost of the divestiture as well as the loss of any synergy that arises from developing both the Android OS and applications that run on it within the same corporation. However, clearly many entities external to Google develop successful apps, so this synergy is necessarily limited. Further, there could be an innovation gain due to open-source contributions to Android.

In addition, divesting the Android ecosystem from Google will prevent Google from leveraging that market power into future markets that might be as lucrative as search, *e.g.*, voice search, the internet of things, autonomous vehicles, and so forth. This one divestiture would help the development of those markets occur on a level playing field. Without Android, a critical and enormous source of market power, Google will not be able to extract as much surplus from OEMs and consumers and cannot leverage its power in the operating system into market power in current applications such as search, or future applications such as the internet of things.

****

The next two proposals are focused on lowering the cost of entry into search.

5. Mandate that Google license its web index at FRAND rates

Once entry is no longer blocked, there are further remedies and regulations that can *encourage* entry and lower its cost. A search engine must create or gain access to what is termed "crawl data" and a web index. Search engines rely on algorithms to serve results that are tailored to individual users and their specific queries. In order to do this, the search engines must first "crawl" the web – a largely automated process for scouring and collecting public and proprietary web pages and the information to which they link – and then "index" that vast quantity of data – which simply means organizing it (by keyword or freshness, for example). Search engines additionally must develop an algorithm that interacts with this vast body of data to produce relevant results.[61]

Crawling the web is a substantial and expensive undertaking. Google reports, for example, that its web index references hundreds of billions of pages and constitutes over 100,000,000

[60] The precise form of regulation of the open-source project is beyond the scope of this paper. As a general matter, however, if the regulator were to oversee the creation of a new, "Android Foundation," the regulator could oversee its operations directly. The governance structure of the Linux Foundation does permit government and/or nonprofit participation. We also note that "projects" within the Linux umbrella sometimes have specialized governance involving fewer than all members of the Foundation. Assuming that AOSP and/or its related levers were a specialized project, it could be possible to directly regulate Google's or others' participation in those projects.

[61] *See generally* GOOGLE, HOW SEARCH ORGANIZES INFORMATION (2021), https://www.google.com/search/howsearchworks/crawling-indexing/.

gigabytes of data.[62] However, because the lowest levels of these functions are relatively straightforward and mechanical, whoever performs them will generate functionally nearly identical results.

A new entrant would have to spend substantial time and money to build and store an index even a fraction as large as the one Google has built. Moreover, crawling is costly for the sites being crawled, so many do not give permission for rival search engines to gather information about them. Because any new index is unlikely to be substantially different or better than what Google already has built, there little social welfare to be gained from the investment. From an economic standpoint, therefore, to the extent competing indexes are similar and crawling is costly, there is little reason for duplication. The index, therefore, shares some characteristics with natural monopolies. While competition in indexes would arise if the market were larger or fixed costs smaller, that might be difficult to sustain, depending on future trends. Bing has built its own index based on its own crawling data, but a rival with a much smaller scale likely would find it more cost-effective to license the index from Google or another entity rather than create an entirely new index itself.

Because the index is akin to a natural monopoly, it is a logical candidate for regulation. Eliminating the need for new entrants and small incumbents to incur this significant fixed cost will lower an entry barrier and allow the equilibrium number of search engines to rise. The regulator should therefore mandate that Google license its index at FRAND rates. Crawling and indexing implicate no privacy concerns, making sharing easier. Furthermore, Google presumably queries its index already within the company, thus the APIs needed to use the index already exist and can simply be shared with licensees.[63]

The regulator would – through consultation with Google, interested parties, and reliance on experts – develop technical interoperability standards, such as additional APIs or other mechanisms, that would facilitate interactions with the common licensable index. The regulator should take care that neither Google nor any other party captures this process. These interoperability standards would permit private crawling and indexing results to be added to the stock of results in a way that would be equally productive and useful to all licensees.

We also have considered the possibility that Google could be required to sell its crawling and index data to a for-profit third-party, which then would be regulated and license the data. The incentives such an entity would experience are unclear. On one hand, the entity might have a financial incentive to crawl and store the index efficiently. The entity also might have a profit motive to maximize the utility of the index – through architecture, interoperability features, etc. – for a variety of search engines. The regulator would choose an access price sufficiently high to incentivize the regulated monopoly to invest and innovate. On the other hand, the entity might not have sufficient incentive to improve the index because the licensees would principally benefit from any improvement in the quality of the index – via improved quality in search results – and not the indexing entity. Also, the indexing entity, because it would not itself be engaged in

[62] *See id.*

[63] Another set of data that exhibits no privacy concerns are the results tables available to advertisers, which allow advertisers some insight into the performance of their ads placed through Google. The APIs to these results are already created and made available to advertisers. They could be provided to rivals with a license also.

the operation of a search engine, may not know what index improvements would lead to higher quality search results. Regardless of whether such benefits would outweigh the detriments, the structure comes with costs that convince us to reject this option. Google has presumably invested substantially in the physical infrastructure necessary to store, maintain, and use these data. This equipment and staff would have to be divested, or else duplicated by the regulator, which would be wasteful. The regulator would then need to design and mandate interoperability for the third-party entity that allows all search engines to use the common data with minimal friction.

Regardless of whether the subject data remains with Google or is held by a third party, the regulator would require the parties seeking to use Google's crawl data and index to obtain a license. A license could require satisfying conditions relating to privacy protections, security, interoperability standards, and nondiscrimination requirements. Each license holder could update its commitments and demonstrate proof of compliance annually. Should these conditions not be met, the regulator could revoke the license. The regulator would determine a FRAND licensing fee to be charged for access to the index. The fee could be set to reflect the costs borne by Google for maintaining and offering access to its index to additional users. In particular, the FRAND rate should preserve the economic incentive for Google to crawl and index.

This mandatory index licensing scheme would lower the cost of gaining access to a key input that is necessary in order to deliver high-quality search results. Nonetheless, rival search engines will need to sink fixed costs to develop algorithms that generate useful results given an index. Because investment in an algorithm is substantial, one would not expect the general search market to necessarily have many participants.

A concern that arises in this context is whether selling access to the database at FRAND rates creates a sufficient incentive for search engines to go to the expense of crawling the web at a welfare-maximizing pace. The pages and information available on the web, of course, constantly change and increase. Because of its high market share, Google currently has an incentive to continue to crawl and index in order maintain its quality advantage over other incumbents and potential entrants. Under the new regime of mandatory licensing, however, the returns to crawling are partially shared with competitors, lowering the net return to Google. It therefore is important that the licensing regime maintain enough incentive for Google and other firms to continue to crawl and index in order to add to and improve this public good. Setting the regulated access rate to reflect these costs could be one way to create an incentive for Google to invest.

6. Mandate that Google license its click and query data at FRAND rates

An additional barrier to entry in search is knowledge of what users are looking for and what users consider to be a useful answer to their search query. "Click and query" data provide this information, which enables quality improvement in an entrant or rival's search algorithm. This data is especially important in improving what are called "tail queries," a term that refers to rare or infrequent queries. Many people presumably search for "hotels in Honolulu," for example, so it will not take long for the algorithm of even a small search engine to "learn" the best results to serve in response to that query. Far fewer people, presumably, search for information about "how many species of salamanders exist." Because Google Search processes billions of queries, its search algorithm is far more likely to have seen this or similar searches before and likely has

learned what results would be most relevant. A small search engine likely would not have this experience, and might serve results that, to the user, would look and feel qualitatively worse than the results she got on Google Search. The perception – indeed the reality – that smaller search engines are likely to provide lower quality results than Google with respect to "tail queries" can hobble a small search engine's ability to gain scale.

We therefore propose that Google be required to license its click and query data to rivals at FRAND rates. This has been proposed by the EC in the DMA (6.1)(j), and the UK's CMA has recommended that the digital regulator be given the power to require Google to provide click and query data to third-party search engines to allow them to improve their algorithms.[64] Click and query data reflect more stages of the search process in that the data reflect not only the index, but the algorithm used to create results, the people who used the search engine, and their responses to the results it offered. The interface to choose, collect, and deliver click and query data does not already exist and would have to be designed with oversight from the regulator. In that design would have to be a solution to preserve user privacy, because individual searches form the dataset. The FRAND rate would be chosen so that the data are accessible to rivals while the sale is not harmful to Google. This remedy is similar in purpose to the remedies that allow rivals/new entrants to gain scale, and therefore, quality.[65]

In addition to the click and query data, there are other sources of data that can contribute to the quality of search results, such as local map data, location of Wi-Fi beacons, public transit locations and other similar data. Just as with web crawling and index information, it can be costly and time consuming to compile this sort of public information and integrate it with the web index such that it is available to inform results. The regulator should consider requiring Google to make available these other categories of data it has collected, either on a regular cadence (*e.g.*, annually for ten years) or at a single point in time (for extant rivals) or upon request (for new entrants). Other search engines then would be able to update those datasets on their own, according to their own assessments of how to add value for their users. The regulator would again determine a FRAND cost to the licensees and take into account the need to create incentives to invest.

****

The next three proposals focus on protecting nascent entry into search, protecting the ability of specialized search to lower its costs by disintermediating general search, improving quality for users, and encouraging the sharing of surplus.

---

[64] *See* Cristina Caffarra & Fiona Scott Morton, *How Will the Digital Markets Act Regulate Big Tech?*, PROMARKET, January 11, 2021, https://promarket.org/2021/01/11/digital-markets-act-obligations-big-tech-uk-dmu/; *Proposal for a Regulation of the European Parliament and of the Council on Contestable and Fair Markets in the Digital Sector (Digital Markets Act)*, COM (2020) 842 final (Dec. 15, 2020); COMPETITION & MARKETS AUTHORITY, ONLINE PLATFORMS AND DIGITAL ADVERTISING: MARKET STUDY FINAL REPORT 25 (2020), https://assets.publishing.service.gov.uk/media/5fa557668fa8f5788db46efc/Final_report_Digital_ALT_TEXT.pdf.

[65] It is possible that this remedy would expose aspects of Google's algorithm to its competitors, in that those competitors would gain insight into what Google shows in response to particular queries. The regulator should consider this risk in determining how the click and query data should be shared.

7. *Restrict practices that disadvantage small and nascent competitors by requiring that at least 50 percent of space on initial results screens be devoted to non-monetized results*

As explained above, general search constitutes a product market that is distinct from specialized search (Expedia, Angie's List, etc.). Many of these specialized search engines are potential competitors of general search engines like Google, but they are also current customers of Google. This is because many users navigate to specialized search engines by using a general search engine. Eventually, however, as the specialized search engine's brand recognition grows, a service that starts out by obtaining customers through general search could come to be an independent, competing access point to the internet. In addition, specialized search engines do compete with Google with respect to the most profitable types of searches such as travel, home services, local, and shopping, and therefore are collectively important rivals to Google. Furthermore, Google's practices have raised costs for these rivals by requiring them to purchase access to consumers through general search ads. The regulation in this section will allow specialized search to build and protect their positions as 'first point of call' specialist search, thus allowing them to disintermediate the general search step, and in doing so save users (and eventually consumers) the associated ad spend.

The "essential good" produced by Google which it can foreclose to potential rivals are prominent positions on its search engine results page (SERP).[66] Google has increasingly foreclosed its SERP to specialized search rivals by evolving the design of its SERP over time to display mostly monetized content instead of mostly organic results.

Organic results are the links from Google's crawled and indexed web data most relevant to a user's query, as determined by Google's page rank algorithm. Fifteen years ago, Google's organic results appeared at the top of its SERP. Over time, however, Google's landing SERP has shifted from mostly organic results to mostly or entirely monetized content, at least with respect to high-value searches such as those related to travel or local services. That monetized content could be ads, content from Google-owned properties, or a Google-operated specialized search (*e.g.,* Google Flights) displaying information from service providers who pay to be included in the specialized search. If the nascent specialized search competitor wants to be seen, it must buy an advertisement for itself to appear at the top of the SERP, even if its website appears at the top of the organic results. This foreclosure occurs either through raising rivals' costs (the price of an ad) or reducing their quantity (placement far down the page), both of which disadvantage specialized search engines and benefit Google.

This foreclosure has been increasing over time. It is well-documented by journalists and search engine optimization (SEO) experts that Google's SERP has evolved to prioritize Google-created content and modules, particularly modules that create new revenue streams for Google or keep users within the Google ecosystem.[67] The examples of Google landing SERPs from 2000 and

[66] *See* Joshua D. Wright & Alexander Krzepicki, *Rethinking Foreclosure Analysis in Antitrust: From* Standard Stations *to* Google, CONCURRENTIALISTE J. ANTITRUST L., Dec. 17, 2020, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3769346.

[67] *See* Adrian Jeffries & Leon Yin, *Google's Top Search Result? Surprise – It's Google*, *THE MARKUP,* July 28, 2020, https://themarkup.org/google-the-giant/2020/07/28/google-search-results-prioritize-google-products-over-competitors

2020 below demonstrate this change over time. In 2000, Google's SERP featured a relatively simple collection of organic results (Figure 1). The current trend toward Google modules began when Google introduced "Universal Search" in 2006.[68] Since then, Google has continued to add additional modules to its SERP, until, as shown in the 2020 SERP, organic results do not appear at all on the top of the SERP.[69]

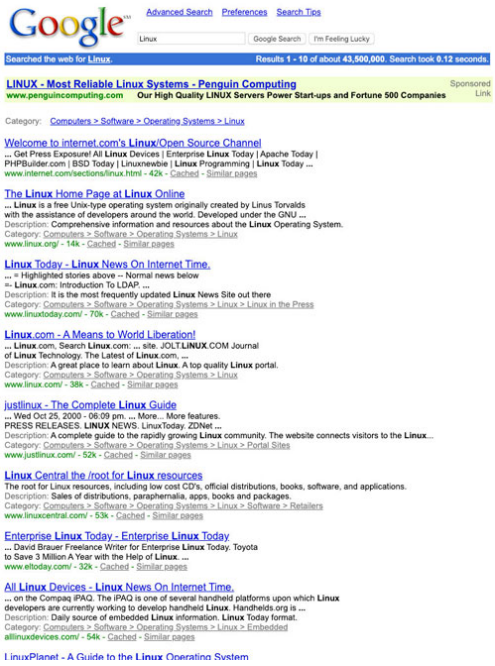

Figure 1: 2000 SERP

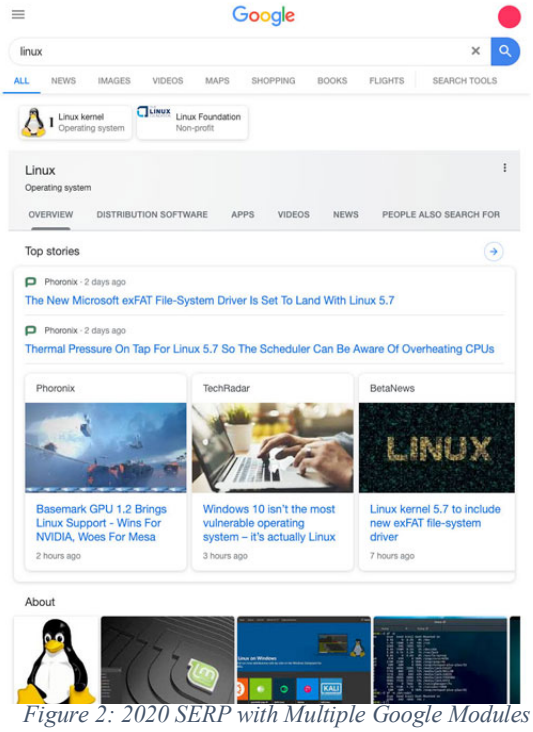

Figure 2: 2020 SERP with Multiple Google Modules

Since introducing the Knowledge Graph in 2006, many of the modules Google has added have opened new revenue streams for the company or made it more likely that search users would remain within the Google ecosystem. In June 2019, a study showed that 50% of Google searches now end on the SERP, without the user clicking through to any non-Google results.[70] Google's modules have taken up an increasing amount of real estate on the SERP over time. In 2020, the top organic result now appears, on average, nearly twice as far down the SERP as the top result

---

[68] *See* Brian, *The Difference Between Local, Organic, and Universal Search,* INTEGRATE DIGITAL MARKETING, April 27, 2015, https://www.integratedigitalmarketing.com/the-difference-between-local-organic-and-universal-search/.

[69] For examples of how Google's SERP evolved between 2000 and 2020 to include Universal Search in 2006 and Knowledge Graphs after 2012, see *Appendix 3: Further Detail on Evolution of Google's SERP*. These examples demonstrate how Google has lowered the prominence of organic results on its SERP and foreclosed increasing amounts of space to its specialized search rivals over time.

[70] *See* George Nguyen, *Now, More Than 50% of Google Searches End Without a Click to Other Content, Study Finds,* SEARCH ENGINE LAND, Aug. 14, 2019, https://searchengineland.com/now-more-50-of-google-searches-end-without-a-click-to-other-content-study-finds-320574#:~:text=The%20update%20includes%20data%20from,clicking%20through%20to%20any%20results.

in 2013.[71] Depending on the query, as much as 100 percent of the initial SERP may be occupied by ads or Google's own modules, with users needing to scroll down the page to view even the top organic result. Indeed, data journalists have shown that Google dedicates, on average, 41 percent of the first page of the SERP to its own products or modules when measured on laptop screens, and 63 percent on mobile phone screens.[72]

Some of Google's modules include Google's own specialized search tools. One such example is Google Flights, a module which appears at the top of users' SERP when they search for flight information, above the organic results for other specialized travel search providers like Orbitz and ITA Matrix. However, research has shown that Google Flights sometimes produces inferior results to those of Google's specialized travel search rivals, offering consumers fewer and more expensive options.[73]

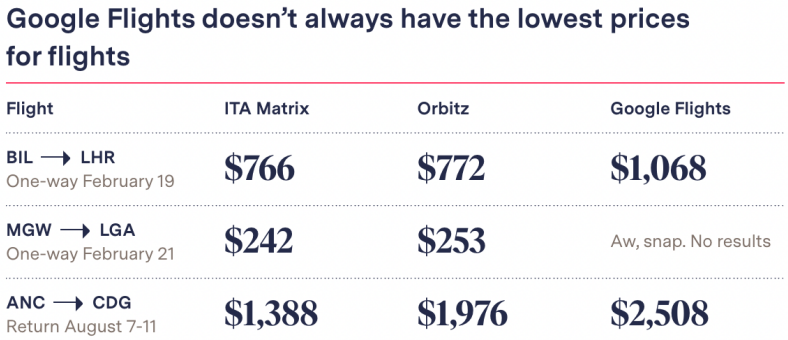

Figure 4: Comparison of Google Flight and Vertical Travel Search Providers

Although Google often asserts its ads – and other monetized or proprietary content – are higher quality than organic results, there is no way for consumers to evaluate this claim because they do not see the two side-by-side. If both organic results and monetized content were displayed in parallel and users chose the latter, this would indicate they valued it. To ensure that monetized content is not exploitative or irrelevant, users should be able to see head-to-head comparisons with organic results and choose those if they are more useful. However, given Google's foreclosure of the SERP and prioritization of its own modules and specialized search tools, this head-to-head comparison is currently impossible.

---

[71] Peter J. Meyers, *How Low Can #1 Go? (2020 Edition),* MOZ.COM, Feb. 26, 2020, https://moz.com/blog/how-low-can-number-one-go-2020.

[72] *See* Adrian Jeffries & Leon Yin, *supra* note 66. Figure 3 in *Appendix 3* shows the percentage of real estate on Google's SERP taken up by Google modules, averaged across a collection of over 15,000 of the most common searches from November 2019 to January 2020. Adrian Jeffries & Leon Yin, *How We Analyzed Google's Search Results*, THE MARKUP, July 28, 2020, https://themarkup.org/google-the-giant/2020/07/28/how-we-analyzed-google-search-results-web-assay-parsing-tool (hereinafter "Markup Methodology").

[73] A 2012 FTC filing obtained by the Wall Street Journal noted, "Although [Google Flights] displays its flight search above any natural search results for flight-booking sites, Google does not provide the most flight options for travelers." WALL ST. J., THE FTC REPORT ON GOOGLE'S BUSINESS PRACTICES (March 24, 2015), https://graphics.wsj.com/google-ftc-report/. Comparison data was gathered by *The Markup.* Adrian Jeffries & Leon Yin, *Google's Top Search Result? Surprise – It's Google*, *THE MARKUP,* July 28, 2020, https://themarkup.org/google-the-giant/2020/07/28/google-search-results-prioritize-google-products-over-competitors

It is difficult to solve the problem of Google's foreclosure of the SERP and its scraping and appropriation of small pieces of content from other online providers for use within its own modules. There are risks to having a regulator weigh in on product design and the value of advertising formats. But given Google's dominant market share, it seems likely that any nascent specialized or general search rivals will need to appear on Google's SERP to allow them to gain brand recognition and popularity among users. Organic results are determined, at least in theory, on the basis of quality and therefore provide an entry path for high-quality nascent competitors without requiring them to pay significant portions of their revenue to appear in ads on Google's SERP. Thus, regulating foreclosure – full or partial – of Google's SERP to specialized and general search rivals is critical to ensuring entry into the search market.

The regulator should prohibit practices that lower quality and exclude rivals by requiring that at least 50 percent of space (measured in pixels) on the left-hand side of the initial results screen (for English speakers, at least) be devoted to non-monetized organic results.[74] Non-monetized organic results are defined as the results delivered by application of the page rank salience-based algorithm to Google's index and crawl data, without any adjustment based on payment by content providers for prominence or placement. The non-monetized results category also would exclude Google's own products or modules.

This regulation will require oversight and enforcement efforts, because search engines have an incentive to evade it and redesign their pages frequently.[75] The digital regulator will need to develop testing criteria to ensure that, even if a search engine complies with the 50 percent pixel limit, it does not deploy other design tactics to render organic results less salient than monetized content.[76] For any search engine licensed to use Google's crawl data, as well as Google, the digital regulator may develop standard testing to ensure compliance with the 50 percent requirement.[77] The digital regulator may disallow design changes that substantially disadvantage organic results or nascent competitors.

8. *Prohibit Google from engaging in any form of self-preferencing in the ranking or display of those non-monetized results*

---

[74] The 50 percent non-monetized organic results requirement is simply a suggestion of one possible simple interface design regulation that would assist in establishing competition. The actual standard should be set by regulators in conjunction with user interface design experts, who can take into account design and attention metrics that may be more meaningful than simple sides of the page and space percentages.

[75] Google, for example, introduced a new product called the AMP framework (Accelerated Mobile Pages) in 2015. Publishers have an incentive to adopt the AMP framework because Google's search algorithm prioritizes those pages. But AMP pages reside on Google servers, not servers maintained by publishers, which gives Google unique insight into who is viewing them and when. Google can use those insights to its advantage, and to the disadvantage of rivals. For a discussion of AMP in the context of Google's market dominance, see Markup Methodology, *supra* note 71.

[76] Design tactics that can be used to shift user attention to monetized content include use of color and images and manipulation of shading, highlighting, font size, etc. These design tactics, when used to manipulate user behavior, are known as "dark patterns." For a discussion of dark patterns in the context of antitrust, see Gregory Day & Abbey Stemler, *Are Dark Patterns Anticompetitive?,* 72 ALA. L. REV. (forthcoming 2021).

[77] The regulator could also require that it receive the results of tests carried out in the normal course of business by search operators, since these are likely to cover substantial changes to SERP design.

Even if a search engine complies with the 50 percent pixel limit, however, it could have an incentive to design its algorithm to surface organic results that send users to monetized results or Google's own products over the products of competitors. Google, for example, could design its algorithm to rank its own flight search service at the top of the organic results while demoting other travel sites such as Travelocity to the second or subsequent screens.[78] Such conduct would create the same competitive danger as foreclosing the SERP with monetized conduct; it disadvantages nascent and potential competitors and raises the costs of rivals by disallowing them direct access to consumers. This forestalls their competitive threat, lowers the quality of organic results for Google's users, and raises the costs of specialized search providers.

The regulator, therefore, should prohibit Google from manipulating or biasing its organic results in order to divert users to its monetized content. The regulator could accomplish this by prohibiting self-preferencing or bias in Google search results, as the DMA proposes in Art. 6.1(d).[79] The regulator will need to develop methods to monitor and analyze search results; it is likely possible to construct tests that would determine whether page rankings reflect actual relevance by reference to objective indicia. As new knowledge and technology emerges, the regulator should incorporate those developments into its review. For example, new technology around eye tracking might be helpful in measuring the salience of various results appearing on the SERP.[80]

With respect to small search engines, there would be no SERP or algorithm design restrictions. It is likely beneficial to innovation and competition to allow competing engines to create differentiated rankings and displays. In the absence of market power, poor rankings will simply drive away consumers, so small search engines have an incentive to differentiate in pro-competitive way. Consistent with this idea, the DMA analog to this proposal applies only to "gatekeepers."[81]

Additionally, harmed competitors or third parties should be empowered to identify harmful violations and make complaints to regulators. Because the regulation is designed to protect nascent and potential competitors, the rule should set forth a process for such competitors to file complaints with the regulator.[82] The regulator could enforce these requirements through fines.

---

[78] In the European Commission's Google Shopping case, Google was found to have done exactly this to privilege its shopping tool over those of competitors. 2018 O.J. (C 9) 11.

[79] In Europe, the proposed DMA regulations impose a similar requirement. Article 6.1(d) requires that "gatekeepers":

> "[R]efrain from treating more favourably in ranking services and products offered by the gatekeeper itself or by any third party belonging to the same undertaking compared to similar services or products of third party and apply fair and non-discriminatory conditions to such ranking . . . ."

Proposal for a Regulation of the European Parliament and of the Council on Contestable and Fair Markets in the Digital Sector (Digital Markets Act), COM (2020) 842 final (Dec. 15, 2020).

[80] *Appendix 4* contains a discussion of how eye-tracking studies are used to evaluate human interactions with computer interfaces, including SERPs.

[81] *See Digital Markets Act, supra* note 78.

[82] In order to ensure that adjudications reflect evolving evidence-based methods for determining the effects of user interface design choices, complaints should be resolved through adversarial proceedings before an administrative law judge, operating pursuant to rules that permit the consideration of expert testimony.

These regulations should be applied to any dominant general search engine that utilizes the public crawl data and index, not just Google. A new dominant engine should not be permitted to engage in the same anticompetitive practices as Google or the basic competition problem will remain. These regulations will facilitate competition on the merits with respect to the price and quality of any general search engines.

9. Undertake enhanced merger pre-notification and review

Alphabet, the parent company of Google, has a financial incentive to acquire rivals and potential rivals long before they become large enough that the acquisition would trigger traditional merger review. The regulator should require all search engines with market shares exceeding a particular threshold to submit all contracts effecting an asset acquisition or merger for review in advance, regardless of whether such transactions might otherwise be subject to mandatory notice under the Hart-Scott-Rodino Act. The filing should include evidence that will allow the regulator to evaluate the potential competitive effects of the proposed acquisition, such as market shares of the merging firms, asset values, and revenues. In light of the importance of protecting nascent entry, the regulator may require authority to investigate and to challenge anticompetitive transactions involving digital platforms under a supplementary or different standard than that applied to other transactions (*e.g.*, a public interest standard).

There is precedent for imposing antitrust scrutiny on mergers in particular sectors that is different than, or supplemental to, the scrutiny applied to mergers in other sectors. In the United States, for example, transactions involving firms subject to the Communications Act are reviewed by the Federal Communications Commission to determine whether, as an affirmative matter, the proposed transaction would serve "the public interest, convenience, and necessity." This is a very different, and higher, standard than that utilized by U.S. antitrust authorities, which generally review proposed transactions only to determine if they would "substantially lessen competition."[83]Although the U.S. Department of Transportation (DOT) does not review airline mergers directly, the DOT does review every proposed international route transfer as well as well all code-share agreements under a "public interest" standard.[84] The U.S. Federal Reserve reviews bank mergers with an eye to systemic risk, a factor that is not a consideration in many other merger contexts. The UK's CMA suggests a somewhat different approach to ensuring that mergers involving digital platforms receive sufficient scrutiny, proposing that mergers involving platforms with "Strategic Market Status" be evaluated under the same standards as other transactions, but using a lower, more cautious, standard of proof.[85]

---

[83] *See* Jon Sallet, *FCC Transaction Review: Competition and the Public Interest,* FCC.GOV, Aug. 12, 2014, https://www.fcc.gov/news-events/blog/2014/08/12/fcc-transaction-review-competition-and-public-interest.
[84] *See*, *e.g.*, *The Role of DOT in the Review of the Proposed American Airlines / US Airways Merger: Hearing Before the S. Comm. on Commerce, Science, and Trans.,* 113th Cong. (2013) (statement of Susan L. Kurland, Asst. Sec. for Aviation & International Affairs, U.S. Dept. of Trans.), https://www.transportation.gov/testimony/role-dot-review-proposed-american-airlines-us-airways-merger.
[85] *See* COMPETITION & MARKETS AUTHORITY, A NEW PRO-COMPETITION REGIME FOR DIGITAL MARKETS (2020), https://assets.publishing.service.gov.uk/media/5fce7567e90e07562f98286c/Digital_Taskforce_-_Advice.pdf.

10. Ensure Google does not monopolize voice-activated search or other products comprising the "Internet of Things" by prohibiting exclusive defaults and considering mandated interoperability of such devices with various search engines

Voice-activated search is a relatively new service as compared to those provided by traditional search engines. Moreover, voice search differs from traditional search in ways that may present competitive concerns separate from or additional to the concerns we have examined with respect to general search. As just one example, voice search services often are tethered to and accessed through a particular physical product such as a speaker or even a car, rather than through a handset or laptop. Today voice search features multiple competitors that do not compete in general search, such as Apple and Amazon. For consumers to benefit from competition in voice search and the innovation that will arise in emerging voice search technology, the regulator should prevent Google's current market power in general search from negatively affecting this new market.

Unfortunately, Google may already be deploying the same playbook in voice search as it has used in mobile search. Google has entered agreements with manufacturers of mobile and home devices that incorporate voice-activated search functions which make Google the exclusive default search engine and also prohibit "concurrency" – the ability of a single device to run more than one voice-activation system at the same time.[86] For the same reasons we provided above, the regulator should likely prohibit such exclusionary agreements in order to prevent Google from monopolizing what may be a separate market.

Because voice search is new and emerging, we recommend that the digital regulator study this sector. The regulator should examine the payment models for voice search, as well as contracts between voice search providers and manufacturers of equipment in which voice search is installed to ensure the same competition problems do not repeat themselves. The regulator also should examine how voice search might be used to harm Google's horizontal rivals through tactics such as (non)interoperability, or Google's vertical rivals through tactics such as "brand flattening."[87]

The regulator should consider mandating interoperability between voice search services and physical devices running these services in order to lower entry barriers. If interoperability can be established in this area, then users will be able to choose among voice search providers and separately among device providers, lowering switching costs. Such regulations should be designed to promote competition and prevent tipping and/or monopolization of the emerging

[86] *See generally* Complaint at ¶ 4, State of Colorado et al. v. Google LLC, No. 1:2020cv03715 (D.D.C. filed Dec. 17, 2020), https://coag.gov/app/uploads/2020/12/Colorado-et-al.-v.-Google-PUBLIC-REDACTED-Complaint.pdf at ¶¶ 127-136.

[87] Brand flattening refers to the incentive experienced by a firm selling multiple brands of a particular product to migrate consumer loyalty to itself and away from the brands. For example, a CVS Pharmacy might sell multiple brands of bar soap – Dove, Olay, Dial, Irish Spring. CVS would rather that its customers think of it as *the* place to buy bar soap (of any brand) rather than having an exclusive affinity for a particular brand. From the standpoint of CVS, the ideal consumer thought process is "I need soap; I therefore must go to CVS." Similarly, an e-commerce retailer might be largely indifferent to which brands of various products its customers purchase, so long as they purchase through that retailer. Google may be indifferent as to what medium users conduct their queries on (desktop, mobile, or voice search) as long as they think of Google as *the* service through which to conduct searches.

voice search market. In addition, interoperability would ensure that the firms offering voice search do not use that service to maintain or expand market power they already have in related or adjacent markets.

11. Conduct ongoing oversight in the public interest to maintain healthy competition on a level playing field by protecting data and digital security, preventing harmful discrimination, and combatting fraud and deception

Competition in search will provide myriad benefits. However, that competition will be even more effective and valuable in an environment free of user manipulation, fraud, bias, and other problematic conduct. In the United States, Congress should give the digital regulator a mandate broader than merely issuing procompetitive regulations. U.S. federal regulatory bodies generally are empowered by law to regulate "in the public interest" or in furtherance of other broad goals Congress identifies. The European Union has already issued proposed language for the Digital Services Act that covers some of these additional goals.

We identify three types of problems that a regulator should be able to control to improve the efficient working of the search market. Although these problems are not strictly economic in nature, as we have stated above, a level playing field and observable price and quality tend to intensify competition. The ideas below are general and representative and are not intended to be exhaustive. We expect that the regulator, in executing its oversight in the public interest, will identify and ameliorate problems as they arise. We include these examples here as illustrations.

First, the regulator should require all search engines to meet minimum data security and other security and privacy-related standards. Second, the regulator should monitor search engines to protect against harmful commercial discrimination. Third, the regulator should be empowered to stop fraud and deception.

A. Security and privacy standards

Search engines can provide an important pathway for hackers to gain access to private and proprietary systems and datasets, including those maintained by governments.[88] To protect the personally identifiable information of search engine users and address other security concerns, the regulator may impose minimum standards, monitor compliance, investigate instances of cybersecurity breaches or other misuse, and provide information to end users that they can trust and rely on in selecting their default search engine. Minimum standards of this sort can promote competition by providing consumers assurance that all search engines, including small or new search engines, meet these basic standards. This assurance can give consumers the confidence necessary to try a new search engine rather than remaining with the one that is tried and true. Of course, nothing should stop any search engine from undertaking measures to exceed these

[88] *See generally* Shane Huntley, Threat Analysis Group, *Updates About Government-Backed Hacking and Disinformation,* GOOGLE: UPDATES FROM THREAT ANALYSIS GROUP, May 27, 2020, https://blog.google/threat-analysis-group/updates-about-government-backed-hacking-and-disinformation/.

minimum standards. Indeed, security and privacy could be one of the parameters along which search engines compete.[89]

B. Commercial discrimination

The regulator also should take steps to prevent harmful commercial discrimination. An algorithm may be designed, or may learn, to serve different results to different categories of people in ways that could be harmful, unfair, or even dangerous or unlawful.

Targeted offers and discrimination reduce competition because the consumer's lack of information creates unfair market power for the offeror. The consumer does not see the offers made to others in the way she would with a publicly posted price in the grocery store. Uniform prices intensify competition when the marginal consumers are elastic and create an incentive for the firm to lower prices. When vulnerable consumers are less elastic due to less information, education, broadband access, or any other reason, competition combined with uniform prices can protect them from exploitation because firms must also make offers that are attractive to non-vulnerable consumers. A spillover benefit of competition enforcement is therefore a reduction in exploitation and inequality. In addition, there are standard forms of discrimination that are illegal in the United States. Search engines should not provide information about certain jobs only to men or advertisements for financial products or property listings only to white people, for example.[90] The regulator should be required by law to protect against such discrimination.

C. Fraud and deception

Clearly, fraud and deception impede efficient functioning of competitive markets. A forthcoming paper in our series will focus specifically on consumer protection concerns, and so we note this topic here merely as a placeholder. The regulator should establish and enforce rules clarifying that particular forms of fraud that search engines can commit (misrepresenting how consumer data will be used, for example, or directing users to deceptive advertising of third parties) are prohibited by existing law.

D. Designating dominant firms

Lastly, some of the regulations proposed above are designed to be applied to a dominant search engine. If these regulations were wildly successful, another search engine might enter, grow and

---

[89] Economists and others are currently assessing whether concerns relating to the collection and use of personal information could be addressed by reliance on third-party data trusts or other means to give end users more ability to monetize and control their data. *See* Anouk Ruhaak, *Data Trusts: Why, What, and How,* MEDIUM, Nov. 11, 2019, https://medium.com/@anoukruhaak/data-trusts-why-what-and-how-a8b53b53d34#:~:text=A%20data%20trust%20is%20a,accessed%20and%20used%20by%20others. Regardless of the ultimate structure of data markets, search engines will continue to have access to personal data and should be expected to submit to minimum security standards.

[90] Not every instance of algorithmic discrimination is invidious. For example, serving ads for women's shoes only to women or others who have expressed interest in women's shoes is not on the whole harmful. As is the case with all regulators that enforce nondiscrimination proscriptions, we assume the digital regulator will develop the necessary line-drawing expertise over time.

achieve dominant status in the future. The digital regulator should be enabled to apply these remedies to another search firm if that were needed and dis-apply them to Google.

Enforcement Remarks

What US entity should impose which remedies?

This paper has presented a menu of options which could be imposed by a court or regulator. We also have noted that the selection of appropriate remedies will depend on the timing of enforcement actions and regulation, as well as the state of the market at the time the court or regulator considers imposing them. We have used the term "regulator" throughout this paper as shorthand for "court or regulator."

Courts and regulators, however, have different powers, capacities, and expertise. It therefore is appropriate to consider which remedies would be best imposed and administered by a court rather than a regulator, or vice versa.[91] There are also some remedies that could be initiated by a court and then administered by a regulator.

- Either a court or regulator could prohibit Google from purchasing exclusive default positions at search access points. The remedy is simple and requires little administration.
- Similarly, a court or regulator could prohibit Google from enforcing anticompetitive restrictions through contractual provisions in AFAs, MADAs, and ACCs. The problem, though, is that Google has demonstrated a propensity to evade prohibitions; the ACCs bear this out. A regulator is better suited to perform ongoing oversight to ensure these contractual provisions don't pop up in new forms.
- A court could require Google to divest the Android ecosystem into an independent entity, as a court required AT&T to divest its local Bell operating companies.[92] A regulator would likely require legislative authority to carry out such a change. Divestiture therefore appears to be a court remedy. However, oversight of the entity that then controls Android and its licensing practices would require ongoing oversight best undertaken by a regulator.
- A court also could mandate that Google license its crawl data and index at FRAND rates. It is not clear that a regulator could do so without explicit instruction from Congress. Courts generally are not well-suited to the business of rate setting, however, and so a regulator is likely necessary to manage the mandatory licensing.
- A court in the abstract could order Google to devote 50 percent of the SERP to organic results and enforce its order if the agency found violations of the order. But supervision of this type of design regulation by a court is slower and more costly than employing a regulator that can engage in active monitoring.

[91] Our observations in this regard are economic in nature, not legal. We defer to lawyers on topics of jurisdiction, agency power, and the like.

[92] *See*, *e.g.*, ROBERT W. CRANDALL, BROOKINGS INST., U.S. DEPARTMENT OF JUSTICE, THE AT&T DIVESTITURE: WAS IT NECESSARY? WAS IT A SUCCESS? (2007), https://www.justice.gov/atr/att-divestiture-was-it-necessary-was-it-success.

- For a different reason, we should look to a regulator to prevent monopolization of voice search and the search functions embedded in the "internet of things." The U.S. enforcement actions as currently crafted do not allege that Google has monopolized these markets, but rather that it is "positioning itself" to monopolize those markets. A regulator could intervene in these markets now to prevent monopolization, even if a court could not.
- Only a regulator would conduct oversight in the public interest.

The overlap between the European DMA and the solutions proposed herein

It is likely that there will be regulations covering search engines issued imminently in Europe pursuant to the Digital Markets Act (DMA). Those regulations may have altered the workings of the global general search market and Google's conduct by the time remedies are imposed in the United States. It therefore is reasonable to compare the solutions we propose herein and ask whether they might be mandated under the proposed DMA regulations. Significantly, the obligations and prohibitions in the proposed DMA apply only to "gatekeepers" – a defined term that we assume will include Google but not any other extant general search engines.

Which of our proposed interventions are likely mandated by the proposed DMA regulations?

Although there are reasonable arguments that certain of the obligations and prohibitions contained in Articles 5 and 6 of the DMA mandate the interventions we propose,[93] there are only two prohibitions that plainly overlap. Article 6.1(j) would expressly require Google to make available its "ranking, query, click and view data in relation to free and paid search generated by end users on online search engines" at FRAND rates. This proposed regulation is functionally the same as our Proposal 6, requiring mandatory licensing of Google's click and query data. Similarly, under Article 6.1(d), Google would not be permitted to alter rankings (including the ranking of monetized results) to benefit itself but instead must ensure that its page rankings are unbiased and fair. This corresponds to our Proposal 8.

Article 16 of the DMA provides that divestitures will be employed as a remedy only after "systematic non-compliance" with the requirements of Articles 5 and 6,[94] meaning that the Commission has issued three or more decisions against the gatekeeper with respect to a core

[93] For completeness, and because we do not intend to preclude any interpretation of the proposed regulations that might require the interventions we propose here, we set out our understanding of the ways in which the DMA might apply to our recommendations more fully in *Appendix 5*.

[94] *See* DMA Article 16.1:

> Where the market investigation shows that a gatekeeper has systematically infringed the obligations laid down in Articles 5 and 6 and has further strengthened or extended its gatekeeper position in relation to the characteristics under Article 3(1), the Commission may . . . impose on such gatekeeper any behavioural or structural remedies which are proportionate to the infringement committed and necessary to ensure compliance with this Regulation.

Proposal for a Regulation of the European Parliament and of the Council on Contestable and Fair Markets in the Digital Sector (Digital Markets Act), COM (2020) 842 final (Dec. 15, 2020).

platform service within five years.[95] In light of the fact that Google has evaded the Commission's search and Android remedies for many years, this provision either could, or soon could, be used to effectuate the divestiture of the Android ecosystem into a free-standing, neutral nonprofit as described in Proposal 4 above.

Discussion of other DMA elements

It also is worth discussing how some of the DMA regulations could serve as helpful supplements to our proposals, as all of these supplements could also be considered by the regulator. Article 6.1(i) is one such proposal.[96] Article 6.1(i) appears to require gatekeeper search engines to make real-time click and query data available to business customers. In addition, Article 6.1(g) would require that platforms make their own tools available to advertisers so that the advertisers can, themselves, verify their ad inventory and its performance, and Article 5(g) provides for better transparency of ad pricing. In the context of search, the data might be consumer responses to search queries and ads relevant to advertisers and specialized search providers.

Such real-time access could provide significant benefits to search advertisers. Advertisers could evaluate for themselves how end users are interacting with their ads and adjust their ad spend among search engines accordingly. Likewise, a specialized search provider would be much better able to assess whether Google was foreclosing it from valuable traffic. This real-time data-access mandate would facilitate competition among search engines.

Article 6.1(a) prohibits gatekeepers from using nonpublic information generated through activities of business users in competition with those business users. This would appear to prevent Google, for example, from collecting information about how end users interact with vertical search sites (or advertisements for those sites) and then using it to inform its own competing products or even the design of the SERP. This proposal is consistent with our various proposals designed to prevent Google from disadvantaging nascent competitors, though it might reduce the quality of Google's products.

Article 5(a) prohibits gatekeepers from combining personal information gathered by their core platform service – in this case, Google Search – with personal data from other sources, without active consumer consent. Depending on the extent to which such active consent is provided, this restriction could prevent Google from using data from its other consumer-facing products such as Gmail and Google Maps, or from the Android OS, in targeting search ads. This would likely reduce the fit of any given ad and make it less useful to the user. It would also significantly reduce the competitive advantage of Google and place entrants on a more level playing field, because all search engines may use information about users inherent in the search term itself (*e.g.*, ski holiday in Switzerland) to target ads.

Article 6.1(b) would guarantee that end users could uninstall any pre-installed software or applications – such as Google Search or the Chrome browser.[97] This is an important baseline; competition is generally promoted when end users can replace software according to their

[95] *See* DMA Article 16.3, *supra* note 78.
[96] *See* DMA Article 6.1, *supra* note 78.
[97] *Id.*

preferences. But in cases where users already have that ability, they rarely exercise it. Most users stick with the default, which is why Google's successful efforts to obtain default positions in search access points cement its monopoly. Therefore Article 6.1(b) by itself may not improve entry in search, although it may complicate Google's attempts to transfer key APIs out of Android OS and into its proprietary applications. On the other hand, if apps may be uninstalled, then the gatekeeper presumably will need to make them re-installable through its app store. This could change the negotiating position between Google and OEMs, and also trigger a variety of DMA rules and protections relating to app stores.

Conclusion

Google has held a durable monopoly in the General Search market for many years. Its monopoly results at least in part from contractual restrictions that have tied up virtually all search access points and prevented rivals and potential rivals from gaining access to the billions of end users who perform searches. Google's ability to enforce these contractual restrictions has allowed it to capture a significant share of online search advertising revenue from firms seeking access to consumers, while at the same time disabling potential search rivals who would threaten Google's revenue stream and access to end users. These restrictions, in combination with technological and demand conditions, have made the market less competitive than it could be. The solutions proposed herein attempt to address various of these problems.

Google's market position is sustained by three main pillars: (1) exclusive default agreements with Apple; (2) Android's monopoly in licensable mobile operating systems; and (3) Google's ability to leverage its Android market power (*e.g.*, through anticompetitive provisions such as those contained in the AFAs and MADAs) to exclude rivals from the search market. Divesting Android and prohibiting these exclusionary contracts will make it easier for other search engines to reach end users. Pro-competition regulation should, in addition, lower the cost of entry to small rivals and protect those nascent entrants from anticompetitive conduct to encourage a competitive market going forward. Requiring the allocation of 50% of the SERP to non-monetized organic results will both protect consumers from the low-quality characteristic of a monopoly and permit relevant specialized search providers that compete with Google to be seen by users.

There are already signs that new entrants will attempt to capture the search profits that Google has heretofore monopolized. Consumers are harmed when a single, for-profit firm acts as the solitary gatekeeper between billions of end users and those with whom they would transact. These harms become even larger when innovative new technologies such as the internet of things may be captured by the incumbent monopolist. Economic theory can help us develop and apply regulations that lower entry barriers and encourage competition in this important market.

Appendix 1 – Author Conflict of Interest Disclosures

Paul Heidhues, Professor of Behavioral and Competition Economics, Düsseldorf Institute for Competition Economics (DICE), Heinrich-Heine University of Düsseldorf. Within the last three years – in collaboration with E.CA Economics – he engaged in competition and consumer protection consulting for the Competition and Markets Authority of the UK as well as in the context of trucking, banking, elevator, and timber industries.

Alessandro Bonatti, John Norris Maguire (1960) Professor, MIT Sloan School of Management. He has no engagements or affiliations to disclose pursuant to the disclosure policy of the American Economic Association.

L. Elisa Celis, Assistant Professor of Statistics and Data Science, Yale University. Within the last three years, she has received the Faculty Award from J.P, Morgan Chase and has been a Research Advisory Board Member for Arnold Ventures' Advancing Pretrial Policy and Research (APPR) Initiative.

Gregory S. Crawford, Professor of Economics, University of Zurich and Center for Economic and Policy Research. Within the last three years, he has engaged in antitrust consulting for Apple on matters unrelated to search as well as for clients in the communications and multichannel video industries in the US and Europe, also on matters unrelated to search.

David Dinielli, Senior Advisor, Omidyar Network. He has no engagements or affiliations to disclose pursuant to the disclosure policy of the American Economic Association.

Michael Luca, Lee J. Styslinger III Associate Professor of Business Administration, Harvard Business School. Within the last three years, he has served on the board of the nonprofit National Association for Business Economics and engaged in consulting on behalf of Yelp.

Tobias Salz, Castle Krob Career Development Assistant Professor of Economics, Massachusetts Institute of Technology. He has received data access from an advertising intermediary for travel websites within the last three years. This data access was granted solely for research purposes.

Monika Schnitzer, Professor of Economics, Ludwig-Maximilians-University Munich. She has no engagements or affiliations to disclose pursuant to the disclosure policy of the American Economic Association.

Fiona M. Scott Morton, Theodore Nierenberg Professor of Economics, Yale School of Management and National Bureau of Economic Research. Within the last three years she engaged in antitrust consulting on behalf of Apple and Amazon unrelated to the search market..

Katja Seim, Professor of Economics, Yale School of Economics and Yale University Department of Economics. She has no engagements or affiliations to disclose pursuant to the disclosure policy of the American Economic Association.

Michael Sinkinson, Assistant Professor of Economics, Yale School of Management. He has no engagements or affiliations to disclose pursuant to the disclosure policy of the American Economic Association.

Jidong Zhou, Associate Professor of Economics, Yale School of Management. He has no engagements or affiliations to disclose pursuant to the disclosure policy of the American Economic Association.

Appendix 2 – Details on the Linux Foundation

In 2020, over 890,000 developers contributed to Linux Foundation open-source projects, with 440,000 of those developers qualifying as "core developers" (frequent contributors). 18,000 companies around the globe contributed to Linux Foundation projects in 2020. 46% of Linux Foundation members come from the Americas, 32% from Europe, the Middle East, and Africa, and 22% from the Asia Pacific. Developers contribute to the project because they hope to benefit from the improved products. The sheer number of contributors bears this out and suggests that this model can work to further development and innovation.

The Linux Foundation is financially supported by member contributions and individual donations. No single organization was responsible for more than 2% of the Linux Foundation's annual funding in 2020. Linux Foundation members are organizations, typically companies, many of whom pay their employees to contribute to the Linux kernel or other open-source projects run by the Linux Foundation. Surveys show that just over half of Linux contributors (51.65%) are paid for at least some of their open-source contributions by their employer or a third-party, while just under half (48.35%) are volunteer contributors.[98]

The Linux Foundation is comprised of a 25-member Board of Directors, a Technical Advisory Board, and a staff who oversee changes to the Linux kernel. Linux has member tiers of Platinum, Gold, Silver, and Associate. Platinum, Gold, and Silver tiers memberships are open to "entities that engage in or support the production, manufacture, use, sale, or standardization of Linux or other open source-based technologies."[99] Platinum membership can be purchased for a $500,000 annual contribution.[100]

---

[98] *See* THE LINUX FOUNDATION, REPORT ON THE 2020 FOSS CONTRIBUTOR SURVEY (2020), https://www.linuxfoundation.org/wp-content/uploads/2020FOSSContributorSurveyReport_121020.pdf.
[99] *See* THE LINUX FOUNDATION, BYLAWS (2021), https://www.linuxfoundation.org/en/bylaws/.
[100] *See* Frederic Lardinois, *Google Ups Its Linux Foundation Membership to the $500,000/year Platinum Level,* TECHCRUNCH, June 27, 2018, https://techcrunch.com/2018/06/27/google-ups-its-linux-foundation-membership-to-the-500000-year-platinum-level/?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAH1HPUfhdj719MGo2OJX4fQNj-SJ_MQdcL-zKxQ7XnlwcLuUtsdTasvgGjzrARYPAPFOvmuHfuDa9k62GZxuocAGnteb4P5KdWDOBgGszV2UgvRaeMEQIJ8eP2vfc4H68YkApQh5p_dKL1ea6wOW-mnCluTUui9BC6JePTfFNCF9.

Each Platinum member is allowed to appoint one director to the BoD, up to a maximum of 20 such directors. Currently, the Linux Foundation has 17 Platinum sponsors, encompassing many of the largest OEMs, as well as cell and internet providers and platforms. Google became a Platinum sponsor of the Linux Foundation in 2018.[101] Microsoft is also a Platinum sponsor, so each company has a director on the Board.[102] To prevent overrepresentation of the interests of a single company or conglomerate, no more than two individuals employed by or receiving money from the same company or conglomerate may serve on the Board at the same time.

Appendix 3 – Further Detail on Evolution of Google's SERP

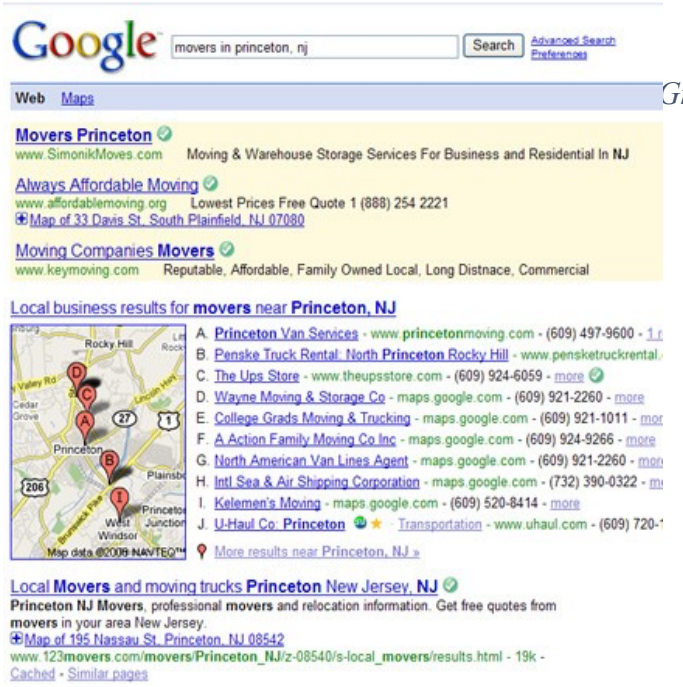

Figure 1: 2006 SERP with Universal Search

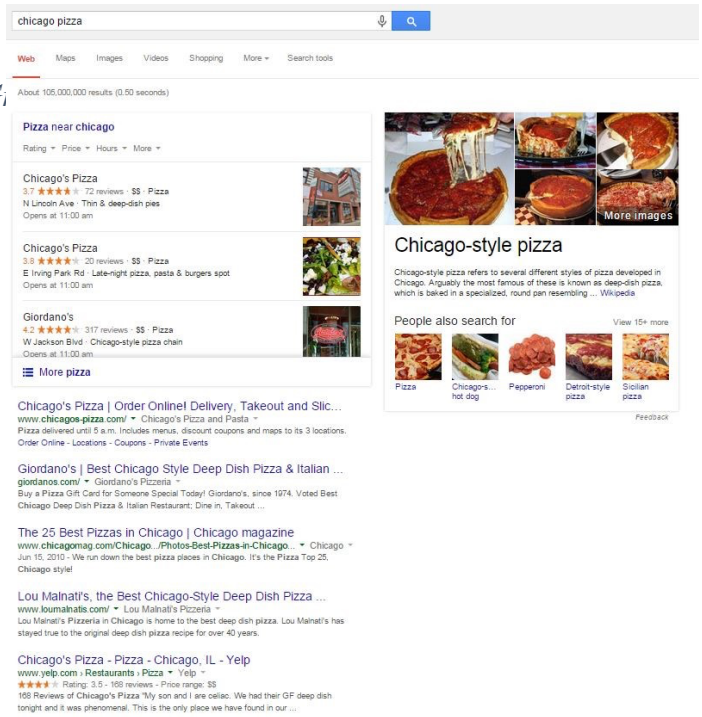

Figure 2: 2015 SERP with Knowledge Graph

---

[101] *See* The Linux Foundation, *Google Becomes Platinum Member of Linux Foundation, Demonstrating Its Commitment to the Open Source Community,* LINUXFOUNDATION.ORG, June 27, 2018, https://www.linuxfoundation.org/en/press-release/google-becomes-platinum-member-of-linux-foundation-demonstrating-its-commitment-to-the-open-source-community/.

[102] *See* THE LINUX FOUNDATION, MEMBERS (2020), https://lf-landscape.netlify.app/members?category=lf-members&grouping=category&style=borderless.

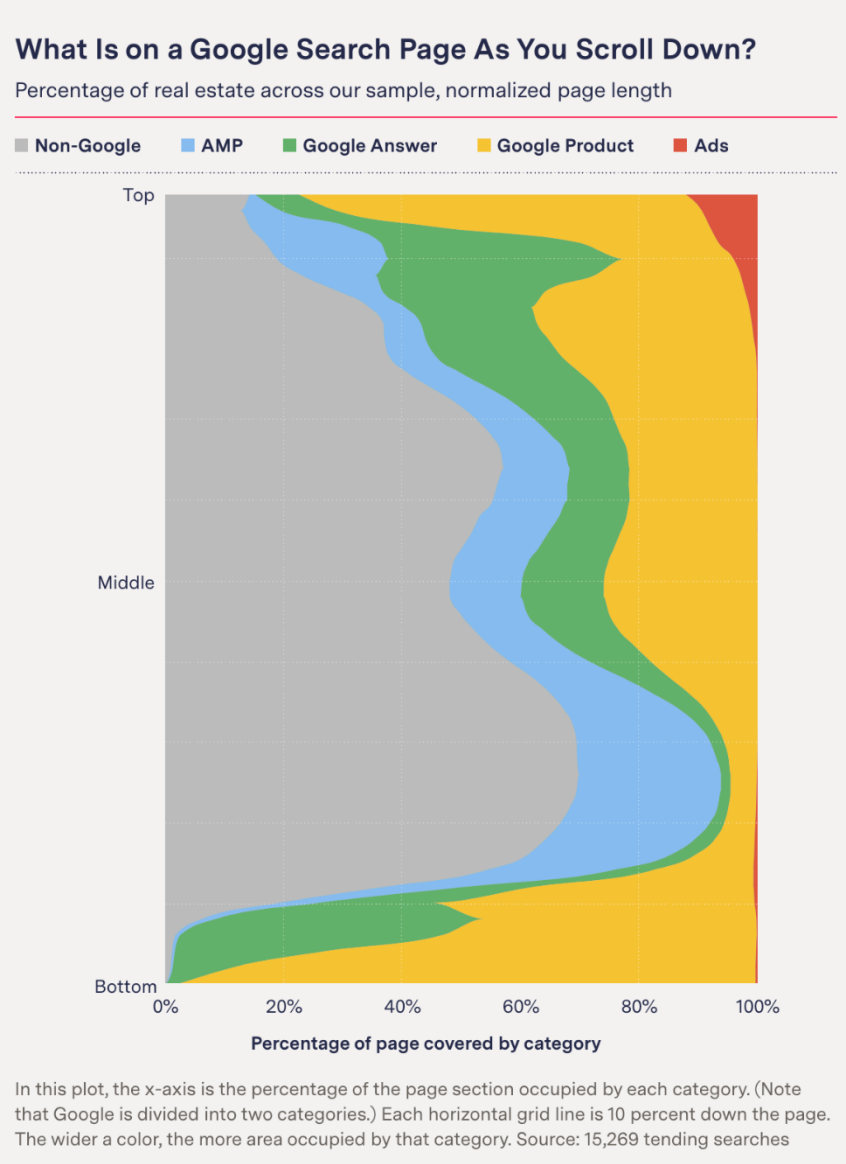

Figure 3: Percent of SERP Covered by Google Properties Across 15,000 Common Searches[103]

Appendix 4 – Eye Tracking Studies and Their Importance in SERP Design

We have called upon a regulator to oversee the design of the SERP, or Search Engine Results Page. The regulator will need to gain expertise in the growing body of scientific knowledge explaining how humans interact with computer screens, a field known as human-computer interaction, and more specifically, user experience or user interface design. Digital platforms, including Google, rely on this growing field in designing their interfaces. In order to enforce the

[103] *See* Adrian Jeffries & Leon Yin, *How We Analyzed Google's Search Results*, THE MARKUP, July 28, 2020, https://themarkup.org/google-the-giant/2020/07/28/how-we-analyzed-google-search-results-web-assay-parsing-tool.

requirement that 50 percent of the pixels on the landing page be devoted to organic results and the related obligation to ensure that dominant search engines do not use other methods that give prominence to their own services while disadvantaging rivals, the regulator will likely need to develop expertise in these specialized and techniques of user interface design and analysis.

Eye-tracking studies are one such technique. They frequently are used in human-computer interaction research and user interface design to measure the impact of design changes on user attention. Eye-tracking studies produce heat maps showing areas of the SERP where users direct their gaze most frequently. The images below show the result of an eye-tracking study conducted in 2007, soon after Google introduced its "Universal Search" feature where videos, images, and other non-text content was included alongside the text-based organic search results.[104]

The SERP on the left is the traditional Google SERP, without any images or Google-promoted content, simply a list of organic text-based results. The SERP on the right is an early example of Google's "Universal Search" feature, including a Google-promoted video among the results, with a screen capture from the video set alongside that entry. Researchers demonstrated that Google's addition of the "Universal Search" feature resulted in user behavior known as "fencing," where the presence of images or graphic elements with straight sides causes users to extend those straight lines out to form mental "fences" beyond which our eyes do not linger. In this case, the presence of the screen capture caused users to draw a horizontal mental fence at that location on the SERP and then concentrate their gaze on the entries above, rather than below, that imaginary fence. Google's placement of the video ensured that users' attention was concentrated on the results at the very top of the screen, rather than distributed more evenly among the organic results.

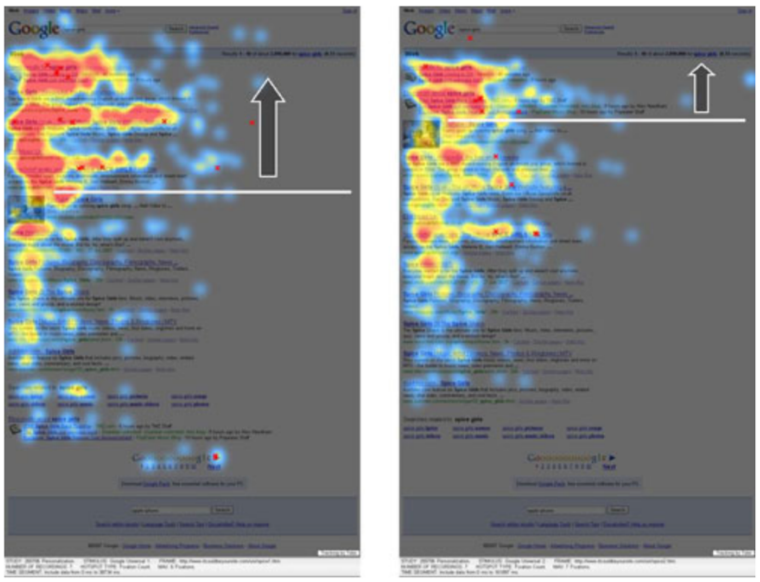

Figure 1: Eye-tracking Study on Google's SERP with and Without Universal Search

[104] *See* Gord Hotchkiss, *Eye Tracking on Universal and Personalized Search,* SEARCH ENGINE LAND, Sept. 21, 2007, https://searchengineland.com/eye-tracking-on-universal-and-personalized-search-12233.

The result above demonstrates the attention-shifting power of adding a single image to the SERP. The percent of users who typically proceed beyond the first page of search results fell from 40% to 32% from 2004 to 2008, the years when Google first introduced Universal Search.[105] In 2012, when Google first added Knowledge Graphs, SEO experts immediately noted that the new modules would cause a drop in traffic to non-Google publishers, because they provided answers to user queries directly on the SERP.[106]

---

[105] *See* Greg Sterling, *iProspect: Blended Search Results in More Clicks on News, Images, and Video,* SEARCH ENGINE LAND, Apr. 7, 2008, https://searchengineland.com/iprospect-blended-search-resulting-in-more-clicks-on-news-images-and-video-13708.

[106] *See* Danny Sullivan, *Google Launches Knowledge Graph to Provide Answers, Not Just Links,* SEARCH ENGINE LAND, May 16, 2012, https://searchengineland.com/google-launches-knowledge-graph-121585.