THE ECONOMICS OF ATTENTION MARKETS

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Abstract

The attention market involves competition in which platforms acquire time from consumers, with bundles of content and ads, and sell ads to marketers to deliver messages during that time. This paper shows that the attention market solves a transaction-cost problem that prevents efficient exchange between consumers and advertisers and that content plays a central role in solving that problem. The attention market contributes to consumer welfare by supplying valuable content, which more than compensates for any nuisance value of ads, and by facilitating competition through the provision of ads. This paper shows that American adults will spend more than 500 billion hours on ad-supported content in 2019. The value of content is measured in the trillions of dollars given the opportunity cost of time; recent studies of the consumer valuation of online media are consistent with that order of magnitude.

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In the "attention market" consumers supply time in return for content that entertains or informs them. Advertisers demand attention so they can deliver messages that will increase their sales and profits. Attention platforms assemble bundles of content to acquire that time and sell advertisers access to those consumers. This paper describes how the attention market uses content to facilitate efficient exchange between consumers and advertisers, estimates the role of the attention market in the economy, and shows that this market accounts for considerable consumer welfare through the provision of content and by making competition more intense.

The attention market is a substantial part of the economy. In 2019, Americans adults will spend 514 billion hours during which they will engage mainly with content interspersed with ads compared to 325 billion hours working.[2] The opportunity cost of that time, which indicates the consumer willingness to spend that time, measures the size of the attention market in the same sense that other markets are measured for national income accounts. Using $13.60 an hour, a figure based on a survey by the U.S. Department of Transportation of time-value studies, yields $7.0 trillion as a rough order of magnitude for 2019. Several economic studies of the consumer valuation of online ad-supported media are consistent with this order of magnitude.

Of course, people are exposed to ads during the time they spend on attention platforms. A myopic consumer may dislike being exposed to an ad while enjoying content. By revealed preference, however, the content more than compensates them for their time on average. Moreover, consumers cannot get the benefit of content from attention platforms without the ads any more than they can get the benefits of boxes of cereal without paying for them. A myopic consumer also doesn't count the benefit they receive as a result of greater competition facilitated by advertising. Even consumers who do not interact with advertising benefit from greater

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[2] Calculations and sources discussed below.

competition and thereby realize positive externalities from those who do. None of this is meant to claim that the attention market, as with any market, is perfect. Various market failures, such as deceptive terms for using personal data, could result in the attention market falling short of maximizing social surplus.

This paper has four sections in addition to this introduction and a conclusion. Section I shows that the attention market is a solution to a transaction-cost problem that prevents efficient exchanges between marketers and consumers. It demonstrates that content is central to how attention platforms solve this problem and thereby increase welfare for advertisers and consumers.

Section II describes the economics of attention platforms based on the relationship between content, time, and advertising. It shows that that ads on platforms do not give rise to negative indirect network effects as is sometimes stated in the two-sided literature. It then presents a simple model that describes the broad features of the attention market in which platforms are price takers for buying time and selling access to it.

Section III uses the economic theory of value of time allocation to provide a framework for estimating the total size of the market. The opportunity cost of time measures the willingness to pay for the time required to consume content and is therefore similar to the monetary price for ordinary goods. The product of the opportunity cost of time and the amount of time provides a measure similar the standard revenue rectangle used for national accounts. Section III implements this approach for the U.S. for 2019 to estimate the size of the attention market and shows that the results are consistent with recent studies of consumer surplus for digital media.

Section IV observes that ads benefit consumers directly and indirectly by facilitating competition. It argues that even though people may not like individual ads they benefit

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collectively, at least from informative ads, and that individuals who engage with these ads create positive externalities for those who don't. A summary of available published studies over many decades on the impact of retail ad restrictions on prices and other dimensions of competition provides support that ads benefit consumers through lower prices.

This paper is related to several economic literatures. There is a long literature which focuses mainly on whether there is a market failure in the provision of advertising; see Bagwell (2007) for a summary. The focus here is explaining what economic problem the attention market solves and how it generates welfare; as with any market it could also be subject to some market failures. The two-sided literature (see the excellent summary by Anderson and Jullien 2016) focuses on modelling the relative prices charged to consumers and advertisers and the proportion of ads. This paper treats platforms as two-sided but emphasizes the role of supplying content to procure time and the resulting positive feedback effects between advertising and content. Finally, there is a nascent literature on attention markets that also focus on the buying and selling of scarce attention and dynamic competition among attention platforms; see Evans (2013, 2019), Murphy and Palacios-Huerto (2016), and Boik, Greenstein, and Prince (2017) This paper complements those but focuses on the relationships between content, time, advertising, and welfare.

I.   The Attention Market and Transactions Costs

An advertisement is a message that a marketer would like to deliver to a consumer. The marketer expects that message will make it more likely that the consumer will buy the marketer's product and thereby increase its profits.

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A. Solution to the Transaction Cost Problem

Consider a world in which there are no advertiser intermediaries. The consumer would value receiving the message if it contained relevant information that could increase her utility by enabling her to make a better selection or get a better price. Suppose, however, the consumer does not want to receive the message, which uses scarce attention, because she expects the message will lack relevant information, or she will find it annoying. This corresponds to the common assumption that an advertisement is a source of disutility.

There is a first-best efficient outcome in the absence of transactions costs. The marketer would pay up to p_M to deliver the ad to the consumer who must consent to receiving it. The consumer would pay up to p_C to avoid the ad.[3] If $p_M > p_C$ there are gains to trade. So long as the marketer makes a side payment of more than p_C and less than p_M, the consumer will take delivery of the ad and the consumer and marketer will both be better off. For example, if $p_M = \$3$ and $p_C = \$1$ the marketer could pay the consumer \$1.50 to receive the ad giving the marketer a surplus of \$1.50 and the consumer a surplus of \$0.50.

Transactions costs, however, get in the way of this bilateral exchange. It is costly for a marketer to identify a consumer for whom there is a beneficial exchange. Even if a marketer could do so, it would be expensive to enter into bilateral negotiations. Having succeeded the marketer would find it costly to ensure that the consumer gives the message any attention. The conditions for the Coase Theorem fail. In fact, that could happen even if the consumer likes some ads simply because it is hard to find the consumer who would agree to receive the message and there are costs of negotiating a deal.[4]

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[3] Or equivalently, would need to be paid more than p_C to accept the ad.

[4] There is empirical evidence that consumers do not dislike some newspaper and magazine ads. See Chandra and Kaiser (2016). Nevertheless, even these platforms typically pay consumers to be exposed to ads in the sense that the consumers pay less than the cost of creating and distributing the content.

Two possible consequences follow from failure of the conditions for the Coase Theorem. Valuable exchanges don't happen. Marketers cannot deliver ads to consumers. Marketers and consumers therefore don't realize the potential gains from trade. Alternatively, it is also possible that consumers don't get the side payments, but they can't avoid ads they don't want. Consumers then experience a classic negative externality—a decrease in their utility for which they receive no compensation.

B. Making a Market

Attention platforms solve these transaction problems across many consumers and advertisers. They make a market. They also provide an alternative method of sending marketing messages that doesn't involve impose a negative externality on the recipient. As Rochet and Tirole (2006) observe the failure of the Coase Theorem is a necessary condition for a two-sided platform.

Before the development of modern advertising, marketers imposed negative externalities on consumers. In medieval times, for example, businesses relied on criers who used bullhorns to advertise goods in the streets.[5] Assuming that irrelevant and annoying ads are not a modern invention, these criers likely imposed uncompensated costs on people. At least through the mid-19th century, marketers relied on billstickers that posted ads on buildings. One historian describes them as a "nuisance of the most intolerable kind" and their "disfigurative work was a prominent feature of the metropolis."[6]

The emergence of newspapers in the 18th century provided a substitute for advertising methods that imposed negative externalities. Newspapers published news and entertainment for readers. They also printed ads for businesses as well as personal classified ads. Although newspapers charged for each copy, which was then often shared among several readers, by the

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[5] Sampson (1874), pp. 46.
[6] Sampson (1874), p. 25. He is referring to mid-19th century London but it appears the practice was longstanding.

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end of the 18th century they made money mainly from ads.[7] By 1837, London, with about 1.8 million people, had 93 newspapers with an annual circulation of 15.1 million copies.[8] They printed 292 thousand ads that year.

The early newspapers introduced the key innovation for reducing transactions costs between marketers and consumers. The newspaper paid the consumer for their attention by providing news and entertainment at a price that did not cover the costs of doing so. The newspaper then sold ads that were inserted in the paper and grabbed the attention of some readers.

The early newspapers thereby made a market in ads for marketers and consumers.

C. The Role of Content

Content has played a central role for solving the transaction cost problem for advertising ever since the emergence of early newspapers. It is a particularly efficient device for facilitating efficient exchanges between marketers and consumers.

Content attracts consumer attention. Consumers have to invest time to enjoy content. They can be exposed to ads while they do that. The opportunity for doing so increases with the amount of time they spend. More pages in a newspaper attracts more time.[9]

Content and ads are supplied jointly in the same medium, such as ads on a newspaper page. This gives rise to an economy of scope between selling content, which is used to buy attention, and selling ads, which tap into that attention. A search engine, for example, can divide a search engine results page into space for natural search results and paid search ads.

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[7] Sampson (1874) referring to the last half of 18th century England observes, "All this time advertising was a growing art, and advertisements were beginning to make themselves manifest as the main support and chief source of profit of newspapers, as well as the most natural channel of communication between the buyers and sellers, the needing and supplying members of a vast community." Id., p. 4.
[8] Sampson (1874), p. 11
[9] For newspapers this is less true to classifieds which are often segregated so that the consumer could examine these ads directly without spending time going through the paper.

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There are significant scale economies in using content to attract attention. Magazines print an edition that contains the same content for all readers. They incur a fixed cost for creating the content. The same content will typically attract multiple readers even if all readers do not like all content.[10]

Content facilitates matching between consumers and advertisers. A newspaper can place ads on pages that have content that is more likely to attract the attention of relevant readers. Having separate sections is one way to do that. A television show can also specialize in particular types of viewer such as those interested in financial markets.

Modern ad-supported media businesses use content in these ways to provide an efficient market for ads.

II.   Economics of Attention Platforms

Attention platforms use content to get consumers to spend time on their platform and sell marketers the ability to expose these consumers to messages.

A. Content, Time, and Ads

Attention platforms provide bundles of contents and ads such as on a newspaper page, a 30-minute radio program, or a search-engine results page.[11] The platform can vary the number of bundles it produces such as increasing pages in the newspaper or providing a thicker magazine. Attention platforms can also vary the value of each bundle by providing more or better content. For simplicity, it is useful to consider a bundle as the price the attention platform offers the

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[10] Many people found newspapers valuable in part because publishers could bundle content some of which appealed to enough people to make it worth their reading the paper. For a discussion of bundling strategy for information goods that increases audience size see, Bakos and Brynjolfsson (1999).

[11] See Murphy and Palacios-Huerta (2016) for an analysis of how media businesses design these bundles of "goods and bads".

consumer in exchange for a unit of time and to assume that the platform does not impose any monetary fees.[12] To acquire more time the platform offers more bundles.

There is a fixed physical or temporal capacity constraint for each bundle. Since content and ads are jointly delivered in discrete parts of the space, an increase in the amount of space devoted to ads results in an exact opposite decrease in the amount of space devoted to content. To show more ads the platform has to either increase the number of bundles or decrease the amount of content in a bundle, thereby making it less attractive and lowering the price offered to consumers for their time. The platform could also compensate for an increase in ads in a bundle by an offsetting increase in the quality of the remaining content, thereby leaving the price the same.

There are scale economies in producing content for each bundle since the same content is used to attract time from many people. There may also be scale economies in supplying bundles at least through some range. Some platforms such as radio and television have binding constraints on the ability to increase the supply of bundles as a result of ownership regulations and spectrum constraints. Others don't.

Advertisers value presenting messages to more consumers who are likely to be interested in or influenced by its messages. The usual scale vs. density considerations arise (Evans and Schmalensee 2016, Weyl and White 2018). Advertisers value getting access to a dense group of consumers who are likely to be interested in their product and of course the more of them the better. There are fixed costs for engaging with a platform and mounting advertising campaigns (Evans 2009). It is well established that advertisers pay more to reach a larger audience. As

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[12] Many attention platforms don't charge monetary prices. Those that do charge for access to a collection of bundles. For example, cable television companies charge a monthly fee that allows consumers to access many channels, which are supplied by diverse ad-supported media companies, each of which provides 24/7 content. Conditional on the monthly fee, that cable subscriber does not pay for spending time watching ad-supported media.

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usual for two-sided platforms, there are positive indirect network effects, in this case of consumers on advertisers.

Based on common experience, most consumers interact with some advertising and value advertising messages that are relevant to them. All else equal, they would prefer a platform that provides more relevant messages. Two issues lead to the situation in which consumers have to be paid to expose themselves to bundles with ads.

First, the fixity of physical and temporal space for the bundle, and the economies of using the same content to reach many viewers, leads many attention platforms to include messages in a bundle that aren't relevant to some potential consumers of the bundle. Second, a consumer cannot know until she pays attention to a message whether it is valuable to her and has learned from experience that ads are often just a nuisance. Sophisticated online targeting methods haven't solved these problems. Click-through rates on targeted ads are very low, and consumers complain about online ads.

Nevertheless, consumers benefit from advertising, generally, because the demand for their time, for which they are paid with content, is derived from the demand by advertisers to present messages to them. An increase in the demand for advertising from the platform can result in an increase in consumers getting more bundles of content such as larger newspapers, more issues of a magazine, or more content on a web site. An increase in the willingness to pay for an advertising spot also increases the value of the time acquired from a given bundle. The platform has an incentive to increase the value of the content by reducing the amount of space devoted to ads or increasing the quality of the content. This relationship between content, time, and advertising leads to a positive relationship between the demands by users on the two sides of the platform.

B. Negative Indirect Network Effects

Advertisements may still be nuisance, but they do not create a negative externality. Ads are not imposed on passive consumers; they are bundled with content by platforms, and consumers voluntarily consume those bundles. At least in equilibrium, consumers are not exposed to advertising on attention platforms without receiving full compensation in expectation. Consumers interact with attention platforms repeatedly and can make judgments on whether consuming bundles from any particular platform that include ads is likely to be worth the time. Of course, a platform could unexpectedly increase the number of ads, and thereby change the terms, but once the consumer knows this, she can decide whether to continue to use the platform or not. Getting less consumer surplus from an otherwise beneficial exchange does not make a negative externality.[13]

An indirect network effect arises when, all else equal, an increase in the number of one type of users increases or decreases the value received by the other types of users. All else cannot be equal in the case of ads on attention platforms, however. Putting changes in the quality of content aside, an increase in ad space in a bundle results in an equal and opposite decrease in content space in that bundle and thus a decrease in the price consumers receive for spending time on that bundle. Thus, the ads on attention platforms also do not give rise to negative indirect network effects as is often asserted in the two-sided literature (see Anderson and Jullien 2016 for a recent survey) including previous papers by the author.

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[13] As noted earlier, this paper does not take a position on whether the attention market achieves a social optimum and whether the provision of ads is perfect in that sense. Market failures could arise that result in consumers attaching a net negative value to the marginal ads plus the content that would not exist but for the marginal ad.

C. The Attention Market for Buying and Selling Time

To maximize profits an attention platform has to determine the price it will pay for time, which is determined by the composition of the bundle, and the amount of time to purchase, which is determined by the number of bundles it offers. And it has to determine jointly the price that it will charge advertisers for spots in the bundles, the amount of space in each bundle, and the number of bundles to supply.

To provide an overall description of the attention market, consider the case where attention is homogeneous from the standpoint of advertisers and diminishing returns in producing content and selling ads limits the size of platforms. There is a buy-side market in which platforms acquire consumer time and a sell-side market in which platforms sell slices of that time to marketers. With sufficient competition, attention platforms are price-takers on the sell side. They charge advertisers a competitive price to insert their advertising messages into the bundles attract time. That leads to a derived demand for consumer time.

With sufficient competition, platforms are also price-takers on the buy-side. They offer consumers a competitive bundle of content and ads, net of any price, for a unit of time. The buy-side can be viewed equivalently as a market in which attention platforms are selling consumers content-ad bundles and the consumers are paying with their time (and perhaps some money too).

This competitive buyer-seller model is consistent with broad features of the overall market for attention. Anyone starting a new print magazine, radio station, or online property faces a predictable market price for advertising.[14] Given that advertisers tend to equalize the return-on-investment in advertising across channels, there is also some predictability of pricing

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[14] For an early article on this see Fisher, McGowan, and Evans (1980) who show the relationship between revenue and audience for local television stations who supply a fixed amount of advertising time. Of course, some large advertisers have some bargaining power as a result of their unique control over access to a large number of users.

across types of media.[15] The opportunity cost of time across many individual for similar media is also predictable. As a result, the value of the bundle of contents and ads needed to attract consumers are likely to be fairly predictable.

The buyer-seller model does not require that content be homogeneous. Attention platforms can compete by offering different types of content to attract time. That could arise because consumers have heterogeneous demands for content or because consumers like diversity in content. Evans (2013) and Boik, Greenstein, and Prince (2017) find, for example, that consumers have switched their attention over time between different types of online content. These results are consistent with platforms competing for a relatively fixed amount of attention by developing alternative forms of content.

Imperfect competition arises for several reasons and results in more fragmented and concentrated attention markets. Supply-side scale economies in creating and distribution content and operating platforms result in larger firms.   Greater advertising demand results in platforms generating more content which results in more consumers; greater consumer demand results in the platform getting more advertising demand which results in more content and therefore more consumer attention. Advertisers are willing to pay more to platforms with more consumer attention as a result of indirect network effects. Attention platforms are differentiated because they specialize in particular types content to match consumers and advertisers or have differentiated particular methods of serving ads that appeal to consumers and advertisers in particular circumstances. While the simple model in which platforms buy and sell attention competitively highlights key features of the attention market it obviously masks important details for particular media.

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[15] See, e.g., Tucker (2013).

III. The Size of the Attention Market[16]

Determining the size of a typical industry in the economy is straightforward. People buy N units at a price of p. The industry generates revenue of p x N. The rectangle provides the measure of value to consumers because, based on revealed preference, it reflects the minimum value they place on those units. For measuring gross domestic product (GDP), the government calculates these revenue rectangles across industries. Of course, there is consumer surplus on top of this. It is not directly observable but is a similar order of magnitude to the rectangle for plausible demand schedules.[17] Economists have estimated consumer surplus for some industries, although doing so precisely generally requires strong assumptions on functional forms of demand.

As is well recognized, the standard framework breaks down for attention markets; see Goolsbee and Klenow (2006). Consumers often get content for free or at a subsidized price. Therefore, there is no direct measure of the value of the content. Content itself is highly heterogeneous. It ranges from reading a Facebook newsfeed to watching an episode of an ad-supported television show. Nor is it generally possible to estimate consumer surplus from variations in monetary prices along demand curves.

This section uses the fact that attention markets are based on trading content for time (T) to measure the output of content in attention markets and the opportunity cost of time (w) to measure the size of attention industry (w x T) in a similar way to measuring the size of other industries. The basic approach is shown in Figure 1. While the time-value method cannot provide precise estimates of the size of the attention industry, in the sense used in national income account calculations, it is good enough to establish that the industry is a substantial part of the US economy.

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[16] An earlier version of this paper reported calculations for 2016; those estimates are available in Evans (2019).

[17] In the standard partial-equilibrium setup, both the change in consumer expenditure and the change in social surplus are approximately quadratic in the shift in the supply curve (with the approximation becoming exact as the shift in supply becomes small). (Harberger 1971).

In fact, the amount of time devoted to it and the value of that time is enormous. This section also

shows that order of magnitude of the rectangle is consistent with the order of magnitude of studies

online media.[18]

Figure 1: Consumer "Spending" and Consumer Surplus for Attention Platforms
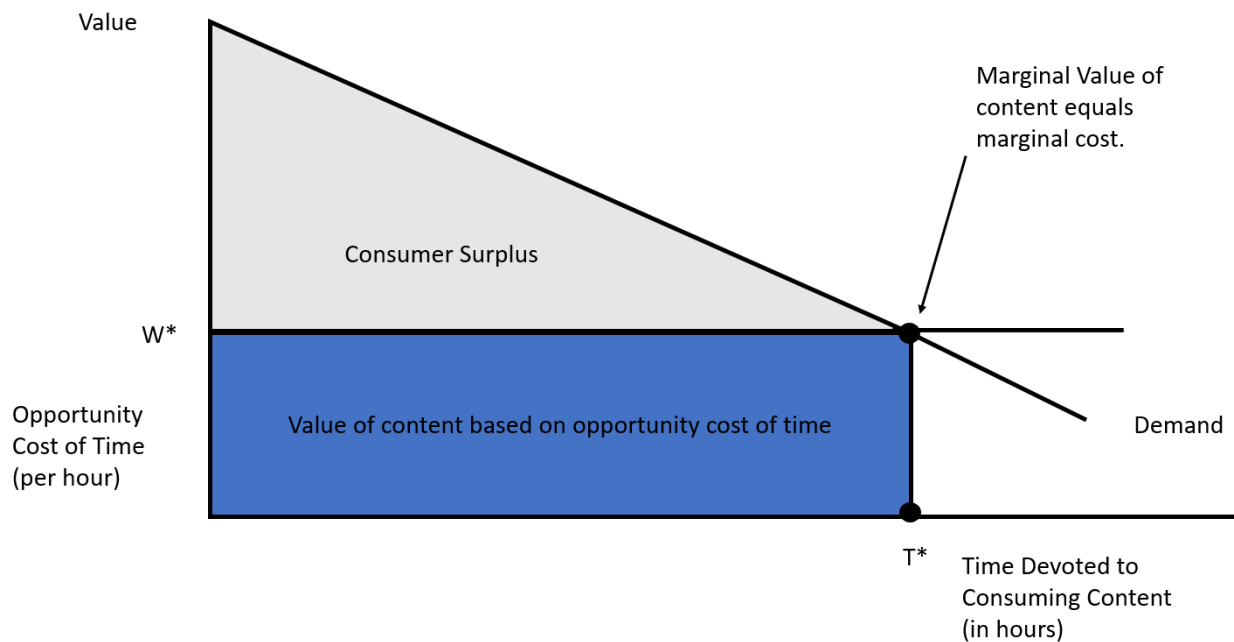

A. Supply of Time to the Attention Market

The average American adult spent an average 11.5 hours a day in 2019Q1 during which

they were exposed to major media.[19] As shown in Figure 2, consumers spent most of their time

watching television, consuming content with a mobile app or from a website and listening to the

radio.

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[18] Appendix B describes the data sources and calculations for this section in detail.

[19] Nielsen (2019) obtains these estimates using representative panels of US families. Separate panels are recruited for each media, and where possible, panelist usage is measured passively using devices provided by Nielsen (national and local people meters for television, portable people meters for radio, Digital Audience Measurement for desktop and mobile device usage). Id. at 24-27.

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Figure 2: Average Hours Per Day Spent Consuming Media Per American Adult, 2019Q1
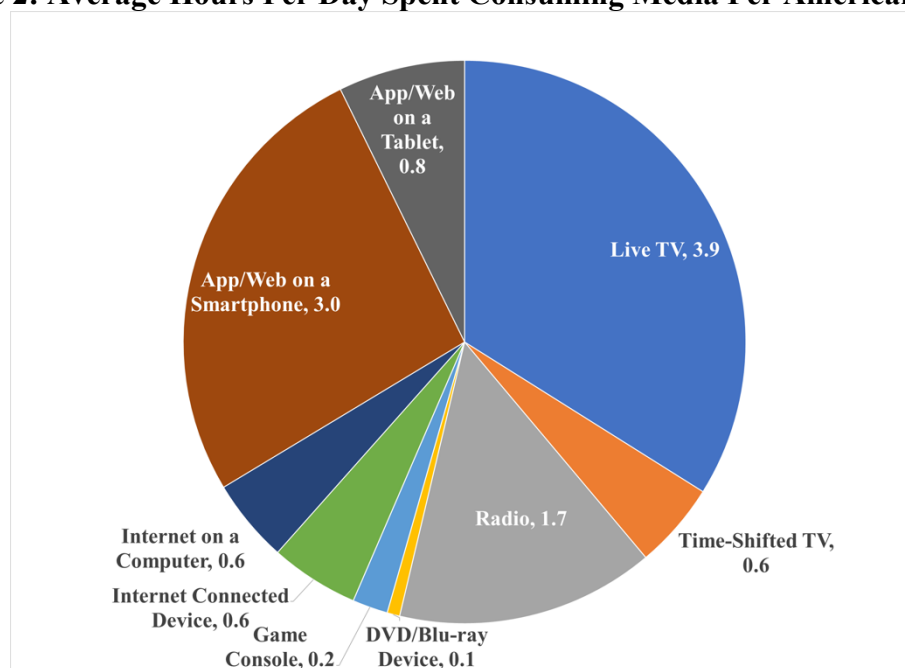
Source: Nielsen (2019) at p. 3.

Some of this time was spent on media that do not present advertising such as pay television, satellite radio, and subscription streaming services. A conservative estimate described in Appendix B puts the total amount of time spent on ad-supported content at about 8.8 hours per day. That amounts to 37 percent of total time available for adults and 76 percent of total time excluding work and sleep based on the American Time Use Survey (BLS 2018).[20]

People often have media playing in the background while engaging in other activities. They may listen to the radio while driving to work, have the television on while cooking, and check their social networks while at work. The time they spend in this way is still valuable to them because they could be engaged in other activities such as listening to an audiobook or chatting with others in their care. The amount of time during which they are mainly consuming

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[20] Data on hours per day spent sleeping and working by adults comes from Bureau of Labor Statistics, "American Time Use Survey, 2018," https://data.bls.gov/cgi-bin/srgate.

content, however, provide a more consistent and conservative estimate of the size of the attention industry.

According to BLS (2018), the average American adult spends 2.8 hours per day "mainly watching television" compared to the 4.5 hours per day spent watching TV reported by Nielsen. Assuming that consumers spend the same ratio of time mainly engaging in activities identified by Nielsen but not by the ATUS yields a total amount of time devoted mainly to media consumption of 7.3 hours of which an estimated 5.6 are ad supported.[21] That amounts to 24 percent of total time and 49 percent total time excluding work and sleep.

Based on these figures, American adults will spend 514 billion hours in 2019 during which they mainly consume ad-supported content. By comparison, American adults worked approximately 325 billion hours in 2018, which is likely to be similar for 2019. Therefore, American adults spent about 58 percent more time mainly consuming ad-supported content than they spent working. They will spend 805 billion hours including the time when American adults were mainly focused on another activity.

By this measure, the ad-supported media industry is an enormous part of the U.S. economy. It generates the content that takes up much of the time people don't spending working or sleeping.

B. Economics of Time Allocation

Of course, time is money (Franklin 1748). The economic theory of household production (Becker 1965) provides the basic building blocks for analyzing the value to consumers of the time

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[21] These numbers were calculated by discounting the figures reported in the preceding paragraph (11.5 hours per day spent on all media and 8.8 hours per day spent on ad-supported media) by a factor of 2.84 / 4.45 = 0.64, which is the ratio of time spent watching television reported in the ATUS data (which assigned multi-tasking time to the main activity) to the time spent watching television in the Nielsen data (which counted all time spent watching each media, even if other activities were done at the same time). Television watching is used for this adjustment because it is the only activity that exactly matches between the Nielsen and ATUS data. The nearest other match is "Internet on a PC" (Nielsen) to "Computer use for leisure" (ATUS). Ignoring the differences between them and adding this time to the TV would yield an adjustment factor of (2.84 + 0.47) / (4.45 + 0.55) = 0.66.

they contribute to the attention market. Consumers use their time to work outside the home, and make money, or in combination with other goods to create value. They could use the time they don't spend working outside the home, or sleeping, for household production, like cooking, where time is a substitute for market goods, like microwaves. They could also use time for leisure, like watching a movie, where time is a complement for market goods. Of course, consumers have a finite amount of time and must allocate it across competing uses.

In the basic model, people derive utility from a range of commodities, $c_1, c_2, \ldots c_N,$ where each is produced through a combination of market goods x_n and time $h_n,$ so that $c_n = f_n(x_n, h_n)$.[22] People can also engage in market work and earn income equal to the wage rate w times the amount of labor they supply L. People must allocate their scarce time across the production of these commodities and labor. The commodities refer to activities such as cleaning the house, which involves various cleaning products and time, or drinking wine, which requires wine, a glass, and time to sip. Commodities vary in how time intensive they are, and in the extent to which time is a substitute for market goods (microwave and cooking) or a complement (a big screen television and watching football).

It is useful to decompose the allocation of time into market labor, household production, and leisure.[23] The boundaries between these categories aren't always clear and could vary across people. As a rough approximation, though, market labor provides the income necessary for buying the market goods that are inputs into the commodities people consume; people don't like household work but it can be more efficient to do it themselves than hire others; and people enjoy spending time on leisure activities. Time is typically a substitute for market goods used for

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[22] This discussion is based in part on Aguiar and Hurst (2007).
[23] This excludes sleep time, although there is some evidence that consumers sleep less when the cost of doing so is higher. See Biddle and Hamermesh (1990).

household work and a complement to market goods for leisure activities. Economists have used this basic model to study secular changes in labor supply, household work, and leisure.[24]

The economic theory of time allocation provides insights into the value of time invested in leisure activities.[25] Consumers allocate time to wage work until the marginal rate of substitution between consumption and leisure equals the marginal after-tax wage rate, which therefore provides a monetary measure of the value of time. At this point, the value of the last dollar spent on leisure, in terms of foregone after-tax wage earnings, is just equal to the value of the last dollar spent on market goods.[26]

At the margin, the total value consumers obtain from a consumption activity, including leisure, must be at least equal to the amount they spend on market goods plus the value of the time they devote to the activity. Otherwise they could improve their welfare by reallocating their money or time expenditures. Consider a consumer, for example, who spends 250 hours a year at the gym and pays an annual membership fee of $2000. The value of that activity to the consumer must at least equal the shadow value of those hours, which could be spent working and earning money or in different leisure activities, plus the out-of-pocket cost. Of course, the value is probably greater than this amount, which results in consumer surplus.

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[24] Several studies have found that over long periods of time people work outside the home less, spend less time working in the home and spend more time on leisure activities. Some authors argue that these trends are likely the result of increases in real wages and technological change. The increase in real wages increases the opportunity cost of leisure but also increases total income; on net, the income effect dominates the price effect. Technological change economizes on household work time (the invention of the washing machine for example) and increases the returns from investing time in leisure (the invention of video games for example). See Aguiar and Hurst (2007) and Greenwood and Vandenbroucke (2005). Also see Francis and Ramey (2009) for a related analysis that focuses on per capita use of time and is related to the economic growth literature.

[25] The neoclassical theory of labor supply provides similar insights in a model that treats market goods and leisure as separate. See Ehrenberg and Smith (1994), Chapters 6-7.

[26] The before-tax wage, on the other hand, measures the marginal product of labor and therefore the opportunity cost to the economy of time devoted to leisure. See Aguiar and Hurst (2007) for further discussion and for calculations of the value of leisure based on the before and after-tax wages.

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C. Willingness to Pay for Content with Time

Consumers incurred an opportunity cost when they chose to devote their time to consuming ad-supported media. They could have worked more. The average American adult worked 25 hours a week and the average employed American adult worked 40 hours a week in 2018.[27] They could also have engaged in other leisure activities or done household work.

The standard theoretical framework for valuing time uses the after-tax marginal wage rate. Economists often use the after-tax average wage rate as a proxy (Aguiar and Hurst 2007). The average hourly earnings among private sector employees was $27.10 during 2018.[28] After taxes, average hourly earnings were $19.65 in 2018.[29]

The estimates reported here rely on a lower number that better reflects the marginal value of time. There is an extensive literature assessing the value of travel-time savings based on the choice of different transportation methods that differ in time and monetary costs. The savings reflect the value of time during which people may be engaged in other leisure activities such as reading a book or listening to music. It therefore reflects roughly the opportunity wage minus the value of possible leisure activity and, since it is conditional on the amount of time people are currently working, the marginal opportunity cost.

The U.S. Department of Transportation (2016) periodically surveys this literature and uses the results to provide estimates of the value of time savings for the purpose of evaluating investments in transportation infrastructure projects. The estimates vary depending on the mode

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[27] Hours worked for the average employee is calculated as the average time spent working per week as reported in BLS (2018), divided by the average civilian labor force participation rate of 63% during 2018. See Bureau of Labor Statistics (2019) "Civilian labor force participation rate," https://www.bls.gov/charts/employment-situation/civilian-labor-force-participation-rate.htm.

[28] Federal Reserve Bank of St. Louis, "Average Hourly Earnings of All Employees: Total Private," https://fred.stlouisfed.org/series/CES0500000003#0.

[29] This is based on the average combined state and federal marginal tax rate of 27.5% reported for 2016 by the National Bureau of Economic Research. See Feenberg and Coutts (1993) and National Bureau of Economic Research, "Marginal and Average Tax Rates and Elasticities for the US," http://users.nber.org/~taxsim/allyup/.

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and purpose of transportation. To approximate the results of this literature, the most recent guidance document, issued in 2016, recommends using 50 percent of the before-tax hourly median household income, or $13.60 per hour, to value travel time savings for local personal travel, which is the lowest figure the agency recommends. This figure is 31 percent lower than the estimated average after-tax wage in 2018.

To estimate the value of time that is spent mainly consuming ad-supported content, we multiply the estimated amount of time that American adults spend mainly on consuming ad-supported content by $13.60. In 2019, American adults are projected to spend, based on the estimates above, 514 billion hours mainly consuming ad-supported content. The opportunity cost of that time was therefore $7.0 trillion in 2019.

That figure reflects the value of the content provided by the many diverse sources of ad-supported media in the United States. This broad attention industry is larger than the retail industry which is estimated to be $3.9 trillion in 2019. The value is mainly the consequence that people devote so much time to mainly consuming ad-supported content. Even if the value of time was as low as $7.59 an hour, the value of ad-supported content would equal the value of retail sales.

D. Recent Studies of Consumer Surplus from Online Content

The opportunity cost of time spent primarily consuming ad-supported content was $28,029 for the average American adult in 2019 based on the calculations reported above. Several economic studies have estimated the value of online media using either a time-value approach (e.g. Goolsbee and Klenow 2006), which exploits variations in individual wages and time use to estimate demand, or a survey-based approach (Brynjolfsson, Collis, and Eggers 2019) based on contingent

valuation.[30] The more recent studies use large-scale surveys of willingness to accept (WTA) payment not to have access to the service; some studies try to secure reliable responses by paying randomly selected respondents more than that amount not to use the service. The WTA figures measure consumer surplus given that the monetary cost of using online services is zero. Based on the figures reported above the time spent on online media accounted for 44 percent of all time spent on media in 2019Q1. Table 1 reports the main result of these studies on a consistent per adult user basis, in 2018 dollars, the total implied value across all adults based on these results, and a brief summary of their methodology.

The estimates in Table 1 are consistent with the finding above that the order of magnitude of the value of content, measured by the opportunity cost of time, for the attention market overall is in the multi-trillions and that consumer surplus is as well. Brynjolfsson and Oh (2012) found from a time-value study that the consumers obtained consumer surplus from the Internet of $928 billion in 2011. Using survey-based methods Brynjolfsson, Collis, and Eggers (2019) found willingness to accept payment not to use of $3.8 trillion in 2017 for a wide selection of online media.

Not surprisingly, given the amount of time consumers devote to it, the attention industry is an enormous part of the economy.

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[30] Syverson (2017) argues that these time-value studies overstate the value of free online services and he summarizes alternative studies based on the demand for different broadband speeds. As discussed further in Evans (2019) the time-value studies provide more reliable estimates than broadband studies because they are based on wide variation in wage rates while the broadband studies are based on small variation in prices.

Table 1: Summary of Economic Studies of the Value of Ad-Supported Media (in 2018 Dollars)

Study	Summary	Yearly Value Per U.S. Adult User of the Medium	Aggregate Yearly Value (in billions)
Brynjolfsson, Collis, and Eggers (2019)	Utilized online discrete choice experiments during 2017 to estimate the monetary compensation consumers needed to compensate losing access to various digital goods.	Search engines: $17,957 Social Media: $330 Online video: $274 Online music: $70	$3,797
Allcott, Braghieri, Eichmeyer, and Gentzkow (2019)	Used a Becker-DeGroot-Marschak mechanism to elicit Facebook users' willingness to-accept (WTA) to stay deactivated from Facebook for four weeks during 2018.	Facebook: $2,340	$410
Brynjolfsson and Oh (2012)	Used data on consumers time spent using the internet and their opportunity cost of time (income) to estimate consumer surplus from the internet during 2011.	Internet: $4,880	$928
Goolsbee and Klenow (2006)	Used data on consumers time spent using the internet and their opportunity cost of time (income) to estimate consumer surplus from the internet during 2005.	Internet: $2,053 - $3,120	$287-436

Note: Authors' estimates are multiplied by a factor that represents my estimate of the proportion of the media that is accounted for by an ad-supported model. If the author estimates are on a per-user basis, I compute aggregate valuations based on estimates of the number of U.S. adults that use the media form. See Appendix B for details.

IV.   Advertising, Consumers, and Welfare

Although consumers may not like many advertising messages, there is a strong presumption that the dissemination of messages promotes competition and benefits to consumers over and above the content that they enjoy in return for exposing themselves to these messages. There is also a likely externality among consumers. Many people ignore advertising messages. However, the people who do pay attention to messages may be the marginal consumers who ultimately get firms to lower prices and improve quality. When people learn about new products, and better prices, they often tell family and friends. This diffusion of information also likely results in greater competition.

Indeed, it is hard to imagine competition working well in a modern economy with frequent innovation and great product variety without the extensive dissemination of informative advertising messages. It is how sellers make themselves known, tell consumers about the features of their products, and provide other valuable information to consumers. Today, most sellers, from individuals looking to sell a second-hand chair to multinational companies selling electronics, engage in advertising.

The widespread use of advertising by sellers, dating back millennia now, suggests that it is an efficient element of competitive markets.[31] Otherwise, we would expect that markets would have figured out how to avoid this expense, which is ultimately born by some combination of buyers and sellers. In fact, advertising spending as a share of GDP has remained roughly constant for about a century—with an average of 2.2 percent (with a standard deviation of 0.4 percent) and no long-term trend.[32]

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[31] According to Sampson (1874), p. 33, "There need be no hesitation in ascribing the origin of advertising to the remotest possible times." He goes on to document the development of advertising beginning in ancient Greece.
[32] Galbi (2008).

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Some economic literature has argued that "persuasive advertising" doesn't create economic value because it simply switches consumers from one brand to another and perhaps even in ways that made consumers worse off. [33] Economists have also argued that investments in persuasive advertising could act as a barrier to entry and thereby increase market power, particularly if companies have scale economies in conducting advertising campaigns.[34] Others have argued that even persuasive advertising is welfare-enhancing on net (Becker and Murphy 1993).

The boundary between welfare-decreasing persuasive advertising and welfare-increasing informative advertising isn't clear. Firms invest in brand advertising, such as typical television ads, in part to get people to know they exist and provide information on their products. Firms invest in brand advertising to break into markets. It is possible that advertisers use non-informational features, such as hyperbolic or persuasive content, to increase the chances that the consumer receives the informational content.[35]

The most rigorous evidence on the effect of advertising on competition comes studies based on from quasi-natural experiments in which we can observe retail markets with and without advertising.[36] The typical study identifies situations in which state laws or by associations of competitions prohibited advertising for some period of time and then these prohibitions were removed. I have been able to identify 23 studies that have been published in peer-reviewed journals or by competition authorities and that have examined the effect of

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[33] See Bagwell (2007) for a summary of the extensive literature on this topic.
[34] For a critique see Schmalensee (1972).
[35] Early on, commentators pointed out that some ad copywriters used what was called "puffery". (Moran 1905, p. 27). In 1757, Samuel Johnson noted that, "Advertisements are now so numerous that they are very negligently perused, and it is therefore become necessary to gain attention by magnificence of promises, and by eloquence sometimes sublime and sometimes pathetic." See Samson 1874, p. 200. Johnson goes on the regale the reader with examples of puffery.
[36] See Benham (1972) for the classic study in this area. There is little rigorous empirical evidence on the effect of advertising that is mainly persuasive.

advertising restrictions on prices and other dimensions of competition. Appendix A lists the studies, their methodologies, and their key findings. Almost all of these studies find that prices are lower with advertising than without advertising.

This analysis has some implications for evaluating surplus from attention platforms. The sum of surplus across all marketers overstates the surplus they receive as buyers. The advertising restriction studies show that collectively advertising could reduce profits. Revealed preference shows that the businesses that have adopted or lobbied for these restrictions must believe that. The studies confirm they are right because lifting the restrictions intensifies competition. Advertising might not be a negative sum game for all markets. Companies that have sought restrictions are more likely to benefit from them. But once we account for the negative externalities of advertising across firms in the same market, it is likely the case that collectively these firms would benefit from less advertising.

The opposite is true for consumers. They benefit from marketers engaging in more advertising. It increases the supply of information to consumers generally, enables them to make better choices, and drives prices down. People who search more intensely, and rely on advertisements more intensely, generate positive externalities for others by intensifying competition.[37] Attention platforms therefore generate more consumer surplus for consumers than the value of content they obtain. Informative advertising, at least, may be a nuisance individually but not collectively.

V.   Conclusions

The attention market could, of course, be subject to various market failures and there may be policy interventions that could increase social welfare. This paper doesn't provide any basis

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[37] For a related point see Salop (1976).

for suggesting that the attention market is perfect. But it does point to a few things to keep in mind in considering its contributions to welfare, the net consequences of any failure, and alternative second-best interventions.[38]

By meeting the desire of marketers to present messages to consumers the attention market facilitates efficient exchange that makes consumers better off. The content consumers get in return for spending time is worth a lot. People may not like having ads interrupt the content. They can't, however, generally get the content without the ads, at least not without paying more. Moreover, one person's nuisance is another one's assistance. And it is this dissemination of information that facilitates competition to the benefit of consumers broadly.

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[38] See Evans 2019 for further discussion related to accounting for the value of content in evaluating public policy including towards privacy, mergers, and antitrust.

REFERENCES

Aguiar, Mark and Erik Hurst (2007) "Measuring Trends in Leisure: The Allocation of Time Over Five Decades," *Quarterly Journal of Economics* 122(3), pp. 969-1006.

Allcott, Hunt, Luca Braghieri, Sarah Eichmeyer, and Matthew Gentzkow (2019) "The Welfare Effects of Social Media," Working Paper No. 19-002.

Anderson, Simon and Bruno Jullien (2016) "The Advertising Financed business model in two-sided media markets," in *The Handbook of Media Economics* (S. Anderson, D. Stromberg, and J. Waldfogel eds.), pp. 41-90.

Bagwell, Kyle (2007), "The Economic Analysis of Advertising," in *The Handbook of Industrial Organization* Vol. 3 (M. Armstrong and R. Porter eds.), pp. 1701-1844.

Bakos, Yannis and Erik Brynjolfsson (1999), "Bundling Information Goods: Pricing, Profits and Efficiency," *Management Science* 45(12), pp. 1612-1630.

Becker, Gary S. (1965), "A Theory of the Allocation of Time," *Economic Journal* 75(299), pp. 493-517.

Becker, Gary S. and Kevin Murphy (1993), "A Simple Theory of Advertising as a Good or Bad," *The Quarterly Journal of Economics* Vol. 108, No. 4, pp. 941-964.

Begun, James W. and Roger Feldman (1978) "The Effects of Advertising: Lessons from Optometry," *Journal of Human Resources* Vol. 13, pp. 247-262.

Begun, James W. and Roger Feldman (1980) "Does Advertising of Prices Reduce the Mean and Variance of Prices?" *Economic Inquiry* Vol. 18, pp. 487-492.

Begun, James W. and Roger Feldman (1985) "The Welfare Cost of Quality Change Due to Professional Regulation," *Journal of Industrial Economics* 34(1), pp. 17-32.

Benham, Lee (1972), "The Effect of Advertising on the Price of Eyeglass," *Journal of Law and Economics* 159(2), pp. 337-52.

Benham, Alexandra and Lee Benham (1975), "Regulating through the Professions: A Perspective on Information Control," *Journal of Law and Economics* 18(2), pp. 421-447.

Biddle, Jeff and Daniel Hamermesh (1990) "Sleep and the Allocation of Time," *The Journal of Political Economy* 98(5), pp. 922-943.

Boik, Andre, Shane M. Greenstein, and Jeffrey Prince (2017), "The Empirical Economics of Online Attention". Kelley School of Business Research Paper No. 16-57.

Bond, Ronald S., John E. Kwoka, Jr., John J. Phelan, and Ira Taylor (1983), "Self Regulation in Optometry: The Impact on Price and Quality," *Law and Human Behavior* 7(2/3), pp. 219-234.

Bond, Ronald S., John E. Kwoka, Jr., John J. Phelan, and Ira Taylor Whitten (1980), "Staff Report on Effects of Restrictions on Advertising and Commercial Practice in the Professions: The Case of Optometry," *Bureau of Economics and Federal Trade Commission Report*.

Brynjolfsson, Erik, Avinash Collis, and Felix Eggers (2019), "Using Massive Online Choice Experiments to Measure Changes in Well-Being," *PNAS* 116(15), pp. 7250-7255.

Brynjolfsson, Erik and Joo Hee Oh (2012), "The Attention Economy: Measuring the Value of Free Digital Services on the Internet," *33rd International Conference on Information Systems*.

Bureau of Labor Statistics (2018) "American Time Use Survey 2018," https://data.bls.gov/cgi-bin/srgate.

Bureau of Labor Statistics (2019) "Civilian labor force participation rate," https://www.bls.gov/charts/employment-situation/civilian-labor-force-participation-rate.htm.

Cady, John F. (1976) "An Estimate of the Price Effects of Restrictions on Drug Price Advertising," *Economic Inquiry* 14(4), pp. 493-510.

Chandra, Ambarish and Ulrich Kaiser (2016) "Newspapers and Magazines," in *The Handbook of Media Economics* (S. Anderson, D. Stromberg, and J. Waldfogel eds.), pp. 397-444.

Clark, Robert C. (2007) "Advertising Restrictions and Competition in the Children's Breakfast Cereal Industry," *The Journal of Law and Economics* 50(4), pp. 757-780.

Comscore (2016) "Mobile Metrix Key Measures (March 2016)."

Comscore (2017) "State of OTT."

Cox, Steven R., William C. Canby, Jr. and Allan C. DeSerpa (1982) "Consumer Information and the Pricing of Legal Services" *Journal of Industrial Economics* 30(3), pp. 305-318.

Cox, Steven R., John R. Schroeter, and Scott L. Smith (1987), "Advertising Competition in Routine Legal Services Markets: An Empirical Investigation," *Journal of Industrial Economics* 36(1), pp. 49-60.

Ehrenberg, Ronald and Robert S. Smith (1994) *Modern Labor Economics*, HarperCollins.

Engstrom, Nora Freeman (2013) "Attorney Advertising and Contingency Fee Cost Paradox," *Stanford Law Review* Vol. 65, pp. 633-696.

Evans, David S. (2009) "The Online Advertising Industry: Economics, Evolution, and Privacy," *Journal of Economic Perspectives* 23(3), pp. 37-60.

Evans, David S. (2013) "Attention Rivalry Among Online Platforms," *Journal of Competition Law and Economics* 9(2), pp. 313-357.

Evans, David S. (2019) "Attention Platforms, the Value of Content, and Public Policy," *Review of Industrial Organization* 54(4), pp. 775-792.

Fisher, Franklin M., John J. McGowan, and David S. Evans (1980), "The Audience-Revenue Relationship for Local Television Stations," Bell Journal of Economics, pp. 694-708.

Federal Reserve Bank of St. Louis (2019) "Average Hourly Earnings of All Employees: Total Private," https://fred.stlouisfed.org/series/CES0500000003#0.

Federal Reserve Bank of St. Louis (2019b) "Gross Domestic Product: Implicit Price Deflator," https://fred.stlouisfed.org/series/GDPDEF/.

Feenberg, Daniel and Elizabeth Coutts (1993) "An Introduction to the TAXSIM Model," *Journal of Policy Analysis and Management* 12(1), pp. 189-194.

Francis, Neville and Valerie A. Ramey (2009), "Measures of per Capita Hours and Their Implications for the Technology-Hours Debate," Journal of Money, Credit, and Banking, 41(6): 1071-1097.

Franklin, Benjamin (1748), "Advice to a Young Tradesman, Written by an Old One," George Fisher, The American Instructor: or Young Man's Best Companion, 9.

Galbi, Douglas (2008) "U.S. Annual Advertising Spending Since 1919," http://galbithink.org/ad-spending.htm.

Glazer, Amihai (1981) "Advertising, Information, and Prices – A Case Study," *Economic Inquiry* 19(4), pp. 661-671.

Goolsbee, Austan and Peter J. Klenow (2006) "Valuing Consumer Products by the Time Spent Using Them: An Application to the Internet," *American Economic Review Papers & Proceedings* 96(2), pp. 108-113.

Greenstein, Shane and Greg Stranger (2008) "Pricing in the Shadow of Firm Turnover: ISPs During the 1990s," *International Journal of Industrial Organization* 26(3), pp. 625-642.

Greenwood, Jeremy and Guillaume Vandenbroucke (2005) "Hours Worked: Long-Run Trends," Economie d'avant garde Research Report No. 10, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=743208.

Harberger, Arnold C. (1971), "Three Basic Postulates for Applied Welfare Economics: An Interpretative Essay," Journal of Economic Literature, 9(3): 785-797.

Hypebot, "100 Million Use Paid Music Streaming Services In US,"
https://www.hypebot.com/hypebot/2019/03/100-million-use-paid-music-streaming-services-in-us-musicwatch-1.html.

Johnson, Samuel (1757), *The Idler*, Issue No. 40, January 20, 1759.

Kelly, Thom and Alex Maurizi (1978) "Prices and Consumer Information: The Benefits from Posting Retail Gasoline Prices," American Enterprise Institute.

Kwoka Jr., John E. (1984) "Advertising and the Price and Quality of Optometric Services," *American Economic Review* 74(1), pp. 211-216.

Maurizi, Alex R., Ruth L. Moore, and Lawrence Shepard (1981) "Competing for Professional Control: Professional Mix in the Eyeglasses Industry," *Journal of Law and Economics* 24(2), pp. 351-364.

McChesney, Fred S. and Timothy J. Muris (1979) "The Effect of Advertising on the Quality of Legal Services," *American Bar Association Journal* 65(10), pp. 1503-1506.

Milyo, Jeffrey and Joel Waldfogel (1999) "The Effect of Price Advertising on Prices: Evidence in the Wake of 44 Liquormart," *American Economic Review* 89(5), pp. 1081-1096.

Moran, Clarence, The Business of Advertising, Methuen & Co., London, 1905.

Murphy, Kevin and Ignacio Palacios-Huerta (2016) "A Theory of Bundling Advertisements in Media Markets," NBER Working Paper 22994.

Muzondo, Timothy R. and Bohumir Pazderka (1980) "Occupational Licensing and Professional Incomes in Canada," *Canadian Journal of Economics* 13(4), pp. 659-667.

National Bureau of Economic Research, "Marginal and Average Tax Rates and Elasticities for the US," http://users.nber.org/~taxsim/allyup/

The National Telecommunications and Information Administration, "Digital Nation Data Explorer," https://www.ntia.doc.gov/data/digital-nation-data-explorer#sel=videoUser&demo=metro&pc=prop&disp=chart.

Nielsen (2019) "The Nielsen Total Audience Report Q1 2019."

Pew Research Center (2011) "Search and email still top the list of most popular online activities," https://www.pewinternet.org/2011/08/09/search-and-email-still-top-the-list-of-most-popular-online-activities/.

Pew Research Center (2019a) "10 facts about Americans and Facebook," https://www.pewresearch.org/fact-tank/2019/05/16/facts-about-americans-and-facebook/

Pew Research Center (2019b) "Internet/Broadband Fact Sheet," https://www.pewinternet.org/fact-sheet/internet-broadband/.

Rauch, Ferdinand (2013), "Advertising Expenditure and Consumer Prices," *International Journal of Industrial Organization* 31(4), pp. 331-341.

Rochet, Jean-Charles and Jean Tirole (2006) "Two-Sided Markets: A Progress Report," *RAND Journal of Economics* 37(3), pp. 645-667.

Salop, Steve (1976) "Information and Monopolistic Competition," *American Economic Review* 66(2), pp. 240-245.

Sampson, Henry (1874) *The History of Advertising from the Earliest Times*, Chatto and Windus.

Sass, Tim R. and David S. Saurman (1995) "Advertising Restrictions and Concentration: The Case of Malt Beverages," *Review of Economics and Statistics* 77(1), pp. 66-81.

Richard Schmalensee (1972), The Economics of Advertising, (New York: North Holland).

Schneider, Michael (2019) "100 Most-Watched TV Shows of 2018-19: Winners and Losers," Indie Wire, https://variety.com/2019/tv/news/most-watched-tv-shows-highest-rated-2018-2019-season-game-of-thrones-1203222287/.

Slomin, Scott (1981) "Survey: Ads Not Drawing Malpractice Claims," *ABA Journal* Vol. 67, pp. 25-26.

Steiner, Robert L. (1973) "Does Advertising Lower Consumer Prices?" *Journal of Marketing* 37(4), pp. 19-26.

Syverson, Chad (2017), "Challenges to Mismeasurement Explanations for the US Productivity Slowdown," *Journal of Economic Perspectives* 31(2), pp. 165-186.

Tucker, Catherine (2013) "The Implications of Improved Attribution and Measurability for Antitrust and Privacy in Online Advertising Markets," *George Mason Law Review* 20(4), pp. 1025-1054.

U.S. Census Bureau, "National Intercensal Tables: 2000-2010," https://www.census.gov/data/tables/time-series/demo/popest/intercensal-2000-2010-national.html.

U.S. Census Bureau, "National Population by Characteristics: 2010-2018," https://www.census.gov/data/tables/time-series/demo/popest/2010s-national-detail.html.

U.S. Department of Transportation (2016), "The Value of Travel Time Savings: Departmental Guidance for Conducting Economic Evaluations Revision 2 (2016 Update),"

https://www.transportation.gov/sites/dot.gov/files/docs/2016%20Revised%20Value%20of%20Travel%20Time%20Guidance.pdf.

Weyl, E. Glenn and Alexander White (2016) "Insulated Platform Competition" *Working Paper.*

Appendix A. Economic Literature on Advertising Restrictions

Study	Industry	Identifying Variation	Key Finding
Benham (1972)	Eyeglasses	Variation across states in restrictions on price advertising	"Prices were found to be substantially lower in states which allowed advertising"
Benham and Benham (1975)	Eyeglasses	Variation across states in restrictions on advertising and other promotional and professional activity	"Prices appear to be 25 per cent to 40 per cent higher in markets with greater professional control. These higher prices are in turn associated with a significant reduction in the proportion of individuals obtaining eyeglasses during a year."
Bond et al (1980)	Optometry Services and Eyeglasses	Variation across cities in restrictions on advertising	"The existence of advertising and commercial practice by some optometrists in a market does not result in a lowering of the quality of examinations available to consumers… The existence of price advertising and commercial practice by some optometrists does result in lower prices. The prices of both less thorough and more thorough examinations and eyeglasses were significantly lower in the least restrictive cities than in the most restrictive cities."
Bond et al (1983)	Optometry Services and Eyeglasses	Variation across cities in restrictions on advertising	"The data in this study support the view that advertising and commercial practice lower prices. Very thorough examinations and eyeglasses cost on average $21 less in markets where advertising and commercial practice are allowed. Less thorough examinations and eyeglasses cost on average $31 less when purchased from a large chain optical firm than when purchased from an optometrist in a market without advertising and commercial practice. The data are not consistent with the view that advertising and commercial practice lower the quality of professional care available in the market. The average quality of eye examinations available to consumers is about the same whether or not

			advertising and commercial practice are allowed."
Cady (1976)	Prescription Drugs	Variation across states in restrictions on advertising	"Restrictions on prescription drug advertising result in monopoly returns estimated at between $135 and $152 million as best estimates, (almost 4 percent of total prescription sales) in 1970. These returns take the form of an income transfer, in the form of higher prices, from drug purchasers to retail sellers."
Clark (2007)	Children's Cereal	Variation across Canadian provinces in restrictions on advertising	"I take advantage of the prohibition on advertising directed at children in the province of Quebec to examine the nature of advertising and to determine whether the restriction hinders competition. I show that prices are higher in Quebec than in Canadian provinces that permit advertising."
Cox et al (1982)	Legal Services	Variation between advertising and non-advertising firms	"A pattern of less price dispersion and lower average fees among those attorneys who do advertise (or plan to) also emerges from our Phoenix survey results. In virtually every instance, the mean or standard deviation for those who had advertised or would advertise was significantly lower than that for the other attorneys surveyed. No inferences, however, concerning the likely effect of attorney advertising on routine legal service fees can be drawn from the differences these data show… [I]t is probable that the data capture the tendency for those seeking additional clients both to advertise and to charge lower fees.
Engstrom (2013)	Legal Services (Personal Injury Lawyers)	Variation across firms in the amount of advertising	"…[T]hough advertisers typically charge less than nonadvertisers, there is no evidence that advertising personal injury lawyers charge less, on a percentage basis, than their non-advertising counterparts. Nor is there evidence that, despite the swell of personal injury attorney advertising, contingency fees—the near-uniform method of payment for PI services—have dropped over the past four decades… [F]ragmentary evidence suggests that, if anything, advertising PI lawyers charge higher contingency fees, on a percentage basis, than non-advertising PI lawyers, and that, with some notable exceptions, contingency fees for legal services are— and have long remained—sticky around 33%."
Begun and Feldman (1978)	Optometry Services	Variation across states in advertising restrictions	"An empirical section shows that price is 16 percent higher in states ban optometric and optician price advertising, when

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			examination length, procedures, and office equipment are held constant."
Begun and Feldman (1980)	Optometry Services	Variation across states in advertising restrictions	"[In an OLS Regression, a] MODERATE advertising ban has a negligible effect on price, but a STRICT ban raises prices by about 11 percent… The GLS estimates of the advertising ban effect again suggests that both bans raise price by 11 percent relative to permissive states… [W]e find that advertising bans increase the price variance of vision examinations."
Begun and Feldman (1985)	Optometry Services	Variation across states in advertising bans and other professional regulation	"In the market for vision examinations by optometrists, quality changes due to three selected professional regulations result in economic profits for producers of some $140 million, and positive changes in quality due to the regulations are not valued by consumers at their marginal cost. A small annual welfare loss of about $8 million results from these professional regulations. When quantity effects are also included, the welfare loss increases to $16 million."
Glazer (1981)	Supermarkets	Similar to differences-in-differences: a newspaper strike reduced advertising in NYC, but not in Nassau County	"…[T]he newspaper strike caused an increase in the level of food prices in Queens County."
Kwoka (1984)	Optometry Services	Variation across cities in restrictions on advertising and other commercial practices	"[Where advertising is permitted, t]he evidence reveals that advertisers' prices and quality are indeed lower, and while nonadvertisers' prices fall, their quality actually is greater. Furthermore, nonadvertisers remain in sufficient numbers in the market so that average market quality is not lower, but indeed greater."
Kelly and Maurizi (1978)	Gasoline	Variation across cities in restrictions on price advertising	"Consumer gains throughout the nation in 1975 due to price posting as intense as that in the Los Angeles area were estimated to be at least $322 million annually and possibly as much as $507 million annually."
Maurizi et al (1981)	Eyeglasses	Variation between advertising and non-advertising firms	"For both types of frames, advertisers charged about $7 less than nonadvertisers."
Milyo and Waldfogel (1999)	Liquor Stores	Differences-in-differences: Rhode Island eliminated its ban on price advertising, while Massachusetts	"Using Massachusetts prices as controls, we find that advertising stores substantially cut only prices of the products that they advertise. Prices of other products, at both advertising and nonadvertising stores, do not change. Advertising stores cut their

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		continued to allow it	prices on products advertised by rivals, while nonadvertising stores do not."
McChesney and Muris (1979)	Legal Services	Variation between advertising and non-advertising firms	"While the data on prices charged by [advertising] legal clinics and [non-advertising] traditional firms are fragmentary, clinic prices are generally lower, at least for services produced in greater volumes… Based on the results of both the subjective and objective tests, our evidence conclusively rejects the proposition that firms relying on advertising to charge lower prices will necessarily produce lower-quality services."
Muzondo and Pazderka (1980)	Professional Services	Variation across professions in whether advertising was allowed and in other restrictions	"Our results are consistent with the hypothesis that restrictions on fee competition and advertising have significant and positive effect on professional earnings… Our results suggest that, on average, individuals in professions which restrict advertising earn 32.8 per cent more than individuals in professions in which advertising is unrestricted, ceteris paribus."
Rauch (2013)	Consumer Products	Differences-in-Differences: When Austria harmonized its tax on advertising, the tax increased in some regions and decreased in others	"The estimation results suggest that informative forces, which decrease prices with advertising, dominate in the industries food and education; while persuasive forces that increase consumer prices with advertising seem to dominate in the industries of alcohol and tobacco, transportation, hotels, and restaurants." (Note that search advertising is generally considered to provide informative advertising.)
Sass and Saurman (1995)	Malt Beverage Brewing	Variations across states in restrictions on advertising	"We find that the presence of proscriptions on price advertising significantly increases market concentration at the state level, both absolutely and relative to a measure of national concentration. The evidence also indicates that banning local non-price advertising in addition to price advertising yields no marginal significant change in either measure of state-level concentration. Analysis of individual brewers' market shares suggests that large national brewers gain at the expense of smaller brewers when price advertising is restricted… Our estimates suggest that a state that bans only price advertising can be expected to endure a Hirschman-Herfindahl concentration index 210 points higher than otherwise."
Cox, Schroeter, and Smith (1987)	Legal Services	Variation across firms and markets in advertising intensity	"This study's findings, together with the results of earlier studies of the relationship between advertising and market prices, provide considerable empirical support for

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			the pro-competitive view of seller advertising. Data on attorney fees and advertising practices in seventeen metropolitan areas across the US were used to estimate the effect of market advertising intensity on firm demand elasticities, holding other possible influencing factors constant. The results obtained for all three routine legal services examined are consistent with the hypothesis that advertising increases competition among sellers in a market."
Slomin (1981)	Legal Services	Variation between advertising and non-advertising firms	"[E]arly indications are that whether a lawyer advertises isn't a factor in predicting the likelihood of a malpractice claim."
Steiner (1973)	Toy Manufacturing	Variation over time in industry-wide advertising levels and variation in advertising intensity across different lines of toys	"This article has described the process by which advertising lowers consumer prices and has developed a theory to explain why this occurs in strongly advertised industries whose goods are sold through the general retail trade. Traditionally, advertising has been analyzed almost exclusively in terms of its effect on manufacturers' selling prices. This effect is believed to be modest compared to advertising's impact on distribution margins. Here, in conjunction with mass merchandising, advertising has slashed markups on advertised brands and reduced them on competing nonadvertised products as well, bringing lower prices to the consumer"

Appendix B: Technical Appendix

1.   Estimates of Time Spent on Advertising Supported Media

The Nielsen Q1 2019 Total Audience Report provides estimates of the amount of time the average American Adult spends per day consuming media.[39] The media forms include: Live TV, Time-Shifted TV, Radio, DVD/Blu-ray Device, Game Console, Internet Connected Device, Internet on a Computer, App/Web on a Smartphone, and App/Web on a Tablet.

For each medium I estimated the share of the total time that was spent with ad-supported versions of the medium, using conservative assumptions. For Live TV, I examined the top 100 rated shows of the 2018-2019 season and found that 99 of the 100 aired on ad-supported

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[39] Nielsen (2019), p. 3.

channels, with a ratings-weighted count of 97 percent.[40] To be conservative, I rounded this down to 90 percent.

For AM/FM radio, I conservatively used the same 90 percent, even though virtually all AM/FM radio (as opposed to satellite radio) is ad-supported.

For Internet on a PC, I assumed that 65 percent of the time was spent on ad-supported sites, relying on an estimate of two-thirds reported by Greenstein and Stranger (2008).

For app/web on a smartphone or tablet, I examined the top 20 mobile websites and apps by time usage in March 2016, as reported by comScore.[41] Of the 20 websites/apps, 17 are currently ad-supported, and these 17 accounted for 92.9 percent of the total time spent on the top 20 mobile websites/apps. I rounded this down to 90 percent.

For all of the other types of media (Time-Shifted TV, DVD/Blu-ray Device, Game Console, Internet Connected Device), I assumed that zero percent of the time was spent on ad-supported versions.

2. Calculations Underlying Table 1: Summary of Economic Studies of the Value of Ad-Supported Media (in 2018 Dollars)

A. Brynjolfsson, Collis, and Eggers (2019)

Brynjolfsson, Collis, and Eggers estimate the monetary compensation consumers needed to compensate losing access to digital goods during 2017, including search engines, email, online maps, online video, e-commerce, social media, messaging, and online music.[42] I've considered their estimates for search engines, online video, social media, and online music because these media forms have some portion of their business that is ad-supported.

Brynjolfsson, Collis, and Eggers estimated consumer valuation of search engines during 2017 was $17,530. I allocate 100% of consumer time on search engines to time with ad-supported versions and convert the 2017 estimates into 2018 dollars using the GDP price deflator published by the U.S. Bureau of Economic Analysis.[43] This yields a per-user valuation of

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[40] Schneider (2019).
[41] Comscore (2016).
[42] Brynjolfsson, Collis, and Eggers (2019) at Table 1.
[43] Federal Reserve Bank of St. Louis, "Gross Domestic Product: Implicit Price Deflator," https://fred.stlouisfed.org/series/GDPDEF/.

Electronic copy available at: https://ssrn.com/abstract=3044858

$17,957. I compute the aggregate value of search engines by multiplying the per-user valuation by the number of search engine users in the U.S. The Pew Research Center last surveyed internet users about their use of search engines during 2011.[44] Pew Research found 92 percent of internet users utilized search engines and the percentage was roughly constant since 2005. Pew Research estimated that 89 percent of American adults used the internet during 2017.[45] I therefore assume 81 percent of American adults use search engines (89% x 92%) during 2017 and multiply search engine penetration by the number of American adults in that year.[46] Multiplying the number of adult search engine users by the per-user valuation of search engines yields an aggregate valuation of $3.7 trillion.

I similarly compute the aggregate value of online video. Brynjolfsson, Collis, and Eggers estimated the consumer valuation during 2017 was $1,173, which I convert to 2018 dollars, yielding a per user valuation of $1,202. Comscore reported the share of Over the Top Streaming Service time accounted for by Netflix, Hulu, Amazon, and YouTube.[47] Of those services, YouTube accounted for 23% of viewing time and is the only primarily ad-based platform. I therefore allocate 23% of consumer online video time to time with ad-supported versions, which yields a per-user valuation of $274. The National Telecommunications and Information Administration (NTIA) reported that 70% of Americans aged 15+ watched videos online during 2017.[48] I multiply that proportion by the number of U.S. adults and the per-user valuation, which yields an aggregate valuation of $48 billion.

Brynjolfsson, Collis, and Eggers estimated consumer valuation of social media during 2017 was $322, which I convert to 2018 dollars, which yields a per user valuation of $330. I allocate 100% of social media time to with ad-supported versions. The NTIA reported that 74%

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[44] Pew Research Center (2011).
[45] Pew Research Center (2019b).
[46] U.S. Census Bureau, "National Population by Characteristics: 2010-2018," https://www.census.gov/data/tables/time-series/demo/popest/2010s-national-detail.html; U.S. Census Bureau, "National Intercensal Tables: 2000-2010," https://www.census.gov/data/tables/time-series/demo/popest/intercensal-2000-2010-national.html.
[47] Comscore (2017) at p. 27. The top four video providers account for 79 percent of total OTT viewing hours. Using YouTube's share of the top-four providers assumes that ad-supported versions account for the same share of time among the non-top-four providers as it does among the top-four.
[48] The National Telecommunications and Information Administration, "Digital Nation Data Explorer," https://www.ntia.doc.gov/data/digital-nation-data-explorer#sel=videoUser&demo=metro&pc=prop&disp=chart.

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of Americans aged 15+ used social media during 2017. I multiply that proportion by the number of U.S. adults and the per-user valuation, which yields an aggregate valuation of $62 billion.

Finally, Brynjolfsson, Collis, and Eggers estimated consumer valuation of online music during 2017 was $168, which I convert to 2018 dollars, which yields a per user valuation of $172. During 2017, 41% of online music streamers in the U.S. are subscribed to a free, ad-supported service.[49] I therefore allocate 41% of online music time to with ad-supported versions, which yields a per-user valuation of $70. The NTIA reported that 53% of Americans aged 15+ streamed or downloaded music, radio, or podcasts during 2017. I multiply that proportion by the number of U.S. adults and the per-user valuation, which yields an aggregate valuation of $9 billion.

Combined, these estimates suggest U.S. adults valued ad-supported search engines, social media, online video and music at $3.8 trillion.

B. Allcott, Braghieri, Eichmeyer, and Gentzkow (2019)

Allcott, Braghieri, Eichmeyer, and Gentzkow employ a Becker-DeGroot-Marschak mechanism to elicit Facebook users' willingness to-accept (WTA) to stay deactivated from Facebook for four weeks during 2018. They estimate an average WTA of $180,[50] which I extrapolate to a yearly valuation of $2,340. I allocate 100% of Facebook time to with ad-supported consumption. Pew Research Center estimated that 69 percent of U.S. adults used Facebook during 2018.[51] I multiply that proportion by the number of U.S. adults and the per-user valuation, which yields an aggregate valuation of $410 billion.

C. Brynjolfsson and Oh (2012)

Brynjolfsson and Oh used data on consumers' time spent using the internet and their opportunity cost of time (income) to estimate consumer surplus from the internet during 2011. As described above, I assume that 65 percent of the time spent using the internet on a PC is spent on ad-supported sites. They estimate aggregate consumer surplus of $1,196 billion[52] based on

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[49] Hypebot, "100 Million Use Paid Music Streaming Services In US," https://www.hypebot.com/hypebot/2019/03/100-million-use-paid-music-streaming-services-in-us-musicwatch-1.html.
[50] Allcott, Braghieri, Eichmeyer, and Gentzkow (2019) at p. 31.
[51] Pew Research Center (2019a).
[52] Brynjolfsson and Oh (2012) at Table 4.

2007 income, which I convert into 2018 dollars and multiply by 65 percent, which yields an aggregate value of $928 billion. Brynjolfsson and Oh (2012) report that 80% of their sample used the internet during 2011,[53] which I multiply by the U.S. adult population to get the total number of adult internet users during 2011. I divide my estimated $928 billion valuation of ad-supported internet usage by the number of adult internet users to get a per-user valuation of $4,880.

D. Goolsbee and Klenow (2006)

Goolsbee and Klenow used data on consumers' time spent using the internet and their opportunity cost of time (income) to estimate consumer surplus from the internet during 2005. As described above, I assume that 65 percent of the time spent using the internet on a PC is spent on ad-supported sites. They estimate consumer surplus between $2,500 and $3,800 per user,[54] which I convert into 2018 dollars and multiply by 65 percent, which yields a range of $2,053 - $3,120. Goolsbee and Klenow estimate that 63 percent of their sample used the internet.[55] I multiply that proportion by the U.S. adult population and the per-user valuation, which yields an aggregate valuation range of $287-436 billion.

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[53] Brynjolfsson and Oh (2012) at Table 2.
[54] Goolsbee and Klenow (2006) at p. 112.
[55] Goolsbee and Klenow (2006) at p. 110.