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The Socioeconomic Impact of Internet Tracking
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## Acknowledgments

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## Introduction

Privacy is an idea in crisis: personal, political, and economic. The digital age has challenged a centuries-old delicate balance. We have a legitimate need for privacy, we relish the sometimes-contradictory wish to project an identity, and we recognize that government, justice, and commerce all want or need to lift the veil of our privacy from time to time for myriad reasons, from the protection of our national security, to public safety, to targeted digital content and advertising.

The challenge to the delicate balance is nowhere more acute than in the practice of digital tracking. As simple an act as visiting a website or connecting to a public wireless network makes us trackable and may leave us feeling vulnerable. Tracking can send our personal data into circulation, sending it to entities we are unaware of, with real consequences in our private lives and to our public identities.

Yet tracking is integral to a multi-billion-dollar economic system employing hundreds of thousands of people and contributing to entrepreneurship on a scale our economy has not seen before.

People and machines have been using tracking tools such as cookies to identify browsers and to track consumer activities on the internet, often without giving consumers a choice, since the birth of online browsing in 1994. These practices have become integral to the architecture of the World Wide Web. As a society, we are renegotiating the balance, implementing tools, policies and protocols — such as the California Consumer Privacy Act — which have been created in haste and have consequences that are imperfectly understood.

Ensuring privacy and identity protection choice to Web users calls for deliberate and informed action on a national level.

This report intends to contribute a more precise understanding of tracking and its consequences, both economic and social. We describe how:

- tracking works to circulate data and affect privacy
- data circulation benefits the U.S. economy
- the publishing industry uses data to shape the ratio of free ad-supported content to subscription content
- tracking affects aspects of the consumer web experience, beyond cost
- targeted advertising reduces inventory waste
- in the absence of tracking, economic power would concentrate in the hands of the largest four or five technology companies because they are independent of circulated tracking data
- in the absence of mitigating actions, loss of tracking would produce quantifiable revenue losses to independent publishers and their supporting technology infrastructure

Privacy — a vital human interest — is in crisis. A responsible remaking of privacy controls is required for future digital generations.

## Key Findings

Tracking makes much of the content on the Web free, because it enables high-performing internet advertising. It allows services and systems to be addressed to individuals, not mass audiences. It enables entrepreneurs to find prospective customers for services built to capitalize upon existing digital businesses. By giving a view into consumers' digital choices, it makes digital marketing more efficient and less wasteful than pre-digital marketing practices.

Internet advertising has grown to become over half of all U.S. advertising due in large part to its capabilities in audience targeting and its effectiveness in tracking ad performance. An internet without advertising would require users to pay subscriptions, as they did in the internet's early days when they bought services such as Compuserve, Prodigy, and AOL. Subscription impedes adoption, and by economist Richard Thaler's maxim that if you want people to do something, make it easy, a free internet deserves credit as a principal driver in the $1.1 trillion force[1] that the internet ecosystem has become to the U.S. economy.

We do not predict, however, that an end to tracking would mean an end to advertising. The value of internet advertising is too well established. Instead ad spending would be diverted to a small number of very large digital publishers whose first-party relationships with consumers are so extensive that they can operate without tracking.

We find that if tracking were to end, absent a mitigating technology, there would be a shift of between $32 billion and $39 billion of advertising and ecosystem revenue away from the open web[2] by 2025.

From $24 billion to $29 billion of advertising revenue would be lost to the open web by 2025. Advertising buyers would then be compelled to turn to such walled garden publishers and platforms as Google, Facebook and Amazon, creating windfall advertising revenue for them of between $19 billion and $24 billion. Other beneficiaries of the end of tracking would be firms capable of evolving their business models into a first-party data/walled garden model, and this sector would grow their advertising revenues by about $5 billion according to our estimates.

We estimate that between $8 billion and $10 billion of ecosystem revenue would be lost to the open web by 2025. Whether these jobs and revenues follow publisher revenues into the walled gardens, or whether the jobs will simply be lost to the U.S. economy, will depend on whether the technology infrastructure of walled gardens is adequate to serve the ad impressions no longer served by the open web, or needs to expand.

The advertising-supported internet would become more concentrated in the hands of a few very large publishers than it is today. While it is not within the scope of this report to calculate the impact of the changes on the internet's vitality and entrepreneurship, it is almost inevitable that innovation in the internet ecosystem would be negatively impacted in ways not measured in the $32 to $39 billion shift from the open web to the walled gardens.

[1] John Deighton, Leora D. Kornfeld, and Marlon Gerra, "Economic Value of the Advertising-Supported Internet Ecosystem," IAB, 2017

[2] The open web is an ecosystem of publishers and marketing technology firms operating collaboratively to serve the customer acquisition and retention needs of brands. It competes with firms like Google, Amazon, and Facebook, which offer self-contained solutions to brands.

## How Tracking Affects a Web User's Experience

In this section we discuss how, while web users often experience tracking as privacy-invading, it allows for other, more welfare-enhancing, experiences than are possible if consumers are anonymous to Web publishers. As will be explored in more detail later, a cookie or tracking mechanism functions as a unique identifier of a computing device and makes possible the delivery of information to users that is unique to them and their online behaviors. This section examines the ways in which the user experience may be impacted, both negatively and positively, by the absence of third-party cookies and/or tracking mechanisms. We draw throughout this paper for our conclusions on literature from such disciplines as consumer behavior, behavioral economics, and information economics.

Surveys suggest that public attitudes to tracking are largely negative.[3] Asked what a cookie does, a common response is likely to be 'it tracks me, and then tries to sell me something, or sells my data to another company.' A more sophisticated view might perceive a wider array of user benefits. Among them are automatic log-ins, which eliminate the need to log in to a website or family of websites on each visit, or to start over when an online activity such as shopping is interrupted, auto-completion, such as completion of a previously searched map address, a search term, or frequently requested information on a form, cross-device continuity which allows a user's identity to be preserved as they switch among devices, and customization of publisher content based on a reader's interests.

While benefits such as a persistent identity tied to an online shopping cart or website may appear mundane, there are industry-level affordances that are transformative. Inarguably the internet's greatest benefit to consumers has been the fee-free, primarily advertising-supported content that ranges from news and information to educational content to sports, entertainment, special interest information, how-to information, and user-generated content. Such resources can be accessed through search, on demand, through recommendation systems, or on social platforms. Increasingly the delivery systems for such content and services are optimized with data, through first-party data relationships with users on the large platforms, the walled gardens and through third-party data flows for the content and service providers on the open web, terms to be defined later. The deployment of data enables a highly 'knowable' consumer, in near real time, removing the frictions of services and systems that once had no choice but to address a largely undifferentiated user.

Furthermore, the network effects and rapid scalability of digital businesses have made possible new digital business models that benefit consumers. One such business model is software-as-a-service or SaaS, in which users can identify the parts of the software package they require and purchase only those, and only for the period of time they want to use the software. This is a significant departure from the pay once, pay for the entire feature set world of software-in-a-box. Some SaaS products offer both free and premium versions, known colloquially as a freemium strategy. They offer one feature set free of charge, and an advanced feature set for a price. This 'commerce at the price of zero' business model can be seen in many online games and music streaming services as well as in widely adopted communication and productivity tools such as Dropbox, Slack, Mailchimp, Skype, and LinkedIn. The freemium model is data and analytics reliant and can be financially viable with just a single digit percentage of users paying for the upgraded version of the service. Research on the popularity of the freemium model[4] echoes classical work

[3] Nicole Perrin, Consumer Attitudes on Marketing 2019: Privacy Concerns Mount, and Ad Blocking Isn't Going Away, eMarketer Nov 4, 2019

[4] Thomas Niemand, et al., "The Freemium Effect: Why Consumers Perceive More Value with Free Rather than with Premium Offers," https://pdfs.semanticscholar. org/040e/50c1210e80e3fece96c1b3426e54739e6f0c.pdf, 2015

in the field of behavioral economics, specifically Kahneman and Tversky (1979),[5] in which "...consumers form expected (reference) prices beforehand and evaluate an offer more positively if the offered price is below this reference price. Applied to freemium, the reference price will be somewhere between the free and premium offer (positive willingness to pay), while the free offer price (zero) will always be lower, making a positive evaluation likely."

Consumers' understanding of the business models of online services, social media, and apps has grown significantly over the past few years, and many now grasp that the options for paying are either with data or with dollars. And even in the midst of the spate of controversy related to data breaches and ethical missteps by some of the largest tech companies, evidence suggests that consumers prefer to pay with data.[6]

Consumers benefit from entrepreneurs being able to build on top of existing digital businesses, a key feature of the internet ecosystem. Cookies and tracking technologies and the data they generate enable the creation of markets in defiance of entrenched business institutions. Whether for user-generated content (e.g., YouTube and Instagram), professionally created content (e.g., Netflix and Hulu), job hunting (e.g., ZipRecruiter), real estate transactions (e.g., Opendoor), or automated 'robo-advisor' investing (e.g., Wealthfront) the collection and optimizing of user data allows products and services to be developed that bypass the traditional gatekeepers and by definition are highly dynamic in nature. Highly specialized and individualized products and services can be built using a foundation of data and analytics, with the recent proliferation of direct-to-consumer (D2C) brands being a prime example of the phenomenon.

Ad targeting is controversial, particularly in the context of political ads that can be targeted to exploit individual biases. Major tech platforms exhibit a range of policies on political advertising[7]. As with many of the discussions surrounding data, it is important to acknowledge the dark aspects of the practice, in which divisive and sometimes hateful rhetoric may be promoted, as well as those aspects that offer benefits and convenience to consumers.

In contrast to broadcast advertising media, targeted advertising can be customized to an individual's tastes and preferences and, unfortunately, prejudices and biases. If one has been determined to be unlikely to purchase in an esoteric product category such as high-end kitchen accessories or hiking boots, ads for those products will not be shown. In their place will be ads for items or services that an individual has either directly or indirectly demonstrated to have an interest in. But political and incendiary advertising can also be matched to biases.

[5] Kahneman, D. and Tversky, A., "Prospect Theory: An Analysis of Decision under Risk". https://econpapers.repec.org/article/ecmemetrp/v_3a47_3ay_3a1979_3ai_3a2_3ap_3a263-91.htm, 1979

[6] For example, a January 2019 survey conducted by the Center for Data Innovation found that only one in four Americans want online services such as Facebook and Google to collect less of their data if it means they would have to start paying a monthly subscription fee (https://www.datainnovation.org/2019/01/survey-few-americans-willing-to-pay-for-privacy/) and March 2019 research from the Pew Center found that only 14% of U.S. adults say they personally have paid for local news within the past year, whether through subscriptions, donations or memberships. When asked why they don't pay for local news, around half of non-payers (49%) point to the widespread availability of free content. (https://www.journalism.org/2019/03/26/for-local-news-americans-embrace-digital-but-still-want-strong-community-connection/#americans-have-little-awareness-of-the-financial-challenges-facing-the-industry)

[7] Stewart, Emily, "Why everybody is freaking out about political ads on Facebook and Google", https://www.vox.com/recode/2019/11/27/20977988/google-facebook-political-ads-targeting-twitter-disinformation, November 27, 2019

Retargeting ads, when done well, can deliver consumer benefit. For example, when one is 'window shopping' for an item online, being reminded about the item or other options in the category can be helpful to the consumer. When done clumsily, however, retargeting diminishes brand value and annoys consumers, as is argued in the work of Hoffman (1999) on 'resigned disgust,'[8] and Draper & Turow (2019) on 'consumer resignation.'[9]

Another benefit of tracking technology is that publishers are able to realize higher prices for their inventory from marketers because they can reach consumers with greater precision. Increased revenues for publishers can in turn correlate to a greater volume and higher quality of content available to consumers.

[8] Donna Hoffman, "Building Consumer Trust Online," Communications of the ACM, https://www.researchgate.net/publication/220427207_Building_Consumer_Trust_Online, 1999

[9] Nora Draper and Joseph Turow, "The corporate cultivation of digital resignation," New Media & Society, https://www.researchgate.net/publication/331618712_The_corporate_cultivation_of_digital_resignation

## How Tracking Affects the Economy of the Internet

In the most general terms and setting aside for the present the claim a Web user may make for the right to withhold personal data from the market, we note the observation of economist Joseph Stiglitz that frictions in the distribution of information increase costs to marketers and in turn to consumers. He writes: "(I)nformation, once created, is a public good, and any barrier to its free dissemination introduces a distortion in the economy. In practice, the static costs are often higher because these restrictions create barriers to entry, supporting a less competitive market environment, and yet the incentives provided for the creation of knowledge may be limited. Indeed, since the most important input into the production of knowledge is knowledge, by restricting the use of knowledge they may actually impede innovation itself."[10]

The most substantial economic effect of tracking has been on advertising efficiency. Cookies have been used from the beginning of web advertising as a way to accomplish necessary tasks such as to cap ad frequency. More recently they have transformed how marketers buy and sell advertising from a focus on media to people. For most of the centuries-long history of advertising, advertisers bought media. They relied on publishers, including broadcasters, to assemble audiences of readers and viewers, and chose the most relevant of these audiences for their particular purposes. The *Wall Street Journal* assembled one kind of audience, while *Look* magazine assembled a different kind. Even as digital publishing grew, advertisers continued to buy publications, or bundles of publications called ad networks. For example, iVillage.com was a digital publication assembling an audience of women, and Glam Media was an ad network assembling a similar audience. In the last decade, a monumental shift has taken place as advertisers have found they could buy audience members directly, not through publishers, broadcasters, digital media, and ad networks as mediators. The effect was to make marketing spending more efficient, not because digital media were less expensive than analog counterparts, but because advertisers needed pay only to reach the audience members they wanted, undiluted by people they don't want.

Thus, it was not the birth of digital media that reduced waste. The first digital ads ran in 1994, and for almost two decades thereafter advertisers bought digital publications just as they had bought analog publications. Instead, what drove the shift was the recognition that browser cookies could identify people, and buying people was often less expensive and more efficient than buying publications. As people browsed the web, a profile of each person could be assembled to say whether the person was of interest to the advertiser. Advertisers could then bid for particular profiles.

In about 2009 the first ads began to be bought by real-time bidding for the opportunity to reach people profiled by means of cookies. As of 2019 in the U.S., more than 80% of digital ads are addressed to people who are tracked either with third-party trackers or with first-party profiles,[11] Because of this precise addressing, digital advertising has grown to more than half of all advertising.

In under a decade the browser cookie, and other closely analogous tracking tools such as mobile device identifiers have fundamentally changed advertising efficiency. Advertisers can buy access to the people they want to reach because they have the data to find them and are able to do so without having to pay for access to unwanted people who often make up a large part of a publication's audience.

[10] Joseph Stiglitz, "The revolution of information economics: The past and the future," NBER Working Paper 23780, https://www.nber.org/papers/w23780.pdf, 2017

[11] Fisher, Lauren, "U.S. Programmatic Ad Spending Forecast 2019," eMarketer April 25, 2019. https://www.emarketer.com/content/us-programmatic-ad-spending-forecast-2019

## Defining the Tracking Cookie and Related Devices

Cookies are small strings of code and data that websites install onto a user's computing device and subsequently read so that they can recognize the user on a subsequent encounter. When a website detects a call from a user's browser to download data from the website, it responds not only with the requested data but with a very small data string that the browser is programmed to accept and store, to associate the visitor's machine with the website.

Cookies long predated the internet,[12] but were first used there in 1994 when Netscape was designing the world's first browser, to solve the following problem. A website often wanted to remember a visitor's so-called 'stateful' data, or data to keep track of the state of interaction with a visitor to the site, usually by setting values in a storage field designated for that purpose. The data could have been stored on the website, but the first client for web browsing, the telecommunications firm MCI (now part of Verizon), told Netscape in August 1994 that it did not want to store partial transaction data on its servers. Ever since, stateful data has lived on the visitor's side of the interaction.

Stateful data include items added in a shopping cart in an online store, a visitor's clicking activity on the site including time of logging in, and entries made by the visitor on the website such as a name and address. The data is scoped in such a way that only the site setting the cookie on the visitor's browser can read it, and the site cannot read it if the visitor returns by way of a different browser.

### First and Third-Party Cookies

The cookies described so far are known as first-party cookies because the website that sets them is the only website that can read them. The website can set cookies on behalf of third parties, such as those of Google Analytics or Adobe Experience Cloud, but they are considered to be first-party cookies. The simple test of whether a cookie is a first-party cookie is whether the cookie comes from the domain whose name is the one shown in the visitor's browser's window.

Most tracking cookies fail that test. When someone visits a website containing advertising, that person is actually visiting at least two websites: the publisher's, whose URL appears in the browser window, and an ad exchange which delivers the advertising, whose URL does not. When the ad server sends its content to the web page, it too can set a cookie on the visitor's browser.

Publishers typically delegate the delivery of ads to ad exchanges such as Google Ad Manager (formerly DoubleClick), OpenX, or AppNexus, that operate at a much larger scale than any single publisher could do. The ad exchange serves ads across multiple publisher sites, and consequently has the ability to record visits to a large number of sites using its cookie.

[12] Wikipedia notes that the term, sometimes referred to a a "magic cookie," is found in computing applications as far back as 1979 to refer to "a short packet of data passed between communicating programs, where the data is typically not meaningful to the recipient program. The contents are opaque and not usually interpreted until the recipient passes the cookie data back to the sender or perhaps another program at a later time."

This cookie is known in the industry as a third-party tracking cookie because, although readable by only the tracker, the tracker's domain is not the one shown in the viewer's browser. The practice of keeping track of a viewer's movement across the network of websites served by a single ad exchange is known as cross-site tracking. Tracking movement by following the cookies placed by more than one ad exchange requires cookie synching and will be discussed in the section of this paper on programmatic advertising.

**Processes That Substitute for or Complement Cookies**

On mobile device apps, a mobile ad ID (MAID) is available for tracking. It is a string of hexadecimal digits set by the mobile device's operating system onto the device, much as a cookie would be set, with the distinction that cookies are set by websites or ad exchanges, while MAIDs are set by the device's operating system, either iOS or Android or another. All app publishers can read them. Consequently, nothing equivalent to cookie synching is needed to follow movement across different mobile apps because the MAID serves as a persistent identifier. Two considerations protect the privacy of mobile app users. First the apps are unable to make permanent connections between a user and a MAID. Second, a user can reset their device's MAID.

Nevertheless, the persistent identifier enables the operating system to build a profile that is valuable to advertisers. Apple's MAID, which it calls Identifier for Advertisers (IFA or IDFA), is used to build such profiles. Apple explains that "to ensure ads are relevant, Apple's advertising platform creates groups of people, called segments, who share similar characteristics and uses these groups for delivering targeted ads. Information about you is used to determine which segments you are assigned to, and thus, which ads you receive. To protect your privacy, your information is used to place you into segments of at least 5,000 people."

Apple relies on its apps, including Apple's News and Stocks, its App Store, and its contextual ad platform, but any ad platform can offer segments of consumers to advertisers. In Apple's case these segments can aggregate 5,000 or more IFAs and match these segments to information advertisers have about their own users, such as phone numbers or emails, and reports music, movies, books, TV shows, and apps favored by the segment, and report ad impressions delivered.

Mobile apps can also be tracked by reading what are called the "fingerprints" of the mobile devices. A fingerprint refers to a set of small technical details of the device used by the website visitor, that can identify it with a high degree of distinctiveness. Unlike cookies, which the visitor can delete and the website cannot store, a device fingerprint is collected by the website and there is nothing to delete stored on the visitor's device.

Various vendors use various technical details for fingerprinting, such as the client's transmission control protocol/internet protocol configuration, the device's operating system, the phone's screen resolution, and a clock skew, the discrepancy between the time shown on the device's clock and the time at its source.

Fingerprints derived from these characteristics are termed passive fingerprints and, though relatively distinctive, are not unique to the machine. Other mobile ad exchanges use what are called active fingerprints, which are unique. To obtain a unique fingerprint, the website server installs executable code onto the client's machine, reads its MAC address or other unique serial number,[13] and executes it on the server side. Fingerprints derived in this way are termed active fingerprints. They depend on the device tolerating the installing of executable code, which not all devices will do.

[13] https://en.wikipedia.org/wiki/Device_fingerprint

## Functions of Tracking

We discuss tracking in three important applications:

- Ad Placement
- Ad Effectiveness and Attribution
- Customer Relationship Management

1. *Ad Placement:* Tracking cookies have become integral to generating the advertising revenues on which most Web publishers depend. As early as 1996 the industry recognized that tracking cookies could pose a challenge to the privacy of web use. The Internet Engineering Task Force (IETF), which describes itself as a large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the internet architecture and its smooth operation, formed a working group to propose solutions.

   As fast as solutions were proposed and adopted, however, the nature of the tracking problem would change. Tracking methods do not stand still. In their 25 years as a core technology to track client browsing across the web, systems for tying third-party cookies to email addresses, locations, device IDs, logins, and sometimes physical addresses, have evolved almost continuously. At first, they recorded the sites a single browser visited, then they evolved to track a single machine supporting two or more browsers. Now tracking operates in an even more complex environment. A person moves between a laptop and a mobile device, between devices and addressable television, onto ad-supported streaming services, from email to the internet, leaves the internet to open an app, is tracked by global positioning technology as they encounter offline media such as billboards, and visits offline retail stores, movie theaters, and public spaces if they have been "ringfenced" to recognize their mobile devices.

   This challenge is known as cross-platform tracking. Cookies and fingerprints remain at the core of tracking in this more complex landscape, serving as inputs to efforts to build a persistent identity across multiple points of observation. The challenge is not necessarily to build an identity that contains a name and address, but to know, for example, whether a person recognized at one point in what may be a path to purchase is the same as the one at a second point.

2. *Ad Effectiveness Attribution:* If an advertiser wants to attribute the effect of an ad shown on any one of these media and contexts to a sale, it must know what was shown on every one of them. Otherwise the advertiser's perspective will be myopic or distorted, and its belief about what caused the sale will be a poor guide to future ad spending.

3. *Customer Relationship Management:* Tracking cookies play two additional roles in marketing beside placing ads and measuring their effects. First, they can support firms' customer acquisition efforts. They can, for example, introduce services to people who are not aware of them by finding people whose past behavior suggests they are predisposed to like a market offering. Second, they can support a firm's customer retention efforts. Recognizing a customer over repeated online encounters is not always a matter for the brand's own website and its first-party cookies. With tracking technology, a firm can recognize the customer, for example a credit card holder at risk of lapsing, elsewhere on the web and use advertising to attempt to reactivate the customer.

Consider the following example as an illustration of the utility of tracking technologies. When Airbnb was expanding its offerings to include customized local experiences for travelers willing to pay a premium for more than just a room, the company began by targeting prospective customers according to geography — in this case in the UK, U.S., Australia, Germany, India, and South Korea. With tracking profiles of these prospects, the company could experiment within each geography, and do so with a variety of ad campaign treatments for different styles of trip, such as family vacations, business travel, holiday destinations, and romantic getaways.

The advertising technology vendor that Airbnb worked with was able to send these ad campaigns, at scale, to people segmented by style of trip. Airbnb used its marketing resources efficiently, reaching only people in specified geographies, and only those most likely to be interested in particular local experiences. The campaign ran across Facebook, Instagram, Twitter, Pinterest, and video platforms, targeting 101 million people identified as being in the market for the new service in the regions of interest. The result was 70 million video views with an unusually high 10% view-through rate.[14]

[14] Amobee website https://www.amobee.com/success-story/airbnb/

## Tracking's Role in Programmatic Advertising

Cookies and fingerprints are at the heart of the buying and selling of advertising, but it is easy to lose sight of their presence in the complexity of the programmatic buying and selling of ad insertions. For this reason, an understanding of tracking requires not simply a focus on the cookie on a browser, but the cookie in the context of a marketing technology ecosystem.

We identify how tracking devices enable tracking data to play a role in the buying and/or bidding on the audiences that brands and marketers want to reach.

**Figure 1: The Functions of the Ad Tech Ecosystems**

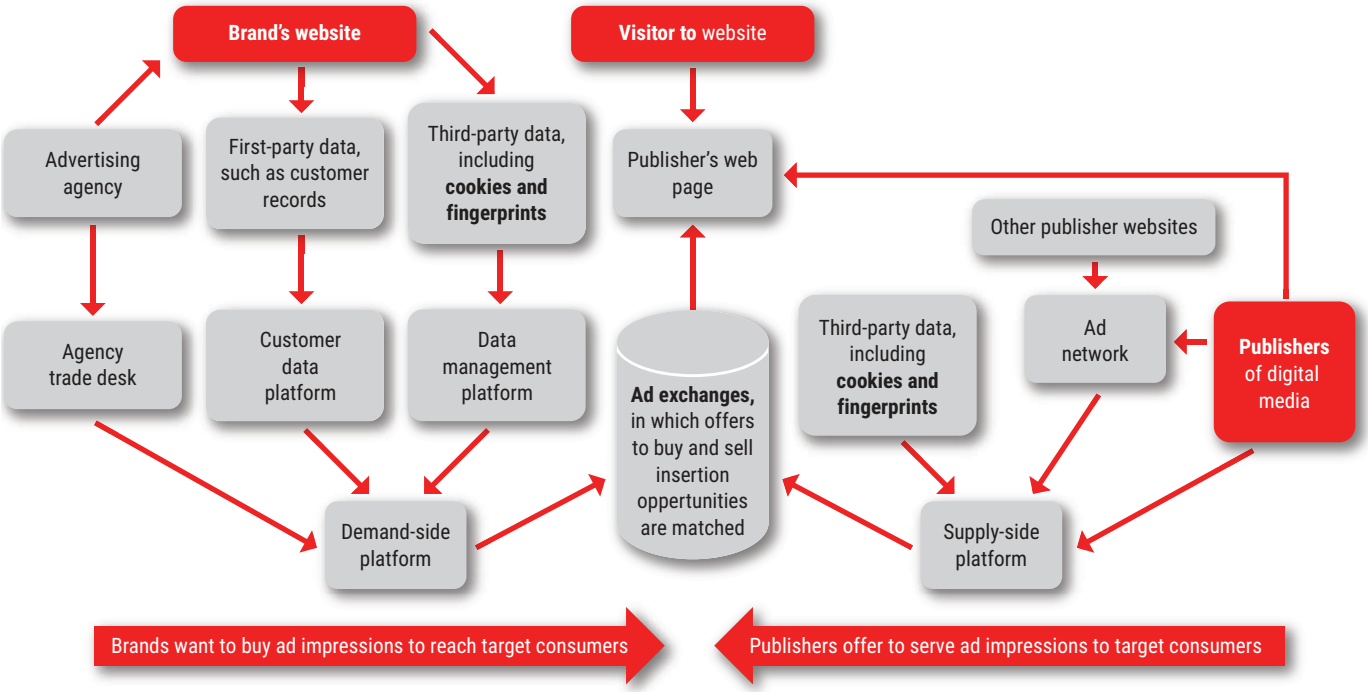



Figure 1 maps the process by which a brand decides whether to serve an ad to a consumer who visits a publisher's website.

The consumer's browser carries cookies storing information about the visitor gathered during past web browsing. The publisher contracts with an ad network to read the tracking cookies on the consumer's browser. It adds other information such as the nature of the publisher's content, search terms that may have led the browser's search engine to serve up the website, geo-targeting information such as location of the visitor's internet service provider or location in a geo-fenced region, or previous visits to the publisher's website. The ad network sends this profile to a supply-side platform (SSP), which may add information from third-party sources.

The SSP offers to a demand-side platform (DSP) the opportunity to advertise to the visitor. The DSP consults the data management platform (DMP) and customer data platform (CDP) of the brands it serves to decide if the consumer's profile is of interest. If it is, the DSP can bid to display an ad to the visitor. Before it decides to bid, it may check to see whether it is constrained by a frequency cap, a brand-imposed number of repetitions of a message in a time period. After it bids it may follow up to see whether the exposure achieved a desired outcome, such as a new impression, a user action such as a click perhaps leading to a software installation, or a post-installation metric such as a purchase, a registration, or a sequence of purchases. Often the DSP will implement dynamic creative optimization (DCO) in which a range of ad variants are developed and tested on randomly selected samples to identify the best performing variant. Optimizing can be conditional on factors such as geographic region time-of-day, day-of-week, and season. The DSP reports to the brand the number and cost of impressions delivered, allowing the advertiser to refine its strategy.

The DMP stores mainly second- and third-party data such as cookies, IP addresses, and device IDs, and does not rely much on first-party data. The data stored in DMPs is generally pseudonymized and segmented into categories relevant to the advertisers that the DMP serves.

The CDP stores an advertiser's first-party PII data including first-party cookies and self-reported data. Some CDPs consolidate first- and third-party data, and online and offline data, building a universal customer and prospect view across all the brand's touch points.

There are two kinds of CDPs. If the marketer's business goal is to act in real time by, for example, presenting the consumer with an offer, a personalized web page, a mobile message, or a marketing email, the CDP needs to make a precise, deterministic match. It acts only if the profile offered by the SSP contains the advertiser's first-party cookie.

Other CDPs look for broader matches between the SSP's offered profile and the needs of the brand. They build what are called identity graphs assembled from the consumer's digital and offline actions. They can use data not only from the brand's own website but also from data warehouse, call centers, and in-store sensors. Matching in such contexts can be probabilistic.

Note that in all these descriptions, the DSP and DMP know only what one ad network has told it. Each ad network knows only a fragment of all the information stored in the cookies on the visitor's browser. There is an incentive for ad networks to let DSPs or SSPs reassemble the fragments. They can do so by means of a step known as cookie matching or, synonymously, cookie synching. Each ad network can include in its cookie an identifier unique to that browser. When the DSP bids to advertise to a visitor, it tells the ad network to put a DSP identifier onto the visitor's browser. At intervals, typically daily, a DSP (or SSP) constructs a table whose rows are the identifier numbers of all the ad networks whose trackers they read that day, and whose columns are all the DSP identifier numbers. When the same DSP identifier appears with two or more ad network identifiers, the DSP can unite two or more fragments of visitor's profile.

## The Open Web and Walled Gardens

Programmatic advertising can be performed by either an open web ecosystem or a walled garden. The open web is a group of vendors that collaborate and compete to match consumers to brands using third-party data that circulates among the vendors through the system of SSPs and DSPs. Advertisers buy through DSPs as described in the previous section. A walled garden is a single firm that relies on its own first-party data to do the matching. It sells to advertisers through the publisher's proprietary buying tool.

### The Open Web

The open web is a constantly evolving marketplace of services, centered on ad networks. The ad networks initially faced intense competition for the right to represent publishers to advertisers, with little to differentiate one from another beyond price. In response, some integrated their tracking into full service programmatic offerings that included DSPs, SSPs, and ad exchanges, where they could compete on quality and breadth of service as well as breadth of network, some integrated with publishers. An example is AppNexus, which, from its origins as an ad network, has evolved into an integrated offering that includes online auction infrastructure and technology for data management, optimization, financial clearing, and support for directly negotiated advertising campaigns. It has both DSP and SSP capabilities. Recently it was folded into a very large publisher, AT&T, and offers the integrated suite of services to brands under the name Xandr, ATT's advertising and analytics division.

Several firms that originated as ad networks remain independent of publishers and compete on breadth of network or ancillary services such as attribution of sales effects to media purchases. The Trade Desk, for example, first expanded its scope of services to become a DSP, and more recently has expanded its network of publishers to include connected (or individually addressable) TV delivered on over-the-top (OTT) transmission systems that bypass cable distributors. Other independent ad networks that have evolved into DSPs and SSPs, such as MediaMath and Amobee, are also pursuing the integration of connected TV in search of market distinctiveness.

Another form of integration within the open web has taken the form of combining content distribution with programmatic ad placement. An example is the merger of Dataxu, a DSP, with Roku, a distributor of streaming video. Here Dataxu can leverage Roku's data on streaming video subscribers across the open web.

### Walled Gardens

When a platform/publisher site requires its visitors to sign in, as do Facebook, Instagram, Twitter, Pinterest, LinkedIn, and Gmail, the visitors do not need to be tracked. By signing in, the visitor acquires a persistent identity that is the platform/publisher's first-party data and is a proprietary asset of the platform/publisher. To protect that asset, the platform/publisher may choose to sell its advertising exposure opportunities through its own proprietary ad insertion tool and not list the inventory on independent DSPs. It may keep to itself the identities of visitors who respond to or do not respond to particular ads, passing to the advertiser only information on visitors who become customers. Platforms or publishers that take these protective actions are or are on the path to becoming walled gardens.

Some of them are made up of networks of sites, Google for instance has at least seven products with over a billion (likely duplicated) users globally, namely Gmail, Chrome, Maps, Search, YouTube, Google Play Store, and Android. Visitors have a persistent identity in Google's eyes across this whole network of web and app properties, and this identity takes the place of the many browser cookies that collectively create identity on the open web. Facebook has four such properties (Facebook, WhatApp, Messenger, and Instagram.) These single-owner networks are particularly powerful forms of walled garden because of the richness of the persistent visitor identities that they command. We shall refer to them as "data concentrations" to capture the intersection of two distinctive features, a very large identified network of users and a proprietary ad sales system to sell opportunities to address its visitors.

Google, Facebook, and Amazon are mature instances of data concentration. When we write about walled gardens hereafter, we are referring to these three firms. A next tier of firms, which we shall refer to as integrated firms, might evolve more rapidly to the data concentration business model as restrictions on third-party data gathering hinder the open web. Two firms in this tier are close to possessing the two defining features of walled gardens. Microsoft and AT&T have large data concentrations. Through LinkedIn, Microsoft has a proprietary ad sales system, and AT&T is building one with Xander. Other telecommunication networks such as Verizon, Comcast, and Cox Communications could acquire these capabilities. Roku has proprietary user data on about 30 million U.S. streaming television households, and now has an element of an ad sales system in the form of DataXu. Apple currently depends more on product sales than ad sales but deserves to be counted in this next tier. Another tier of publishers including Twitter and Pinterest have proprietary ad sales systems, but because they do not have large data concentrations we would not count them as potential walled gardens unless they should be acquired by or acquire a large data source.

Advertisers have limited access to the proprietary data of walled gardens. When they list on Amazon, they can use data on buying behavior. At Facebook they can use behavioral segmentation criteria inferred from content posted to Facebook and Instagram. At Google they can use information from Maps, Search, Gmail, YouTube, and other Google properties. And because each walled garden has a network of third-party sites, such as Facebook Audience Network, the Google Display Network, Google Adwords, and Amazon Advertising Platform, advertisers can segment on proprietary data and then target across the whole internet.

Because these data concentrations are proprietary and exclusive to the walled gardens, they are prized as proprietary assets and the walled garden publishers prevent advertisers from augmenting their own data files or attribution models with the data.

## The Role of Browsers in Tracking

The infrastructure of marketing technology is so complex and fast evolving that it is easy to overlook the central role of the user's browser. The conversation around privacy and tracking is concerned with the identity of people, but the entity that is tracked is not a person but a browser, a software tool used to link a computer to a site on the internet.

It may be helpful at the start to distinguish browsers from search engines. At the most basic, browsers sit on the client side of the interaction between a personal computer and the internet and can accept cookies, while search engines sit on the server side and can (with a few exceptions such as DuckDuckGo) set cookies.

A browser is software installed on the user's desktop, laptop, or mobile device. The browser displays a text box, known as the address bar, into which the user enters the address of a website they want to visit. The browser works with the website server to assemble the website on the user's device, and in the process accepts cookies. Sometimes a user gets to a website by clicking on an address embedded in a website. Although it might appear that the user has bypassed the device's browser, in fact the browser that the user has designated to be the default assembles the address and accepts the cookies. The central point here is that people are not tracked, their devices are, and it happens by means of cookies that websites set on the device's browser.

A search engine is essentially software that resides in the cloud. It displays a text box, termed the search box, which returns suggested answers to search queries. Confusion can arise because some browsers will accept search queries in their address bars. Chrome, a browser, treats terms that do not end with a domain name like .com or .org as if they were search terms, and calls Google to return answers. Internet Explorer handles them by calling the user's default search engine.

Search engines, being websites, can set tracking cookies or decline to set them. The Google.com search engine sets cookies and later, when the user searches again, uses them to deliver search results that differ from person to person (or, more accurately, from browser to browser.) The DuckDuckGo.com search engine does not. It sets no cookies, and blocks attempts by websites that attempt to set them, so its search results do not vary by past search history.

The policy actors in matters of privacy are browsers because they store cookies, and search engines and websites because they set them. We discuss here the stance of browsers toward cookies, because they are the gatekeepers. While most browsers store first-party cookies, their policies toward tracking cookies range from neutral to uncooperative.

Least cooperative of the browsers is Brave, which launched in 2016. It stores no third-party cookies. It goes further and strips ads from ad-supported websites and replaces them with ads from its own ad network. These ads are not targeted to user characteristics, because no user information is stored on its servers and its ads contain no trackers. Because the websites it serves do not have to be loaded from multiple servers it is a faster browser. It plans to reward users with 'basic attention tokens,' which users can pass to publisher sites to be redeemed to compensate for the loss of ad revenue.

Almost as uncooperative is Apple's Safari. WebKit, the open source engine behind Safari, places targeted ads on sites like Apple News using first-party profile information gathered from its own properties. It has said that it will do its best to prevent all 'covert' tracking and all cross-site tracking whether covert or not. It implements a branded 'Intelligent Tracking Prevention' system to limit third-party tracking.

Mozilla's Firefox had been neutral until August 2018 when it changed to become relatively uncooperative. It began to reject efforts to set cookies by default, requiring users to take the initiative if they wanted to enable them.

Google's Chrome had been neutral toward cookies, but in August 2019, Google's Director of Chrome Engineering announced[15] an initiative to develop a set of open standards that it called a Privacy Sandbox. While the announcement was interpreted by many as a move against cookies, it began by acknowledging two unintended consequences would flow from large scale blocking of cookies. First, cookie blocking would, perversely, undermine people's privacy if it encouraged "opaque techniques such as fingerprinting," because users could not clear fingerprints the way they cleared cookies, and so could not control how their information was collected. Second, without cookies publishers would find it difficult to sell advertising to fund the free content that contributed to the "vibrant web."

Then in mid-January 2020 the plan for Google's Privacy Sandbox acquired a timeline. Chrome would phase out support for third-party cookies within two years. Google pledged iteration and feedback with three constituencies, users, publishers, and advertisers, as it built privacy-preserving and open-standard mechanisms to sustain a healthy, ad-supported web in a way that would render third-party cookies obsolete. "We plan to start the first origin trials by the end of this year, starting with conversion measurement and following with personalization."[16]

Microsoft's Internet Explorer is most neutral toward cookies. It lets users allow or disable tracking cookies, but at installation it allows them by default.

Exhibit 1 shows the market shares of browsers. The browsers that collectively hold 80% market share are all owned by firms that are part of the walled garden ecosystem. Therefore, when they block tracking cookies (Safari) or make it easy for users to block them (Chrome), they do much less harm to their own ad revenues than to the ad revenues of open web publishers. They can sell ad space to advertisers that performs well because it is targeted to user profiles, while open web publishers sell their space with less targeting information at commensurately lower prices.

[15] Justin Schuh, "Building a more private web," https://www.blog.google/products/chrome/building-a-more-private-web/, 2019

[16] Justin Shuh, "Building a more private web: A path towards making third-party cookies obsolete," https://blog.chromium.org/2020/01/building-more-private-web-path-towards.html, 2020

## Exhibit 1: U.S. Market Share of Web Browsers

| Browser | November 2019 Browser Market Share (Mobile and Desktop) |
|---|---|
| Chrome | 49.35% |
| Safari | 35.03% |
| Firefox | 4.21% |
| Edge | 3.95% |
| IE | 2.73% |
| Samsung | 2.42% |
| Android | 0.95% |
| Opera | 0.46% |
| Mozilla | 0.24% |
| UC Browser | 0.22% |
| Sony PS4 | 0.07% |
| Yandex Browser | 0.05% |
| Puffin | 0.04% |
| Chromium | 0.04% |
| Unknown | 0.03% |
| QQ Browser | 0.03% |
| Vivaldi | 0.02% |
| Pale Moon | 0.02% |
| Maxthon | 0.01% |
| IEMobile | 0.01% |

| Browser | November 2019 Browser Market Share (Desktop Only) |
|---|---|
| Chrome | 62.15% |
| Safari | 13.54% |
| Edge | 8.39% |
| Firefox | 8.37% |
| IE | 5.86% |
| Opera | 0.72% |
| Mozilla | 0.51% |
| Yandex Browser | 0.09% |
| Chromium | 0.09% |
| Vivaldi | 0.04% |
| Pale Moon | 0.04% |
| QQ Browser | 0.03% |
| Maxthon | 0.03% |
| Sogou Explorer | 0.03% |
| 360 Safe Browser | 0.02% |
| Waterfox | 0.02% |
| UC Browser | 0.02% |
| Coc Coc | 0.01% |
| SeaMonkey | 0.01% |
| Other | 0.03% |

| Browser | November 2019 Browser Market Share (Mobile Only) |
|---|---|
| Safari | 52.65% |
| Chrome | 40.46% |
| Samsung Internet | 5.02% |
| Firefox | 0.62% |
| UC Browser | 0.44% |
| Android | 0.27% |
| Opera | 0.25% |
| Puffin | 0.07% |
| Unknown | 0.06% |
| QQ Browser | 0.04% |
| IEMobile | 0.03% |
| BlackBerry | 0.01% |
| Yandex Browser | 0.01% |
| Edge | 0.01% |
| Other | 0.05% |

Source: https://gs.statcounter.com/browser-market-share/all/united-states-of-america/

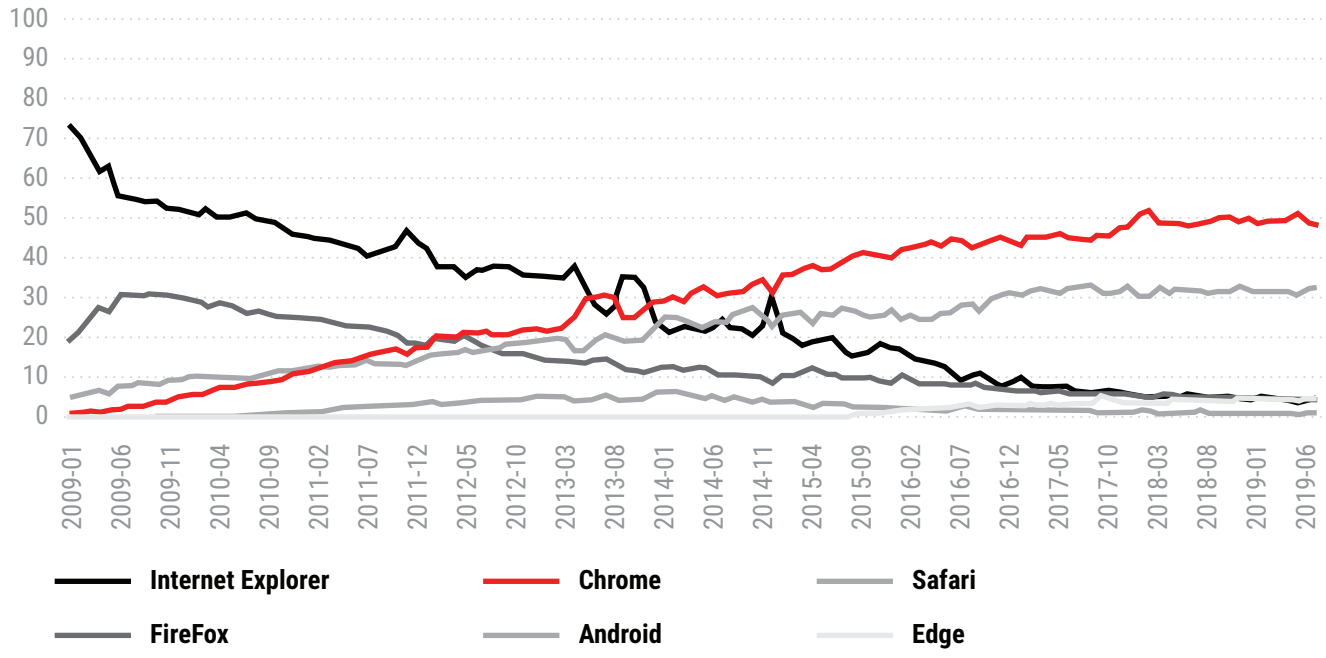
Exhibit 2 shows browser shares over the past decade. The story here is of the steady decline of Microsoft's Internet Explorer browser, the ascent of Google's Chrome browser, and the steady growth of Apple's Safari browser. Of particular interest to this paper's theme is what can be concluded about the likelihood that new browsers can take share.

Internet Explorer achieved its early dominance by being bundled with the Microsoft Windows operating system. The U.S. Justice Department challenged this bundling, and Microsoft decoupled the two products. The graph shows that the decoupling benefitted Firefox initially. At this time Google launched the Chrome browser. Despite the general perception that it was a faster and more fully featured product, few users saw immediate reason to switch.

Safari's growth correlates closely with the growing popularity of Apple's hardware with which it is bundled. That Apple's share of devices grew slowly from a very small base might explain why the U.S. Justice Department did not challenge this bundling.

Experience over the past decade suggests therefore that browsers are low-involvement products that appear to benefit from ties to related products and from user inertia. In recent years small privacy-centric browsers have been launched. None has yet disturbed several years of 80% share by the two walled garden firms, Google's Chrome and Apple's Safari. While browser shares have evolved unusually slowly over the past decade, it is possible that privacy is a feature that may alter that pattern.

**Exhibit 2: U.S. Browser Market Share, 2009 to Present**



## Measuring Consumer Perceptions of Tracking

To measure the (dis)utility of cookies to consumers, an economist conventionally tries to measure the willingness to pay to avoid being tracked or, in other terms, to pay for privacy. Several studies have attempted to get at the answer.

In an experiment by Beresford, Kubler and Preibusch (2012)[17] the experimenters offered shoppers a choice of buying a DVD at one of two competing online stores. The stores were identical except that one store asked the shoppers to report their income, and the second their favorite color. In one condition, both stores charged the same price, and in another condition, the first store was €1 less expensive. When both stores charged the same price, the stores attracted approximately equal numbers of customers, suggesting about half of the sample were reluctant to share income information. But when there was a price disparity, almost all shopped at the less expensive store. The study concludes that the privacy-sensitive half of the sample were unwilling to pay even €1 to preserve their privacy. The result was hard to reconcile with the findings of a study by Tsai, Egelman, Cranor and Acquisti[18] that suggested that consumers would pay a premium to buy from privacy protecting sites.

Acquisti, John, and Loewenstein (2013)[19] attempted a reconciliation by running an experiment that compared the price required to disclose (give up) personal information to the price required to protect (keep) it, an application of the classic 'endowment effect' in behavioral economics. This effect finds that for a typical personal possession the pain of losing it is psychologically about twice as powerful as the pleasure of gaining it. For privacy, Acquisti et al find that the inducement needed to give up privacy is almost 6 times greater than the inducement to keep it, which is close to 3 times the ratio commonly found in studies of regular private goods. They conclude that it is hard to value privacy, whether giving it up or keeping it, because people are unaccustomed to trade it directly as it is often bundled with other features of a transaction. In a more recent study Winegar and Sunstein (2019)[20] found a very similar result. Consumers would pay $5 per month to maintain data privacy but would demand $80 to allow access. They asked even more if the data was health-related.

Both papers argue that the choices people make about protecting or revealing their personal data should in this case not be trusted. Economists use the term 'revealed' preferences to describe the preferences revealed by acts of choosing in contrast to 'self-reported' preferences, and say that what people do is, generally, more trustworthy as an indicator of true preferences than what they say they would do. But Acqiusti, John, and Loewenstein (2013) and Winegar and Sunstein (2019) disagree when it comes to choices about privacy. These preferences are, they conclude, so malleable that they are of little value in designing policy interventions. Because of a lack of information and behavioral biases, both willingness to pay and willingness to accept measures are highly unreliable guides to the welfare effects of retaining or giving up data (Winegar and Sunstein, 2019). Instead, they reason, policy should be designed to protect people from their suboptimal decisions.

In conclusion, when it comes to allowing or rejecting tracking, peoples' choices are highly contextual, and in these contexts, people know their minds on the balancing of costs and benefits.

[17] Beresford, Kubler and Preibusch, "Unwillingness to pay for privacy: A field experiment," Economics Letters, https://econpapers.repec.org/article/eeeecolet/v_3a117_3ay_3a2012_3ai_3a1_3ap_3a25-27.htm, 2012

[18] Janice Tsai, Serge Egelman, Lorrie Craynot, and Alessandor Acquisti, "The effect of online privacy information on purchasing behavior: An experimental study," Information Systems Research, 2011

[19] Alessandro Acquisti, Leslie John, and George Loewenstein, "What is privacy worth?" Journal of Legal Studies, 2013

[20] Angela Winegar and Cass Sunstein, "How Much Is Data Privacy Worth? A Preliminary Investigation," https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3413277, 2019

## How Loss of Tracking Data Reduces the Revenues of the Marketing Ecosystem of the Open Web

The thesis of this section of the report is that availability of data from browsers is pro-competitive. It gives small marketers and publishers the same access to data as large publishers. Large publishers have many sources of consumer data and a variety of ways to match that data to consumers across sites and devices within walled gardens. Smaller and startup web properties do not have this matching ability. They rely on technology vendors to do the matching.

We propose, loss of tracking data will hurt two industries: the independent publishers (including startups), as well as the open web technology companies that handle programmatic ad technology, CRM, marketing technology, measurement and analytics, data suppliers, and full-service advertising agencies.
We analyze these two industries separately.

## 1. Impact on Publishers

Without browser data, publishers must sell their advertising space as undifferentiated audiences when they trade on the open web. Consequently, their space will fetch a lower price than when audiences are differentiated. In response, they will offer their space to be resold with profiling data by the walled gardens, but they will be what economists refer to as the 'price takers', or those who must accept the prevailing price in the marketplace as they do not possess the power or market share to set prices.

Absent tracking data and an alternative technical solution, revenues and profits of walled garden firms, which currently capture approximately two thirds of U.S. digital spending will rise, and the open web will decline to below the equilibrium it had established when armed with tracking data.

The methodology by which we reach our conclusions takes as its starting point a study by Deighton Associates commissioned by the IAB and published in 2016 that identifies the thousands of individual firms that collectively contributed $1.1 trillion to U.S. GDP[21] in that year. We benchmarked against a recently published quantitative study by the Bureau of Economic Analysis (BEA)[22] measuring growth in the U.S. digital economy. In addition, we consulted both academic and trade/industry publications, and report those sources in a bibliography.

We selected 18 sectors from the Consumer Services Layer of the 2016 study and a sector that we termed 'integrated firms' because they operated in multiple sectors. We estimated, sector by sector, the loss of advertising and ad-related employment that would result from the loss of tracking. We estimated the gain to those integrated firms that operated on walled garden business principles and therefore were not dependent upon third-party tracking. For the other large integrated firms, we assumed that, absent tracking, they would accelerate their evolution into walled gardens.

We used a bottom-up approach, by which we mean that we investigated the advertising revenues and employment of individual firms in the internet ecosystem, made judgments about the impact of loss of tracking data on each, and aggregated up to a total for the U.S. internet economy. We report on the firms not individually, but in the 18 sectors. We conclude that only 12 of the 18 earn any meaningful advertising revenues. For the integrated firms we separately analyzed the walled gardens and all others.

For each of the 12 sectors and individual firms we start with an estimate of internet-dependent revenues and employment from Deighton Associates' 2016 report. We update to 2019 at 20% per year, our forecast of growth to date in digital advertising,[23] and at slower rates from 2019 to 2025, as opportunities to take advertising revenue from analog media begin to be exhausted. We apportion total internet-dependent revenue into advertising revenues on behalf of third parties, and subscription and other non-advertising sources. Finally, we estimate how these third-party advertising revenues will decline as publishers find they fetch lower prices for their inventory when they have to sell ad insertion opportunities without profile data from tracking sources.

[21] https://www.iab.com/insights/economic-value-advertising-supported-internet-ecosystem/

[22] Barefoot et al, "Measuring The Digital Economy", U.S. Bureau of Economic Analysis, https://apps.bea.gov/scb/2019/05-may/pdf/0519-digital-economy.pdf, 2019

[23] Brian Weiser, "This Year Next Year: US Media Forecasts," Group M Intelligence, 2019

We derive our estimate of the price impact of loss of profile data from several studies. Johnson, Shriver and Du (2019)[24] in a paper forthcoming in the journal Marketing Science capitalize on a period in 2010 when some consumers took advantage of an offer by AdChoices to opt out of online behavioral advertising. Opportunities to advertise to these opt-out profiles fetched 52% lower prices than other profiles. Chen and Stallaert (2014),[25] in a game theoretic analysis, find that behaviorally targeted ads can command in some circumstances double the price of ads without such data. Beales and Eisenach (2014) estimate the premium at 66%, Goldfarb and Tucker (2011)[26] find a 65% premium. A Google study[27] found the premium to be 52%. A proprietary study by the ad exchange OpenX found that, over a week in which cookies were stripped from 3 billion impression opportunities, prices realized by cookie-less impressions were 51% lower. Finally, the ad technology firm Rubicon Project studied the price of ads targeted to Safari browser users during the two years since Apple introduced its Intelligent Tracking Prevention[28] feature. It found[29] that the prices realized by publishers selling to Safari users fell by over 60%, presumably because these users were not as well profiled as before.

Drawing on these studies we conclude that if tracking data were lost today (2019), a conservative assumption is that publisher ad revenues and associated employment will fall by an average of 50%. We assume that this lost revenue will be captured by the integrated firms, both walled gardens and all others, with the effect that their ad revenues will grow from a larger base by an average of 12%.

The 18 sectors of the ad-supported internet ecosystem are:

1. News and information publishers
2. Multi-genre content publishers
3. Specialized research and user-generated content publishers
4. Music streaming services
5. Streaming game sites
6. Streaming video
7. eLearning and online education
8. Retailing excluding Amazon*
9. Travel services
10. Financial services including banking, fintech, digital payments, and currencies*

[24] Garrett Johnson, Scott Shriver, and Shaoyin Du, "Consumer privacy choice in online advertising: Who opts out and at what cost to industry?," https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3020503 2017, revised 2019

[25] Jianqing Chen and Jan Stallaert, "An Economic Analysis of Online Advertising Using Behavioral Targeting," MIS Quarterly, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1787608, 2010, revised 2015

[26] Avi Goldfarb and Catherine Tucker, "Privacy and Innovation", National Bureau of Economic Research (NBER) Working Paper Series, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1866085, 2011, revised 2014

[27] Deepak Ravichandran and Nitish Korula, "Effect of disabling third-party cookies on revenue", https://services.google.com/fh/files/misc/disabling_third-party_cookies_publisher_revenue.pdf, 2019

[28] Jessica Davies, "WTF is Apple's latest anti-tracking update?," Digiday, https://digiday.com/uk/wtf-apples-latest-anti-tracking-update/, 2019

[29] Tom Dolan, "Apple's Ad-Targeting Crackdown Shakes Up Ad Market," The Information 2019

11. Platforms
12. On-demand economy workers*
13. Social media sites
14. Online Ddating
15. Employment services*
16. Human resources*
17. Productivity tools*
18. Government services*

We mark with asterisks those where we found no significant ad revenue from third parties (some asterisked categories do advertise but rely on first-party data only.) Exhibit 3 reports our conclusions about the 2019 and 2025 internet-dependent revenues, dividing them between third-party ad sales and subscription revenues. These revenues are the benchmarks against which to measure the loss of revenue if tracking data is no longer available.

In the sections that follow we justify the assumptions about each sector to be used in Exhibits 3 and 4.

**1. News and Information Publishers**

This sector of the internet ecosystem has a single-genre focus on information and/or news. We cluster established publishers with significant digital activity, such as Bloomberg, Thomson Reuters, Gannett, and The New York Times, with natively digital publishers such as Zillow, WebMD, Autoweb, and TheKnot. Overall, this sector earns three quarters of its internet-dependent revenue from contracts, such as viewer subscriptions and affiliate deals, but the business models of several members rely on display advertising, content marketing, and native advertising, all of which are vulnerable to loss of tracking information.

We estimate the 2019 revenue from advertising that benefits from tracking to be $5.3 billion.

**2. Multi-Genre Content Publishers**

As in the previous sector, this one combines legacy media companies and firms native to the digital era, working across diverse genres of entertainment content. We set aside Time Warner, Verizon, and Comcast for separate analysis in the category of Integrated Firms, so here we see legacy firms such as Viacom, Hearst, News Corp, and Disney dominating the sector while companies such as BuzzFeed and Vice Media represent the larger of the pure-play digital entrants. This is also the sector of the open web that plays the largest role in linking individual consumers to advertisers, and as such is most vulnerable if tracking is impeded.

The sector's response to these threats takes three forms in the extreme: retreat in the case of Verizon, integration in the case of Time Warner, and experimentation with native advertising and sponsored content in the remaining cases. There is some potential for subscription, following the model of Netflix, but there is a limit to how many subscriptions consumers will pay to receive entertainment. For example, a 2019 study on subscription payments for media products across three dozen countries and conducted by the Reuters

Institute for the Study of Journalism at the University of Oxford,[30] reported that in the U.S. just 13% of consumers did so on a regular basis.

We estimate the 2019 revenue from advertising that benefits from tracking to be $9.4 billion.

### 3. Specialized Research & User-Generated Content

In this category we analyzed firms such as Yelp, Hoovers, Angie's List, HomeAdvisor.com, Houzz.com, and Porch.com, which provided search services, aggregated information from third-party sources, and user-generated content in the form of reviews and recommendations. The majority of these sites are funded by subscriptions or commissions, but some, like Yelp, have significant revenue from advertising on behalf of third parties. The ability to target this advertising enhances value to the advertisers.

We estimate the 2019 revenue from advertising that benefits from tracking to be $870 million.

### 4. Online Music Services

Several streaming services offer both free and premium (subscription) versions. Pandora Media reports that three quarters of its revenue is from advertising and Spotify reports about 50%. iHeartMedia has an ad-supported streaming service in parallel with its radio business. Rhapsody (rebranded as Napster), Tidal, and Apple Music are currently not ad supported.

We estimate this sector's 2019 revenue from advertising that benefits from tracking to be $1.4 billion.

### 5. Games

From our analysis of the published statements of firms in this sector we conclude that online games earn, overall, about 15% of revenue from ad-supported games. The most significant of the firms with ad-supported models are Activision Blizzard, Electronic Arts, Zynga, and Ubisoft. TakeTwo Interactive and Nintendo of America depend on subscription.

We estimate this sector's 2019 revenue from advertising that benefits from tracking to be $0.5 billion.

### 6. Online Video

Netflix is unique among the large streaming video services for being entirely subscription-based as a standalone product. In recent years Vimeo has shifted its focus from a freemium model to subscription and software services. As of 2019, Disney has not yet entered this sector but is likely to be a large advertising generator in the coming years. Hulu, Vevo, YouTube, Snapchat, and Instagram (particularly its Instagram Stories component) are the current major ad-supported video publishers. (YouTube and Instagram revenues are reported in section 10, Walled Gardens, and Snapchat in Social Media.) Note that Hulu requires user authentication, but also relies on tracking data.[31]

[30] Newman, N., et al, Reuters Institute, Digital News Report 2019, https://reutersinstitute.politics.ox.ac.uk/sites/default/files/2019-06/DNR_2019_FINAL_0.pdf

[31] Erica Sweeney, "Report: Hulu tests performance-based measurements for advertisers," Marketing Dive, https://www.marketingdive.com/news/report-hulu-tests-performance-based-measurements-for-advertisers/545809/, 2019

We estimate this sector's 2019 revenue from advertising that benefits from tracking to be $1.8 billion.

**7. Travel Services**

Many firms in the travel industry have embraced the internet to deliver travel services. Some are paid services, but many depend on advertising. Travel booking and review sites, which include Expedia, Priceline, TripAdvisor, and Travelzoo are publishers of travel content funded by third-party advertising.

We estimate this sector's 2019 revenue from advertising that benefits from tracking to be $2.1 billion.

**8. Social Media Sites**

The largest of the social media sites have expanded in a decade from niche services to de facto home pages for billions of people worldwide. In this sector we group together social media platforms such as LinkedIn, Twitter, Pinterest, and Snapchat. Facebook and Instagram are not analyzed in this sector as they are walled garden firms.

As brands have sought new outlets for digital advertising, some of these sites have flourished. Others, including Digg and Foursquare, have lost advertising revenue as their subscriber bases shrank and/or their business models shifted.

We estimate this sector's 2019 revenue from advertising that benefits from tracking to be $4.9 billion.

**9. Online Dating**

A majority of online dating and matchmaking services, including Match.com, eHarmony, and Tinder earn some to most of their revenue from subscriptions. Others, including OKCupid and Plenty of Fish, are funded through advertising. An analysis of Tinder's revenue sources points to the role of advertising. Most Tinder users pay nothing. The minority who subscribe to its tiered services contribute 70% of revenue, and a la carte features earn a further 30%. But the high proportion of non-paying users still log in, giving a foundation for tracking, and Tinder's owner Match Group has been using programmatic advertising since 2017. Note that IAC Interactive has acquired many of the dating apps and that the firm is included in the multi-genre content section of this report.

We estimate this sector's trackable ad revenues in 2019 to be $0.4 billion.

**10. Walled Gardens**

Three publishers operate as walled gardens as defined earlier. They are Google, Facebook, and Amazon. We estimate the 2019 advertising sales to third parties of these three firms to be $74.5 billion.

**11. Large Integrated Firms**

We are isolating a group of large publisher firms here for separate analysis. They are AT&T, Comcast, Microsoft, Verizon, and Cox Communications. Each has the potential to operate as a walled garden and immunize itself from regulation of tracking but remains as of 2019 as a contributor to the open web. We estimate the trackable ad revenues of this sector in 2019 to be $19.9 billion.

## Exhibit 3: Benchmark Publishers' Revenues Assuming No Loss of Tracking

| | 2019 (All revenues in millions) | | | | 2025 (All revenues in millions) | | | |
|---|---|---|---|---|---|---|---|---|
| | Total internet dependent revenue | Employ't | Revenue from sale of ads | Subscr. and other non-ad revenue | Total internet dependent revenue | Employ't | Revenue from sale of ads | Subscr. and other non-ad revenue |
| News & Information | $31,446 | 82,559 | $5,300 | $26,146 | $62,069 | 162,956 | $10,461 | $51,608 |
| Multi-Genre Content | $33,874 | 59,428 | $9,400 | $24,474 | $66,861 | 117,300 | $18,554 | $48,307 |
| Specialized Research & User Generated Content | $1,612 | 6,967 | $870 | $742 | $3,182 | 13,752 | $1,717 | $1,465 |
| Online Music Services | $4,420 | 5,466 | $1,400 | $3,020 | $8,725 | 10,788 | $2,763 | $5,961 |
| Games | $6,347 | 15,004 | $500 | $5,847 | $12,528 | 29,616 | $987 | $11,541 |
| Online Video | $10,964 | 67,039 | $1,827 | $9,137 | $21,641 | 132,324 | $3,607 | $18,034 |
| Travel Services | $95,163 | 41,374 | $2,160 | $93,003 | $187,834 | 81,664 | $4,263 | $183,571 |
| Social Media Sites | $5,903 | 15,367 | $4,919 | $984 | $11,651 | 30,332 | $9,709 | $1,942 |
| Online Dating | $2,017 | 3,487 | $432 | $1,585 | $3,980 | 6,883 | $853 | $3,128 |
| Sum of Open Web Publishers | $191,746 | 296,691 | $26,808 | $164,937 | $378,471 | 585,615 | $52,915 | $325,557 |
| Integrated Firms | $162,905 | 502,966 | $19,908 | $142,997 | $321,546 | 992,766 | $39,295 | $239,820 |
| Walled Gardens | $126,827 | 391,576 | $74,490 | $52,337 | $280,374 | 865,650 | $164,674 | $115,700 |
| **TOTAL** | **$481,478** | **1,191,233** | **$121,206** | **$360,271** | **$980,391** | **2,444,031** | **$256,884** | **$681,077** |

In Exhibit 4 we present our conclusions regarding the impact on publishers' third-party ad revenue if they cannot sell impression opportunities enhanced by tracking data.

## Exhibit 4: Publishers' Revenue With and Without Tracking

| | 2019 | | | 2025 | | |
|---|---|---|---|---|---|---|
| | Benchmark publisher revenue from sale of ads with tracking | Estimate of publisher revenue from sale of 3P ads after loss of tracking | | Benchmark publisher revenue from sale of ads with tracking | Estimate of publisher revenue from sale of 3P ads after loss of tracking | |
| | | Upper bound | Lower bound | | Upper bound | Lower bound |
| News & Information | $5,300 | $2,915 | $2,385 | $10,461 | $5,754 | $4,708 |
| Multi-Genre Content | $9,400 | $5,170 | $4,230 | $18,554 | $10,205 | $8,349 |
| Specialized Research & User Generated Content | $870 | $522 | $418 | $1,717 | $944 | $773 |
| Online Music Services | $1,400 | $840 | $672 | $2,763 | $1,520 | $1,244 |
| Games | $500 | $300 | $240 | $987 | $543 | $444 |
| Online Video | $1,827 | $1,096 | $877 | $3,607 | $1,984 | $1,623 |
| Travel Services | $2,160 | $1,296 | $1,037 | $4,263 | $2,345 | $1,919 |
| Social Media Sites | $4,919 | $2,951 | $2,361 | $9,709 | $5,340 | $4,369 |
| Online Dating | $432 | $259 | $207 | $853 | $469 | $384 |
| Sum of Open Web Publishers | $26,808 | $15,350 | $12,427 | $52,915 | $29,103 | $23,812 |
| Integrated Firms | $19,908 | $22,325 | $22,941 | $39,295 | $43,882 | $44,902 |
| Walled Gardens | $74,490 | $83,532 | $85,838 | $164,674 | $183,898 | $188,170 |
| **TOTAL** | **$121,206** | **$121,206** | **$121,206** | **$256,884** | **$256,884** | **$256,884** |

Note: The upper and lower bound labels apply to the open web. They apply in reverse for integrated firms and walled gardens.

In Exhibit 5 we present our conclusions regarding the impact on publishers' employment caused by the projected revenue losses.

## Exhibit 5: Impact on Publishers' Employment by Revenue Loss

| | 2019 | | | 2025 | | |
|---|---|---|---|---|---|---|
| | Bechmark employment with tracking in use | Upper bound on employment after tracking eliminated | Lower bound on employment after tracking eliminated | Bechmark employment with tracking in use | Upper bound on employment after tracking eliminated | Lower bound on employment after tracking eliminated |
| News & Information | 82,559 | 45,407 | 37,151 | 162,956 | 89,626 | 73,330 |
| Multi-Genre Content | 59,428 | 32,685 | 26,742 | 117,300 | 64,515 | 52785 |
| Specialized Research & User Generated Content | 6,967 | 4,180 | 3,344 | 13,752 | 8,251 | 6,601 |
| Online Music Services | 5,466 | 3,279 | 2,624 | 10,788 | 6,473 | 5,178 |
| Games | 15,004 | 9,003 | 7,202 | 29,616 | 17,770 | 14,216 |
| Online Video | 67,039 | 40,224 | 32,179 | 132,324 | 79,394 | 63,516 |
| Travel Services | 41,374 | 24,824 | 19,859 | 81,664 | 48,998 | 39,199 |
| Social Media Sites | 15,367 | 9,220 | 7,376 | 30,332 | 18,199 | 14,559 |
| Online Dating | 3,487 | 2,092 | 1,674 | 6,883 | 4,130 | 3,304 |
| Sum of Open Web Publishers | 296,691 | 170,915 | 138,152 | 585,615 | 337,356 | 272,688 |
| Integrated Firms | 502,966 | 573,685 | 592,106 | 992,766 | 1,125,386 | 1,159,932 |
| Walled Gardens | 391,576 | 446,633 | 460,975 | 865,650 | 981,289 | 1,011,412 |
| **TOTAL** | **1,191,233** | **1,191,233** | **1,191,233** | **2,444,031** | **2,444,031** | **2,444,031** |

Note: As in the previous table, the upper and lower bound labels apply to the open web firms. Integrated firms and walled garden firms benefit from a loss of tracking data and the labels therefore apply in reverse.

In sum, an end to third-party tracking would, by 2025, diminish the annual revenues of smaller publishers by between $24 billion and $29 billion annually, an amount that likely would be captured by the walled garden sector.

## 2. Impact on Open Web Technology Within the Following Company Types: Ad/Mar-Tech, CRM, Measurement & Analytics, Data and Ad Agencies

The methodology by which we reached our conclusions here draws, as the previous section did, from the 2016 Deighton Associates study. We selected five sectors from the Consumer Services Support layer of that study. We estimated, sector by sector, the loss of revenue and employment caused by lower ad sales by their customers in the Consumer Services layer. We estimated how much of this loss would shift to firms that operated on walled garden business principles or would accelerate their evolution into walled gardens.

The five sectors are:

1. Full-service advertising agencies
2. CRM and martech vendors
3. Programmatic adtech vendors
4. Measurement and analytics
5. Data suppliers

Unlike the impact on publishing, there have been no studies to estimate how loss of tracking might affect these sectors. Our estimates of impact must necessarily be more tentative. We now discuss our assumptions.

**1. Full-service advertising agencies**

This group includes WPP, Omnicom, Publicis, IPG, and Dentsu. IbisWorld reports that the industry has 2019 revenues of $53.9 billion globally, of which we estimate U.S. revenues are about half and internet-dependent U.S. revenues are about $10.6 billion. Recent industry growth has been 2% annually. Disintermediation by the walled garden firms has been a contributing factor to this slow growth. We forecast that in the period to 2025, as the walled garden share of ad revenues increases with the loss of third-party tracking, disintermediation pressure will intensify. However full-service agencies are highly diversified, and their services include responsibility for monitoring client returns on walled garden expenditures, so we expect that loss of tracking will reduce their U.S. revenues by between 0 and 5%.

**2. CRM and martech vendors**

Customer relationship management and marketing technology firms range from very large, such as Salesforce and Adobe, to a number of small vendors. Our estimate of 2019 U.S. revenues is $17.3 billion relying on corporate accounts for the larger firms and trade press accounts for the others. All this revenue forms part of the internet ecosystem and is materially dependent on tracking of consumers over time and across devices. However, many CRM services make use of the first-party data held in client customer databases, so we anticipate that the impact of the loss of third-party tracking will be limited to customer reacquisition, online-offline identity matching, and some measurement tasks. While ultimately new identity solutions may be found, and partnerships with walled gardens may be negotiated, we project that from 10 to 15% of 2019 revenue is vulnerable.

### 3. Programmatic adtech vendors

The programmatic advertising technology industry, including DSPs, SSPs, and ad exchanges as defined earlier in this report, is the sector most vulnerable to the loss of tracking. Our estimate of the U.S. revenues of these firms in 2019 is $3.7 billion. Already some of them have been acquired by and integrated into publishers and content distributors for low multiples of revenue. Our estimate is that between 80% and 100% of their annual revenue will be lost to the open marketing ecosystem. While the work will not end, it will be performed as a means to other ends, such as ad attribution measurement, at close to its cost, or be done by equivalent services within walled gardens,

### 4. Measurement and analytics

Firms such as Nielsen, ComScore, and smaller and younger entrants such as Quantcast rely on tracking for many of their digital advertising services such as attribution. The firms themselves are well diversified, but some of their internet tracking services may cease to be unless alternative third-party tracking solutions are found or unless the cooperation of walled gardens can be purchased. We estimate that the digital offerings of this sector today generate $1 billion of revenue in the U.S. We forecast that between 80% and 100% of this revenue will be lost or absorbed into the walled gardens.

### 5. Data suppliers

Acxiom, Experian, Equifax, LiveRamp, and IRI are the largest firms in a sector generating internet-dependent revenues in the U.S. of about $5 billion annually. Their data brokerage services rely heavily on tracking technology to match online and offline identities, to provide CRM vendors with the data to perform services that require third-party data to enrich first-party data, and to augment the data management platforms used in programmatic advertising. We estimate that between 10% and 30% of their revenues would be at risk if tracking were discontinued.

Exhibit 6 shows the benchmark revenues in the ecosystem that supports the marketing efforts of brands, assuming no loss of tracking data.

**Exhibit 6: Benchmarks**

| | 2019 | | 2025 | |
|---|---|---|---|---|
| | Total U.S. Internet-Dependent Revenue $ | Employment | Total U.S. Internet-Dependent Revenue $ | Employment |
| Advertising Agencies: Full Service | $10,660 | 48,040 | $12,005 | 54,101 |
| CRM and Martech Vendors | $17,325 | 67,700 | $23,217 | 90,724 |
| Programmatic Adtech Vendors | $3,740 | 5,340 | $4,212 | 6,014 |
| Measurement and Analytics | $1,070 | 5,020 | $1,434 | 6,727 |
| Data Suppliers | $5,100 | 30,460 | $6,834 | 40,819 |
| **TOTAL** | **$37,895** | **156,560** | **$47,702** | **198,386** |

Exhibit 7 shows the annual revenue loss to the ecosystem of the open web implied by the assumptions made above. These are services valued by the marketers who pay for them, and it seems inevitable that the walled gardens will develop versions of these offerings that ride on their first-party relationships.

## Exhibit 7: Estimates of Loss

| | 2019 | | | | 2025 | | | |
|---|---|---|---|---|---|---|---|---|
| | Revenue loss relative to 2019 benchmark | | Employment loss relative to 2019 benchmark | | Revenue loss relative to 2025 benchmark | | Employment loss relative to 2025 benchmark | |
| | Low | High | Low | High | Low | High | Low | High |
| Advertising Agencies: Full Service | $0 | $533 | 0 | 2,402 | $0 | $600 | 0 | 2,705 |
| CRM and MarTech Vendors | $1,733 | $2,599 | 6,770 | 10,155 | $2,322 | $3,483 | 9,072 | 13,609 |
| Programmatic AdTech | $2,992 | $3,740 | 4,272 | 5,340 | $3,369 | $4,212 | 4,811 | 6,014 |
| Measurement and Analytics | $856 | $1,070 | 4,016 | 5,020 | $1,147 | $1,434 | 5,382 | 6,727 |
| Data Suppliers | $510 | $1,530 | 9,138 | 9,138 | $683 | $342 | 4,082 | 12,246 |
| **TOTAL** | **$6,091** | **$9,472** | **18,544** | **32,055** | **$7,522** | **$10,070** | **23,347** | **41,300** |

In sum, an end to third-party tracking would, by 2025, diminish the annual revenues across these company types by between $7.5 billion and $10 billion annually, an amount that might be captured by the walled garden sector to the extent that existing capabilities were insufficient to service the increased ad supply.

## Key Findings Summary

Tens of billions of dollars are at stake if third-party tracking ends without mitigation. The U.S. open web's independent publishers and companies reliant on open web tech would lose between $32 and $39 billion in annual revenue by 2025.

**Where Will It Go?**

1. $24 to $29 billion in annual publisher revenues would likely be absorbed by walled gardens (Google, Facebook, and Amazon), and by other leading companies in industries such as telecommunications that hold stores of first-party data and are close to becoming walled gardens themselves.
2. We estimate that those companies reliant on open web technology* will lose between $8 and $10 billion in annual revenues and the jobs associated with these revenues. Whether these jobs and revenues follow publisher revenues into the walled gardens, or whether the jobs will simply be lost to the U.S. economy, will depend on whether the technology infrastructure of walled gardens is adequate to serve the ad impressions no longer served by the open web, or needs to expand.

Either way, the $8 to $10 billion of annual revenue that has been the prize driving the open web's technological creativity over the last decade, would no longer be available to attract entrepreneurial risk-takers and venture investors.

* Programmatic adtech, CRM and martech, measurement and analytics, data suppliers, and full-serve advertising agencies

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