

Draft-Comments welcome

Online services and the analysis of competitive merger effects in privacy protections and other quality dimensions

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April 25, 2016

Abstract

This paper presents a model of competition in privacy and/or quality offered to consumers in two-sided online markets in which revenue is derived from advertising or the selling of user data. I review a number of the previously reported barriers to including a loss of competition over privacy provisions in antitrust analyses. A standard method for analyzing the effects of mergers on prices can be applied to the effects of mergers on non-price competition such as competition in the level of privacy or quality offered to consumers. The model and results provide tools which competition authorities can use to improve the level of analysis of the effects of mergers on the consumer side in such two-sided online markets, hopefully leading to a more complete analysis of the effects on competition for consumers and better enforcement decisions. The technique can also be adapted for use in analyzing quality competition in other contexts.

1 Introduction

Policy issues related to privacy have received significant attention in recent years. The issue has been the subject of a number of government reports. Reports on privacy

*This research is supported in part by the Media Democracy Action Fund, a project of the Sixteen Thirty Fund. I am grateful for the helpful comments of Joseph Farrell, Allen Grunes, and Gene Kimmelman. The views expressed in this paper are solely those of the author and do not necessarily reflect the opinions of Bates White or its clients.

were issued by the Department of Commerce in 2010, the Federal Trade Commission in 2012, and the White House in 2014.¹ According to its report, a number of themes emerged from the FTC’s examination of the subject:

First, the collection and commercial use of consumer data in today’s society is ubiquitous and often invisible to consumers. Second, consumers generally lack full understanding of the nature and extent of this data collection and use and, therefore, are unable to make informed choices about it. Third, despite this lack of understanding, many consumers are concerned about the privacy of their personal information. Fourth, the collection and use of consumer data has led to significant benefits in the form of new products and services. Finally, the traditional distinction between personally identifiable information and “anonymous” data has blurred.²

Much of the focus of the policy debate has been on the collection of information about consumers online and the use of that information to display targeted advertising—that is, to display different advertising to different users in order to increase the chances that consumers will respond as desired. These privacy issues tend to arise in online services that are offered to consumers without charge but that earn revenue through advertising or sometimes the sale of data. A number of commentators suggest that a loss of privacy is the price that consumers pay for the wide range of free services offered online.³

The issue of online privacy is multidimensional. It relates to what information about users is collected, how it is secured, how long it is stored, what it is used for, who it is shared with, and what choices the user has to control the collection of information.⁴ The information collected generally falls into two categories: information that the user provides to the service—this usually occurs as part of a registration process—and information that is collected through the user’s use of the service. Consumer preferences over these different dimensions of privacy likely vary significantly

¹See Department of Commerce Internet Task Force (2010), Federal Trade Commission (2012), and Executive Office of the President (2014).

²Federal Trade Commission (2012, p. 2).

³For example, see Doctorow (2012) and Ohlhausen and Okuliar (2015). Wiethaus (2015) argues that in two-sided markets the observation that a service does not charge a monetary price for use does not necessarily imply that consumers must be paying in some other way such as a loss of privacy.

⁴For example, see Google’s privacy policy available at <http://www.google.com/policies/privacy/>.

across individual consumers, but research suggests that at least in general consumers express a preference for more privacy over less privacy.⁵

The general policy concern over privacy appears to be that given that consumers appear to lack the information to make informed choices about privacy, online services have an incentive to implement privacy policies that benefit the services without appropriately balancing the concerns of the users.⁶ If a decrease in privacy results in better targeted advertisements or more data to sell, then a decrease in privacy would increase the revenue of an online service. In response to these concerns, a number of policy changes have been suggested.⁷

Along with the more general policy debate, a number of law review articles and speeches by antitrust agency officials deal with the question of how concerns over privacy should or shouldn't be included in antitrust enforcement decisions. The opinions seem to range from the suggestion that privacy issues should be actively pursued in antitrust analyses⁸ to arguing that privacy should play no role in enforcement decisions.⁹ One of the arguments made by a number of commentators is that if firms compete on the basis of how much privacy they offer to users, then privacy (just like price or other types of quality) would be a dimension of competition that should be protected by the antitrust laws.¹⁰ Despite the challenges of competing on a quality dimension over which consumers are reported to be uninformed, in a co-authored paper, FTC Commissioner Ohlhausen states that privacy "increasingly represents a non-price dimension of competition."¹¹

⁵For example, see Federal Trade Commission (2012).

⁶For example, see Farrell (2012).

⁷For example, the report from the Executive Office of the President (2014, p. 60) recommends the advancement of a consumer privacy bill of rights, the passage of national data breach legislation, the extension of privacy protections to non-US persons, the implementation of regulatory or other changes to ensure that data collected on students in school is only used for educational purposes, the expansion of expertise within regulatory agencies charged with the protection of civil rights and consumer protection to protect against unlawful discrimination through the use of big data, and the amendment of the Electronic Communications Privacy Act so as to do away with a number of "archaic" distinctions.

⁸For example, see Swire (2007) and Laude (2008).

⁹For example, Cooper (2013) states, "However facially appealing it may be to combine privacy and antitrust, the merger of these two policy issues presents some serious concerns. Once we realize that publishers [use the data collected from consumers to improve the quality of their product], the analogy between [reductions in] privacy and [reductions in] quality breaks down. What's more, limiting a firm's ability to collect and use data is likely to suppress protected speech. Finally, the inherent subjectivity in the exercise will increase incentives to divert resources from marketplace competition to curry favor with antitrust regulators. It will also cause firms to underinvest in beneficial uses of consumer data. Collectively, these problems suggest that antitrust is the wrong vehicle to address privacy concerns."

¹⁰For example, see Ohlhausen and Okuliar (2015, p. 134).

¹¹Ohlhausen and Okuliar (2015, p. 151).

If in fact firms compete by offering more privacy in order to attract customers from rival firms, then in the merger context, privacy could be a dimension of competition lost as a result of a merger. EU and US antitrust agencies appear to be open and ready to analyze loss of privacy as a potential anticompetitive effect of a merger.¹² In such a situation, competition over privacy is a type of quality competition. Regardless of whatever privacy protections are or are not bundled with an online service, it certainly makes up one of the qualitative aspects of online services. Therefore, competition over privacy protections by definition would be a form of quality competition.

However, competition agencies have struggled to effectively account for quality competition in their analyses. According to an Organisation for Economic Co-operation and Development (OECD) report on the incorporation of quality competition in the enforcement of competition laws,

Competition policy is just as concerned with quality as it is with prices. While the importance of quality is undisputed and issues about quality are mentioned pervasively in competition agency guidelines and court decisions, there is no widely-agreed framework for analysing it which often renders its treatment superficial.

There are a number of reasons why in practice, courts and competition authorities rarely analyse quality effects as rigorously as they analyse price effects. First, quality is a subjective concept and therefore much harder to define and measure than prices. In addition, microeconomic theory offers little help in predicting how changes in the level of competition in a market will affect quality and it is usually up to empirical analysis to determine how quality will change in response to varying degrees of competition in the context of particular markets.¹³

As described in the quote above, the OECD report focuses on two reasons for the difficulty in incorporating considerations of quality competition into antitrust

¹²In comments given at the 42nd Annual Conference on International Antitrust Law and Policy in New York on October 1st and 2nd, 2015, Sophie Moonen, Head of Unit C5—Information, Communication and Media, Directorate General for Competition, European Commission, stated that as part of the European Union’s review of the acquisition of WhatsApp by Facebook, the Commission had reviewed the extent of competition between the two companies in the provision of privacy in messaging. At the same conference, Renata Hesse, Deputy Assistant Attorney General, Antitrust Division, US Department of Justice, stated that the Division would take seriously any evidence that merging firms compete in the supply of privacy. Deborah Feinstein, Director, Bureau of Competition, Federal Trade Commission, is reported to have made a very similar statement. (See <http://www.deallawyers.com/blog/2015/03/mergers-blocked-by-the-ftc-over-potential-privacy-concerns.html>.) Also see Feinstein (2015).

¹³OECD (2013, cover page).

analyses. (1) Quality is often subjective, multidimensional, and difficult to measure relative to the measurement of price. (2) “[M]icroeconomic theory offers little help in predicting how changes in the level of competition in a market will affect quality.”¹⁴ The theoretical models that are described as suggesting ambiguous effects on quality as a result of changes in competition involve models in which firms compete on both price and quality dimensions and thus are not relevant in cases in which price is in some way constrained.¹⁵ Below, I provide a simple model of competition over quality in which a merger decreases the incentive to make costly quality improvements that would make a service more attractive to users. I derive an expression for the downward quality pressure associated with a merger that is analogous to expressions for upward pricing pressure developed for measuring price effects from mergers. The expression for downward quality pressure does not necessarily require that quality be measured, implying that quality effects can be quantified without tackling the thorny issues of measuring quality.

While the model is developed in the context of advertising supported online services, there are other markets where the nexus of competition is on quality rather than price. The approach developed below could be also be applied in those markets. For example, insurance rules prevent hospitals from making direct price offers to patients causing increased attention to the perceived quality. A similar analysis to that developed here could be applied to the merger of hospitals that compete for patients on the basis of quality.

Like other dimensions of quality, privacy exhibits the characteristics of being subjective, multidimensional, and difficult to measure and thus would be equally difficult to incorporate into competitive analyses. Therefore, until the general difficulty of incorporating competition over quality into the analysis can be solved, incorporating competition over privacy will suffer from the same difficulties. One of the contributions of this paper is the development of a framework for analyzing competition over privacy.

In addition to the general difficulty of analyzing non-price competition in the antitrust context, incorporating privacy into the analysis faces a number of other challenges. Grunes (2013) offers a list of other challenges. (1) Many of the services in which privacy is an issue are offered to consumers for free. In such industries, past enforcement has tended to focus on the transaction in which money changes

¹⁴See the Overview in OECD (2013).

¹⁵For the case in which price is constrained as it appears to be on the consumer side of online services, it has long been understood that increased competition leads to higher levels of quality on a per-unit basis. See White (1972).

hands. For these services, that side of the business is usually the sale of advertising. The FTC’s closing statement for the Trulia/Zillow merger exhibits this emphasis on potential effects on an advertising market.¹⁶ (2) If a decrease in privacy actually benefits advertisers, then it may be necessary to balance that benefit against any harm to consumers from less privacy. (3) Competition over privacy might be, at least in general, very limited. If, as the FTC claims in its privacy report, consumers are not knowledgeable enough to make informed choices about privacy, then competition over privacy will be blunted and less likely to arise. (4) Privacy is hard to define and likely subjective in nature.

Along with other issues, Cooper (2013) argues that antitrust should not address privacy concerns by suggesting that the analogy between competition over product quality and competition over privacy breaks down. He argues that decreasing privacy—hence increasing the data collected—increases a service’s costs and allows it to offer a better quality product to consumers.¹⁷ That is, the argument seems to be that rather than harming consumers, decreases in privacy benefit consumers through the creation of services that are better matched to users.

In this paper, I discuss a number of these challenges to incorporating privacy issues into merger enforcement. The question of how concerns over privacy interact with competition laws is a broad and complicated question. Given that competition law commonly requires a fact-driven analysis, trying to suggest how privacy might be incorporated into competition analysis generally without proposing a hypothetical set of facts seems to me difficult if not impossible. Therefore, I approach the question of the interaction of privacy and competition policy with a particular set of circumstances in mind, a set of circumstances that seem to have some empirical relevance. I will focus on the role of privacy concerns in merger analysis under a particular hypothetical. The merging online services compete for consumers by offering particular features, possibly including privacy protections, but the merging online services do not charge consumers a monetary price.¹⁸ The services’ revenue is generated by

¹⁶Federal Trade Commission (2015).

¹⁷Part of Cooper (2013)’s argument is based on the assumption that antitrust remedies could require privacy protections. This seems to be the basis of his view that bringing privacy into antitrust analyses could violate First Amendment free speech protections. However, such remedies seem unlikely in the antitrust context. Analogizing to price or quality competition, such remedies would be similar to a court imposing price or quality controls on companies found to be violating the antitrust laws.

¹⁸The effects of data aggregation are beyond the scope of this paper. One issue that has been raised is whether a merger that decreases privacy and thus consumer welfare as a result of the aggregation of data but does not involve a loss of competition per se could violate merger control laws.

advertising, although revenue might also derive from the sale of user data.

These circumstances involve what is often referred to as a two-sided market or sometimes a two-sided media market.¹⁹ In such circumstances, it is not uncommon to find that advertisers have many substitutes while consumers might have more limited options. Therefore, I will also assume that in my set of hypothetical facts, a change in the supply of advertising by the merging services has a limited effect on the price of advertising; thus, anticompetitive effects in the advertising market are unlikely to arise. Under the assumption that the advertising market is perfectly competitive (at least with respect to the merging services), the merging services will be price-takers in the advertising market, and as I show below, under the model that I propose for advertising pricing, the complications often attributed to the analysis of two-sided markets do not arise.

In the next section, I discuss the subjectivity of preference over privacy and how that might affect the antitrust analysis of privacy issues. If there is evidence of competition over privacy protections, then the services involved in that competition likely believe that consumers (at least on average) would prefer those protections. Such a fact pattern would appear to provide evidence that consumers would likely be better off as a result of an increase in privacy, at least at the margin, and hence lessening the importance of an objective analysis of consumer preferences for privacy. In Section 3, I discuss the two-sided market issues. These include the potential of balancing benefits on the advertising side against harms to consumers and the general inclination to focus on the side of the market in which money is changing hands. If a merger between online services is not likely to adversely affect the advertising side of the market because the merging parties are jointly a small portion of the market, then a decrease in privacy by those services is unlikely to generate a substantial procompetitive benefit to advertisers. In addition, competition in the advertising market in no way protects users on the consumer side. Thus, adverse effects from a merger can be missed by not analyzing the side of an online service's business characterized by non-price competition. In Section 4, I show that there are ways of quantifying the non-price effects of a merger without necessarily quantifying quality or privacy. To show this, I derive a formula analogous to upward pricing pressure formulas and describe how it might be used to inform merger analysis.

¹⁹Filistrucchi, Geradin, van Damme, and Affeldt (2013) describes the distinction between two-sided media markets and other kinds of two-sided markets.

2 Subjective preferences over quality and privacy protections

One of the arguments against or analytical challenges of incorporating privacy issues into the competition analysis is the possibility that there may not be unanimity over preferences for more privacy protections and therefore consumer preferences over privacy are subjective.²⁰ That is, while some consumers may prefer more privacy to less, others may prefer a reduction in privacy so as to be offered advertisements that better match the consumer's interests. The argument is that preferences over privacy are at least in part subjective. However, if there is evidence that merging online services compete on the basis of privacy protections, then the services engaged in that competition believe that they can attract more users by offering more privacy protections, which, at least at some level, implies that consumers prefer more privacy to less. Although it is difficult to predict what kinds of evidence would be available, evidence of competition in privacy could include documents that suggest that the merging services track each others' privacy policies and that not providing a certain level of privacy protections would cause a loss of users to the other service.

The essence of competition involves firms taking actions that are costly in the sense of decreasing their margins in order to retain or increase sales. To increase usage of an online service, the service must seek to make itself more attractive to potential users. Actions by one firm to attract customers will generate an incentive by other firms that would lose customers as a result to take similar actions in order to retain customers. If services compete on price, lowering price makes a service more attractive to consumers and thus (holding everything else constant) would result in increased usage at the expense of substitute services. While lowering price increases sales, it is costly to the service in the sense that depending on how the price decrease is implemented, the decrease in price can decrease the margin on existing sales.

Similarly, when online services compete on non-price dimensions or on privacy protections in particular, the services increase quality or privacy protections in order to make themselves more attractive to consumers and thus (holding everything else constant) believe that such a change would result in an increase in users at the expense of substitute services.²¹ Although the goal of these changes to product characteristics is to increase sales, these changes are likely to be costly to the firm either in the form

²⁰For example, see Cooper (2013) and Grunes (2013).

²¹For simplicity of exposition, I will talk in terms of competing for users; the analysis is essentially the same if there is also competition over the intensity of use.

of higher costs or lower revenue. Assuming that there is evidence of competition over privacy protections, it would be the case that over the range of privacy protections being considered, competing services believe that an increase in privacy protections makes their services more attractive to users; but for the competition over those protections, the services would have preferred a lower level of privacy protection.

What should be inferred from evidence that services compete on non-price dimensions? Given that the services should have strong profit motives to know what kinds of characteristics will attract customers, in most cases it is reasonable to infer that changes that the services believe will attract more customers will in fact make the services more attractive and improve consumer welfare, at least to the customers who would be attracted by such changes. That is, if a change in the qualitative aspects of a service increases usage, then the increased usage among consumers who see the change as making the service more attractive is larger than the decrease in usage among consumers who see the change as making the service less attractive.²²

Cooper asserts that the analogy described above between quality improvements and increases in privacy is false. He hypothesizes that decreases in privacy by collecting more information about users increases the service's costs but would allow it to provide a user experience that better matches the preferences of users.²³ Thus, the assertion seems to be that a decrease in privacy would make a service more attractive to consumers because it would allow the service to better match the preferences of consumers and thus attract more users to the service, but services must balance such a welfare-improving decrease in privacy against the increased costs that would result. Hence, according to Cooper, a decrease in privacy is analogous to an increase in quality because the additional data collected by a service allows it to better tailor the service to its users' preferences. Notwithstanding this claim, at least for some aspects of privacy, it is not obvious on theoretical grounds whether consumers would prefer more or less, but evidence that services compete on the provision of privacy protections implies that incremental decreases in privacy protections below current levels are generally viewed as making a service less attractive to users on average and therefore likely decrease consumer welfare. Although it may be important to consider the preferences of certain users over others, it seems unreasonable to conclude that

²²While likely a reasonable inference in most cases, it will not always be the case that changes in service quality that increase sales increase consumer surplus as measured by the area under the demand curve faced by an online service. A change in service quality could decrease the welfare of infra-marginal users while increasing the welfare of marginal users. In such a case, it would be possible for a service to attract more users while decreasing the aggregate consumer surplus.

²³Cooper (2013, p. 8).

unless consumers are unanimous in their preference for additional privacy protections, a loss of competition in privacy protections should not be protected by the antitrust laws.

3 Two-sided market issues

Privacy concerns tend to arise in the provision of online services that are supported through revenue from advertising. Often these services are provided to consumers without a monetary charge but consumers are “served” with advertisements, and it is the sale of advertising space that provides the revenue that supports the service. One challenge when analyzing a merger of two services that are viewed as substitutes to consumers is how to think about competition over quality (and possibly the supply of privacy) on the consumer side of the services’ business. For example, is it sufficient to analyze the effects of the merger on the side of the services’ business that is monetized—the advertising side? And when analyzing harms from a loss of competition over privacy protections on the consumer side, do the adverse effects arising from a loss of competition over privacy protections have to be balanced against benefits to advertisers that may result?

In order to get at these questions, I use a simple model of the advertising side of the market. The case I focus on involves a situation in which consumers have limited choices of the particular type of online service at issue but advertisers have many ways beyond those services to reach consumers. In such a situation, it is likely that the advertising side of the market is relatively competitive but that a merger of two of these online services could significantly reduce the set of alternatives for use of the particular type of service at issue. Therefore, I will assume that the advertising side of the market is competitive in the sense that merging services cannot affect the terms of trade on the advertising side of the market. In other words, the online service providers are price-takers in the advertising side of the market.

However, being a price-taker in the advertising market does not mean that the service cannot affect its revenue from advertising through actions that increase usage or increase the effectiveness of advertisements through better targeting. Consider the following simple model. The goal of most advertising is to induce consumers to take some action (e.g., purchase a product, register on a website, or vote in a particular way). Let p^A denote the market price for advertising normalized for effectiveness such that p^A can be thought of as the price to induce a consumer to take the desired

action. If the normalized price of advertising differed across suppliers of advertising space, then advertisers would seek to purchase more from the service with the lower normalized price because the advertisers would be able to induce the desired action at lower cost. Therefore, I would expect in equilibrium that services would earn the same normalized price for advertising.

Let r denote the probability that a consumer exposed to advertising will take the desired action or in other words the probability that the advertising is effective, and let d denote the number of users. (d could also denote some other appropriate measure of usage intensity.) The online service’s advertising revenue is the number of users times the probability that the advertising is effective times the normalized market price for inducing that action, drp^A , and per-user advertising revenue is rp^A . Note that advertising revenue of the service increases in the number of users and in the probability that users take the desired action. Price-taking in this context means that an increase (or decrease) in the supply of advertising through an increase (or decrease) in users or an increase (or decrease) in the probability of consumers taking the desired action through better targeting does not affect the normalized market price for inducing consumers to take the desired action. Better-targeted advertising would increase advertising revenue by increasing the probability that the advertising is effective.

There is some empirical justification for such a model of online advertising prices. Beales (2010) finds that in 2009, advertising that involves behavioral targeting is 2.68 times as expensive and 2.43 times as effective as advertising that is less targeted.²⁴ Therefore, Beales (2010) finds that targeted and nontargeted advertising are, when normalized for effectiveness, priced similarly.

Now turning to the consumer side of the market. As has been noted by others, in a two-sided market, it is possible for the profit-maximizing price on one side to be zero as well as positive or negative.²⁵ If pricing decisions on the consumer side were truly unconstrained (as in the usual textbook sense), then observing many prices at exactly zero would seem to be an unlikely outcome. That is, in any given situation, it is unlikely that the unconstrained profit-maximizing price would be exactly equal to zero. It is a knife-edge, or, as David Evans describes it, a “Goldilocks” condition.²⁶ It would be more likely to observe a random distribution of prices that does not involve a spike in frequency at zero. Therefore, it is hard to reconcile the observation

²⁴Beales (2010, Table 1) reports average conversion rates for behaviorally targeted advertising as 6.8% and run-of-the-network advertising of 2.8%.

²⁵For example, see O’Brian and Smith (2014) and Evans (2011).

²⁶Evans (2011, p. 75).

that many online services offer their services to consumers without monetary charge with an assertion that prices are unconstrained by certain frictions. Rather, it is more likely that something is constraining price. Two possible constraints that could generate many more zero prices than would otherwise be expected are transaction costs and demand distortions associated with negative prices.

Zero is a rather special price in that it involves no exchange of money. If setting up a payment system and executing transactions over that payment system is costly enough, then as long as the unconstrained profit-maximizing price would be close enough to zero given the transaction costs, it might be profit maximizing to avoid transaction costs altogether and implement a zero price.²⁷ Therefore, incentives to avoid transaction costs can result in what might otherwise be an unusual number of zero prices.

An alternative but not mutually exclusive constraint is that there is something about negative prices that causes problems that do not arise when the price is non-negative. To see what this might be, suppose that the free weekly paper or advertising flyer that can be picked up from sidewalk boxes were not free but that consumers received some small amount of money (i.e., a negative price) in exchange for taking one. Such pricing creates an incentive to simply take the paper or advertising flyer to get the small remuneration even if the individual has no intention of looking at the paper or flyer. If additional quantity demanded from decreasing price from zero to a negative price is completely driven by people who do not intend to even look at the paper or flyer, then no additional consumers would even see the advertisements within the flyer, and there would be no additional advertising effectiveness as a result of the price decrease. Realistically, additional people would likely read the paper or flyer, but it is easy to see that in such a situation negative prices can create perverse incentives on the consumer side. While some services may be able to implement negative prices without these kinds of distortionary effects, other online services may find it difficult to prevent consumers from gaming the system. Therefore, it may not be feasible to set a negative price and expect such a price decrease to significantly increase advertising revenue without an even more significant increase in distribution costs due to the increase in the quantity demanded by individuals who only want a payment in the form of a negative price.

If both transaction costs and perverse incentives from negative prices are present,

²⁷One should not think of transaction costs too narrowly. Transaction costs include consumer general reluctance to provide payment information to online services or otherwise go through a lengthy registration process.

then we might expect to see no negative pricing (or types of negative pricing meant to prevent the perverse incentives described above) and no prices other than zero that are positive and small. If constraints such as these generate the large number of zero prices that we observe, then it is not possible to make use of the standard critical loss calculations for price competition because such calculations assume that pricing is set optimally without such constraints. If the constraints are significant, then it might not be reasonable to expect any price effects from a merger on the consumer side, even in situations in which the services appear to be close substitutes. However, such constraints on price competition would likely increase the importance of non-price competition.

In order to analyze the effects of a merger on the provision of privacy or other quality dimension, let t_i denote the level of quality or privacy offered by online service $i \in \{1, \dots, n\}$. The demand for service i is denoted as $d_i(t_i, t_{-i})$ and is a function of service i 's own quality level and the quality levels offered by the other services, where t_{-i} denotes the vector of quality levels offered by all of the services other than i . Furthermore, let $m_i(t_i)$ denote the variable per-user profits of service i such that the profits for service i can be written as

$$m_i(t_i)d_i(t_i, t_{-i}).$$

As suggested by this profit equation, I will maintain the assumption that changes in quality or the provision of privacy affect variable costs or revenue and not fixed costs.²⁸ By the simple model of advertising revenue presented above, changes in the level of privacy that affect a service's ability to target advertising change per-user revenue. If we write the probability of consumers taking the desired action as a function of the provision of privacy $r_i(t_i)$, then advertising revenue for service i would be $p^A r_i(t_i)$ and the per-user cost of the service is $c_i(t_i)$, then variable per-user profit of service i is $m_i(t_i) = p^A r_i(t_i) - c_i(t_i)$, where advertising revenue would be $p^A r_i(t_i)d_i(t_i, t_{-i})$. Under the assumption that services $1, \dots, n$ are price-takers in the advertising market, a change in quality by one service seems unlikely to have a direct effect on another service's probability of advertising effectiveness or its cost level. Therefore, under such an assumption, a service's per-user profits will not depend directly on the quality offered by other services.

If the services compete in quality levels t_1, \dots, t_n , the implication is that for any

²⁸If the cost of increasing quality affects fixed costs, then the analysis of merger effects is more complicated and will among other factors depend on whether any of those fixed costs are saved as a result of the merger.

service an increase in its own quality level (all else equal) increases user demand for the service but is costly in the sense of reducing the per-user profit of the service, and an increase in a rival's quality level decreases a service's user demand. If t_1^*, \dots, t_n^* represents pre-merger equilibrium levels of quality, then t_i^* would maximize service i 's profits, assuming that the other services offer their equilibrium quality levels. Assuming differentiability, the first-order condition for service i is thus

$$\frac{\partial m_i(t_i^*)}{\partial t_i} d_i(t_i^*, t_{-i}^*) + m_i(t_i^*) \frac{\partial d_i(t_i^*, t_{-i}^*)}{\partial t_i} = 0.$$

Now consider the effect of a merger between services 1 and 2. The joint profits of the firm post-merger are

$$m_1(t_1) d_1(t_1, t_{-1}) + m_2(t_2) d_2(t_2, t_{-2}).$$

For a merger of services 1 and 2 with no efficiencies, there will be an incentive to decrease quality or privacy if the derivative of joint profits with respect to one of the quality variables is negative when evaluated at pre-merger equilibrium quality levels. Note that the derivative of joint profits with respect to service 1's quality level evaluated at the pre-merger equilibrium qualities is

$$\begin{aligned} \frac{\partial m_1(t_1^*)}{\partial t_1} d_1(t_1^*, t_{-1}^*) + m_1(t_1^*) \frac{\partial d_1(t_1^*, t_{-1}^*)}{\partial t_1} + m_2(t_2^*) \frac{\partial d_2(t_2^*, t_{-2}^*)}{\partial t_1} \\ = m_2(t_2^*) \frac{\partial d_2(t_2^*, t_{-2}^*)}{\partial t_1} < 0, \end{aligned}$$

where the first equality follows as a result of the fact that the derivative of service 1's profits with respect to 1's quality variable evaluated at the pre-merger equilibrium is equal to zero. The derivative is negative, thereby indicating an incentive to reduce quality or privacy below pre-merger levels as long as service 2's pre-merger per-user profit is positive (i.e., $m_2(t_2^*) > 0$) and an increase in service 1's quality level causes a decrease in service 2's demand (i.e., $\partial d_2(t_2^*, t_{-2}^*) / \partial t_1 < 0$) or analogously a decrease in service 1's quality causes an increase in service 2's demand. The same analysis applies to incentives to decrease t_2 post-merger. The mechanism at work here is similar to the mechanism associated with price effects. That is, some of the users lost as a result of a decrease in quality are after the merger recaptured by the merger partner, which changes in the profit-maximizing trade-off between higher per-user profits and the number of users associated with the pre-merger equilibrium.

Notice that effects in the advertising markets do not make such a change in quality

unprofitable, and the mechanism is analogous to price effects as a result of a merger in non-two-sided markets. That is, post-merger, a decrease in quality by service 1 results in the merged firm recapturing some of the customers lost to service 1 through an increase in usage of service 2. The value of those recaptured sales is the size of the diverted users times the per-unit profit margin on those users.

Thus far, I have assumed that the merging services are price-takers on the advertising side of the business. If an increase in privacy and the subsequent decrease in the ability to target advertising results in a decrease in the supply of advertising (because the capacity to induce consumers to respond in the intended way is diminished), then an increase in privacy will tend to cause an increase in advertising prices. By assuming that the merging services are price-takers, I am essentially assuming that such an effect would be sufficiently small such that it is convenient to treat the normalized price for advertising (p^A in the model above) as fixed with respect to changes in privacy. However, if an increase in privacy is believed to have a measurable effect on the price of advertising, then such an effect will, all else equal, tend to dampen the post-merger incentive to decrease privacy protections. To see this, note that in such a situation, an increase in t_1 will cause m_2 to increase as a result of the increase in p^A . Thus, m_2 will be a function of t_1 as well as t_2 and $\partial m_2(t_2^*, t_{-2}^*)/\partial t_1 > 0$. In this case, the derivative of joint post-merger profits with respect to t_1 evaluated at pre-merger quality would be

$$m_2(t_2^*) \frac{\partial d_2(t_2^*, t_{-2}^*)}{\partial t_1} + \frac{\partial m_2(t_2^*, t_{-2}^*)}{\partial t_1} d_2(t_2^*, t_{-2}^*).$$

Generally, in the case in which changes in the supply of advertising as a result of a change in privacy protections have a measurable effect on the market price for advertising, the sign of this derivative will be ambiguous, because the first term in the expression above is negative and the second term would be positive. If the merging services are price-takers, then this second term would be zero. Assuming that an investigation into the advertising side of the services' businesses suggests that the merging services are too small a part of the advertising market to have even a small but significant effect on the price of advertising, then $\partial m_2(t_2^*, t_{-2}^*)/\partial t_1$ will be quite small and might be assumed to be zero. If the ability to affect the price of advertising is material, then it would be necessary to also determine whether the merger creates an incentive to decrease the supply of advertising directly in order to increase the price of advertising. In such a case, the merger might be deemed anticompetitive based on effects on the advertising rather than the consumer side of the market.

Note that if competition on the consumer side is over non-privacy-related quality, then while perhaps not possible to rule out, it is not obvious why a non-privacy change in quality by service 1 would affect the price of advertising or the per-user profit of service 2 more generally. Thus, an analysis of non-privacy-related quality is not likely to involve this extra degree of complication, and the feedback effects that are often discussed in the two-sided markets literature would not be present.

Now consider what benefits might be present on the advertising side of the market that would need to be set against the unilateral incentive to decrease quality to consumers. To start, the two sides are likely best thought of as two different but related markets. Consumers are seeking whatever service that the online sites are providing. For example, in the case of Facebook, consumers are seeking to stay in touch with friends, share photos, etc. The substitutes for consumers include other social networking services such as Twitter and Instagram. Advertisers are seeking something quite different with often but not always very different alternatives from which to choose. Advertisers are looking for ways of getting their messages to consumers (not necessarily only the consumers who are seeking the particular online service at issue in a merger) and hopefully inducing them to take the desired action.

With two potentially different sets of substitutes, it would seem natural to treat the consumer and advertising sides as different but interrelated markets.²⁹ Antitrust agencies are for the most part reluctant to credit efficiencies in one market against anticompetitive effects in another.³⁰ If the merging online services are price-takers in the advertising market, then there would be no procompetitive price effect in the advertising market from an increase in supply of advertising as a result of a decrease in privacy. Using the simple model of advertising described above, an increase in the ability to target advertising would increase the probability that advertising is effective. That is, $r_i(t_i)$ is decreasing in t_i . However, the market price for advertising is defined in terms of the price of inducing a consumer response. Thus, even with better-targeted advertisements, unless the normalized market price for advertising changes, advertisers would be paying the same market price, and in the simple case in which value for the advertiser is only generated when the consumer is induced to take the desired action, there is no benefit to the advertiser from the better-targeted advertisements as the advertiser continues to get the same level of effectiveness per dollar spent. For example, as described above, Beales (2010) finds that when normal-

²⁹This is the position taken by Filistrucchi, Geradin, van Damme, and Affeldt (2013).

³⁰Department of Justice and Federal Trade Commission (2010, Footnote 14) and Directorate-General for Competition (2004, Paragraph 79).

ized for effectiveness advertisers pay the same price for better-targeted advertising as they pay for less-targeted advertising.

If it is not appropriate to treat the merging online services as price-takers, then a change in the supply of advertising by the merging online services could affect the price of advertising; thus, a decrease in privacy could increase the welfare of advertisers. Even if this effect is insignificant by antitrust law standards if the market for advertising is large enough, even an insignificant increase in welfare might be larger than a significant anticompetitive effect in a smaller market on the consumer side. However, in such a case, the merger could also create an incentive to decrease the supply of advertising in order to affect price. Therefore, it is not clear that there would be a procompetitive effect on advertisers.

4 Measurement issues

Protection of quality competition under competition regulations around the world is reported to have been hampered by difficulties of measuring changes in the quality of products and services. In Section 2, I argued that any concerns over the subjective nature of quality competition should be reduced if a merger investigation uncovers evidence of competition over quality. In this section, I provide a framework, similar to the framework used to analyze unilateral price effects from a merger that could be applied in markets in which pricing to consumers is constrained and that avoids issues of measuring changes in quality or, more specifically, changes in privacy.

Thus far, I defined t_i as service i 's level of quality, including possible privacy protections. However, as might have been clear to some readers, the mathematical model presented above for the unilateral effect of competition over t_1, \dots, t_n is quite general. The variables t_1, \dots, t_n can be measures of any aspect of the services that make them more attractive to users such that for service i an increase in t_i increases the number of users but decreases the per-user profit and therefore involves a profit-maximizing trade-off similar to the setting of price. In fact, an increase in t_i could represent a decrease in price, as a price decrease will tend to make a service more attractive but lower per-user profits.

If an online service is not charging a monetary price to users but earning revenue through advertising, then there must be other non-price actions that it could take to try to attract more users. These could include adding features, improving the interface, improving privacy protections, and increased marketing. Each of those actions increases costs or possibly decreases per-user revenues but presumably increases sales.

Assuming a Nash equilibrium in the choice of these actions, pre-merger, each service will find itself setting the action measure by t_1, \dots, t_n at a level that maximizes its profits, assuming that the other services in the market are also taking actions consistent with the equilibrium. If a decrease in t_i would result in some users switching from service i to another service, then in some sense competition from other services constrains service i 's setting of t_i .

Given the similarity between competition in prices and quality as modeled above, it should not be surprising that some of the same quantitative techniques used in the analysis of price competition can also be applied in the analysis of quality competition when analyzing mergers. Here, I focus on the application of an analog of the upward pricing pressure (UPP) calculation. One of the quantifications that is possible when using the UPP formula is the determination of the level of incremental cost efficiency from a merger that would be necessary to eliminate any upward pricing pressure. If efficiencies are below this critical level, then the merger would create an incentive to increase price. Similarly, it is possible to calculate a critical level of incremental cost efficiency from a merger such that efficiencies below that level would create downward pressure on quality (or downward quality pressure (DQP)) and efficiencies above that level would create upward pressure on quality.

As modeled above, the joint profit post-merger of services 1 and 2 with margin per-unit increasing efficiency Δ_1 is

$$(m_1(t_1) + \Delta_1)d_1(t_1, t_{-1}) + m_2(t_2)d_2(t_2, t_{-2}).$$

The efficiency Δ_1 is just sufficient to eliminate adverse unilateral effect on t_1 if the derivative of this joint profit function with respect to t_1 when evaluated at pre-merger quality levels is equal to zero.³¹ That is, the first-order condition of joint profits when evaluated at pre-merger levels of quality will equal zero, thereby implying that t_1^* remains the profit-maximizing level of quality. This first-order condition is

$$d_1(t_1^*, t_{-1}^*) \frac{\partial m_1(t_1^*)}{\partial t_1} + (m_1(t_1^*) + \Delta_1) \frac{\partial d_1(t_1^*, t_{-1}^*)}{\partial t_1} + m_2(t_2^*) \frac{\partial d_2(t_2^*, t_{-2}^*)}{\partial t_1} = 0. \quad (1)$$

³¹Assuming no merger-specific efficiency for service 2 in this derivation is the same simplifying assumption that Farrell and Shapiro (2010a) used to derive the simple version of the UPP formula. There has been some debate regarding the accuracy of this simple version. More complicated and possibly more accurate formulas tend to be more interventionist. For example, see Schmalensee (2009) and Farrell and Shapiro (2010b).

Given that a pre-merger profit-maximizing equilibrium in (t_1, \dots, t_n) implies

$$d_i(t_i^*, t_{-i}^*) \partial m_i(t_i^*) / \partial t_i + m_i(t_i^*) \partial d_i(t_i^*, t_{-i}^*) / \partial t_i = 0$$

including $i = 1$, the first-order condition above (Equation 1) reduces to

$$\Delta_1 \frac{\partial d_1(t_1^*, t_{-1}^*)}{\partial t_1} + m_2(t_2^*) \frac{\partial d_2(t_2^*, t_{-2}^*)}{\partial t_1} = 0.$$

Rearranging this equation and dividing both sides by $m_1(t_1^*)$, one can derive the following expression

$$\Delta_1 = -m_2(t_2^*) \times D_{12}, \tag{2}$$

where

$$D_{12} = \frac{\partial d_2(t_2^*, t_{-2}^*) / \partial t_1}{\partial d_1(t_1^*, t_{-1}^*) / \partial t_1},$$

which is referred to in the literature as the diversion ratio from service 1 to service 2. In other words, there will be no downward pressure on service 1's quality if the efficiency for service 1 attributable to the merger would increase pre-merger per-user profits by an amount equal to the pre-merger per-user profit of service 2 multiplied by the diversion ratio from service 1 to service 2 associated with a decrease in the quality of service 1. There have been a number of versions of UPP formulas. Most of the UPP formulas that have been promulgated involve unitless equalities. A convenient unitless equality for this DQP formula as defined by Equality (2) can be generated by dividing both sides of the equality above by service 1's pre-merger per-user profit margin $m_1(t_1^*)$. Thus,

$$\frac{\Delta_1}{m_1(t_1^*)} = -\frac{m_2(t_2^*)}{m_1(t_1^*)} \times D_{12}.$$

For the symmetric case where $m_1(t_1^*) = m_2(t_2^*)$, this further reduces to implying that the percentage increase in per-user profits from the efficiencies should be at least as large as the percentage diversion to the merger partner, or $\Delta_1 / m_1(t_1^*) \geq D_{12}$.

The quantities in the DQP formula above are generally not more difficult to quantify than those in the UPP formulas and do not necessarily require the actual measurement of quality. Pre-merger margins are an important input in UPP calculations; these are the same pre-merger margins that are inputs to the DQP formula. The diversion ratios associated with price effects need not be that different from diversion ratios associated with small but significant changes in quality. Natural experiments that involve changes to a service's quality could be used to quantify a diversion ratio.

Notice that it is unnecessary to measure the size of the change in quality, only the effect of that change on the number of users of the two services. Therefore, measuring quality need not be an issue. In many applications, an initial assumption is that diversion ratios are proportional to market shares in the following way. If services 1 and 2 have shares s_1 and s_2 and users leaving service 1 in response to a decrease in quality divert to other services in proportion to the other services' shares, then $D_{12} = s_2/(1 - s_1)$. Often, this will not be the right assumption if there is significant diversion outside of the market used to calculate shares or if the merging services 1 and 2 are atypical competitors in the sense of being either close or far in product space.

As long as the online services make a trade off between attracting more users through higher quality or more privacy protections and lower per-user profits, then they are acting as if they are optimally setting the variables t_1, \dots, t_n as described above. The analysis above demonstrates that those variables need not be precisely defined in order to provide a quantification of merger effects similar to quantifications commonly used by competition authorities.

5 Conclusion

In this paper, I have attempted to provide a framework for analyzing the competitive effects from a merger of online services that compete in the level of privacy offered to consumers. In supplementary materials prepared for his panel presentation at the American Bar Association's 2015 Antitrust and Intellectual Property Conference, Daniel Sokol states,

A review of the academic literature specific to Big Data and antitrust reveals few articles specifically on the topic. A number of marketing and economic papers address how Big Data may impact markets more broadly but are not specific to antitrust. Scholars have yet to make an in-depth analysis of why Big Data issues are antitrust issues and institutionally should be solved under antitrust law rather than consumer protection law.³²

This paper is perhaps an initial step in filling in that apparent gap in the literature. Although the market structure of many real-world merger investigations will not

³²Sokol (2015, p. 1).

match the set of facts that I have assumed here, advertising-supported online services offered to consumers for free is the most common business model for online services. Even if there is no evidence of competition over privacy, the analysis here provides a framework for analyzing competition over quality when competition in price does not occur and thus would apply to a broad range of applications in which the only form of competition is over quality.

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