Antitrust, Transaction Costs and Merger Simulation with Non-linear Pricing

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Abstract

This article explores the relationship between transaction costs and antitrust. It makes three points. First, antitrust analysis must pay greater attention to transaction costs. The usual antitrust analysis can be seriously misleading as a guide to consumer or society welfare because it assumes that pricing is linear and uniform. But the type of pricing that emerges is endogenous and depends on transaction costs, including information costs. Second, two key issues in any antitrust analysis are a) whether transaction costs change as a result of the action under scrutiny, and b) whether or not they change, how the existence of nonlinear pricing, if it is present, alters the usual antitrust analysis. We use a merger simulation model with non-linear pricing to illustrate how misleading the standard analysis that assumes uniform pricing can be. Third, since transaction costs influence the ability of various coalitions of consumers, distributors, and manufacturers to form, cooperative game theory can provide a unifying perspective into what situations might give rise to the creation and exploitation of market power.
I. Introduction

This article explores the relationship between antitrust and transaction costs. The article makes three points. First, antitrust analysis must pay greater attention to transaction costs. The usual antitrust analysis can be seriously misleading as a guide to consumer or society welfare because it assumes that pricing is linear and uniform. But the type of pricing that emerges is endogenous and depends on transaction costs, including information costs. For example, as Coase (1960) showed long ago, in the absence of transaction costs, there is no deadweight loss. Hence, if one paid attention to only total surplus, there would be no need for antitrust (Demsetz (1968)). Alternatively, if there are transaction costs, as Coase stressed is the case, then conduct that reduces those costs could enable more efficient pricing that leads to increases in consumer or total surplus. Second, it follows that two key issues in any antitrust analysis are a) whether transaction costs change as a result of the action under scrutiny, and b) whether or not they change, how the existence of nonlinear pricing, if it is present, alters the usual antitrust analysis. Point a) says that a lowering in transaction costs that enables the use of a more efficient pricing mechanism is an efficiency that must be accounted for in any antitrust analysis. Point b) is a recognition that since there is an incentive to engage in nonlinear pricing when there is market power, any antitrust analysis done under the alternative and usual assumption of uniform pricing could be in error since uniform linear pricing and nonlinear pricing lead to different equilibria. Third, an antitrust analysis that considers only two groups, consumers and producers, is too narrow to understand much antitrust conduct. Many more complicated coalitions consisting of some consumers, some distributors, and some producers must be analyzed to understand certain types of horizontal and vertical behavior—even behavior as well understood as a price fixing cartel. Since the transaction costs of organizing coalitions influence the ability to form these various coalitions, cooperative game theory
provides a way of unifying all antitrust conduct and providing insights into when certain types of behavior will occur.

This paper is organized as follows. Section II examines the limitations of the foundational model of antitrust in which a firm (or group of firms) raises price above marginal cost, restricts output, and harms consumer and total welfare. It explains how various types of conduct can alter transaction costs and enhance the ability of the firm to engage in non-linear pricing. To illustrate the limitations of the standard mode of antitrust analysis that focuses on uniform and linear pricing, Section III focuses on the typical merger simulation used in merger analysis where the analysis assumes uniform pricing in a Bertrand competition. We show when and how that analysis can be entirely misleading. To do so, we develop and implement a model of merger simulation with nonlinear pricing – a merger simulation model that we do not believe is in the literature. We show how an analysis of a merger can change, sometimes significantly, even with only small departures from the standard assumption of uniform Bertrand pricing. Such departures, which enhance efficiency, are not only predicted by Coase’s insights but also are consistent with the empirical observations in many industries. Finally, Section IV describes a more general view of how antitrust harm can arise, closely related to cooperative game theory. The key insight is that transaction costs explain which groups are likely to form and are able to exploit other groups. Although the use of cooperative game theory in industrial organization has for the most part been overtaken by the use of non-cooperative game theory (the work of Telser (e.g., 1987, 1997, 2006) and Roth (2008) are notable exceptions), we will see that its use provides a unified way of understanding how antitrust should treat horizontal and vertical behavior. A companion paper to this one (Carlton and Keating (2015)) elaborates on several of the themes in this paper.

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1 See, e.g., Williamson (1968).
II. Coase, Transaction Costs, and Deadweight Loss

As explained in the Introduction, Coase makes the point that since everyone theoretically can be made better off when there is more output, it has to be the case that the economy is always at an efficient point as long as there are no transaction costs, by which he must mean that there are no impediments to reaching that efficient point. But that is not true in the usual case where transaction costs exist. For example, consider the standard diagram showing deadweight loss from monopoly pricing where the monopoly price is set above marginal cost. That pricing result is optimal for the monopolist only if it is too costly for the monopolist to figure out a way to price discriminate against its customers (or alternatively, it is too costly for some customers to negotiate nonlinear prices with the monopolist). That might sometimes be a good assumption, but not always. For example, in many business-to-business transactions, the price and quantity terms are individually negotiated, often pursuant to complex contracts. Why, in such cases, should we think that an analysis based on the assumption of uniform linear pricing will produce accurate and useful insights?

What flows from thinking about transaction costs is that there will be an incentive for the monopolist to deploy (at a cost) pricing mechanisms to enable discriminatory pricing to individual customers. Anytime one sees the standard deadweight loss triangle, instead of bemoaning its existence, one should say to himself – wow, look at that opportunity for some firm to figure out how to adopt more sophisticated pricing mechanisms in order to make profits. There is an incentive for the firm to capture at least some of that deadweight loss and increase its profits, thereby reducing or eliminating the deadweight loss. By doing so, some consumers might even be benefitted. Now, of course, although the firm benefits and some consumers might also, it is not the case that all consumers necessarily benefit. This observation then brings to the fore whether the appropriate role of antitrust is to maximize total or
consumer surplus – a topic much debated but not resolved. See Heyer (2006) for a discussion. We do not focus on that question in this paper but instead show that regardless of one’s objective, the points we raise are relevant. In the simulations in the next section, we report both total and consumer surplus by group.²

The relevant transaction costs for a firm that wants to engage in nonlinear pricing are those costs that the firm must bear above what it would bear if it just engaged in uniform linear pricing. A firm that wants to charge nonlinear prices must possess knowledge about buyers’ willingness to pay (or knowledge about the distribution of such willingness). The acquisition of that knowledge can be costly. Especially in today’s environment of enormous data bases, that knowledge can often be purchased, or accumulated over time. Mergers today are often motivated by a desire for firms to combine and exploit their complementary databases so as to be able to engage in more sophisticated pricing. One good example of that is the recent merger of Ticketmaster and Clear Channel. Ticketmaster has information on their customers who purchase tickets through TicketMaster while Clear Channel has information

² For a discussion of this topic, see also Carlton and Heyer (2008). The divergence between total surplus and consumer surplus is likely greatest in the short run. Because investment incentives can be distorted if a firm’s quasi-rents are reduced, there can be a long-run deadweight loss even when no deadweight loss appears in the short run. This situation occurs when nonlinear pricing is used against buyers in intermediate goods markets where the buyers need to make investments. In the limit, with no ability to pre-commit to not taking quasi-rents, a firm with market power may have to vertically integrate forward to make sure that there is a downstream industry.
about fans who attend concerts of certain performers. By combining the two databases, the combined firm can take advantage of information that one has but the other lacks.  

The complicated software algorithms that firms often use to price products based on customer characteristics are costly to build. Just think about the yield management systems that hotels and airlines use as an example. All of these costs need to be considered in any social efficiency calculation. But even if a firm knows the different willingnesses to pay of buyers, the firm must still exert costly effort to restrict arbitrage, otherwise the nonlinear pricing will be undone.

The required effort and cost to restrict arbitrage may well depend on firm conduct and market structure. For example, if resale is contractually forbidden or if tie-in sales or loyalty discounts are used, non-linear pricing may be easier to carry out. Alternatively, the existence of competing firms can undercut the ability to engage in non-linear pricing. Therefore, an important implication for antitrust analysis is how changes in a firm’s conduct or in market structure can alter the relevant transaction costs to engage in non-linear pricing. One can illustrate this last point with several examples in which the ability to engage in arbitrage is altered by either certain firm conduct or by a vertical or horizontal merger. We will give only one detailed example here based on a horizontal merger and refer the reader to our companion paper (Carlton and Keating (2015)) for more examples. But before we present the example, it is worth noting that although the effect of mergers on the ability to practice non-linear pricing is not the focus of much current research, it is well known that vertical mergers can enable price discrimination. A standard example of this that often appears in textbooks (e.g., see Carlton and Perloff

(2005)) is the vertical integration forward of Alcoa into aluminum end products. This integration is commonly described as being motivated by the desire to practice price discrimination. Although this example is well known, the more general point that mergers can alter the ability to practice non-linear pricing seems to have faded.

To illustrate how a merger can alter the ability to engage in non-linear pricing, consider the following simplified example of a horizontal merger. Suppose that there is a dominant firm with a competitive fringe in an industry in which no further entry of firms can occur. Suppose further that the competitive fringe has constant returns to scale at $10. The dominant firm has market power and finds it optimal to charge $10 (or a bit below) even though its constant marginal cost is below $10. Suppose the consumer surplus is $20 and the deadweight loss from the $10 price is $10. Consider now what happens if it costs $5 to implement a discriminatory pricing mechanism in the absence of the competitive fringe, but that it costs $50 in the presence of the competitive fringe because it is more costly to prevent resale and to prevent arbitrage when the competitive fringe exists. This could occur because with a lot of firms, it might be hard for the dominant firm to charge some customers a price below $10 when resale is possible through the competitive fringe. In other words, the transaction cost of price discrimination is very high in the presence of the competitive fringe but lower in its absence.

There is no incentive for the dominant firm to implement the pricing mechanism (the cost of doing so, $50, exceeds the maximum possible gain of $30) as long as the competitive fringe exists. However, a merger that eliminates the competitive fringe, which under a standard analysis assuming uniform pricing would be found to anti-competitively raise price and decrease output, would enable the monopolist to capture as profit the deadweight loss of $10 plus the consumer surplus of $20 and it would be profitable to do so since the non-linear pricing mechanism costs only $5 to implement in the absence of the fringe. In such a situation, it is even possible in this example for the total consumer
surplus to rise post-merger if the price discrimination is not perfect, as is likely for information reasons. This can occur as long as the firm’s profits rise enough to cover the $5 cost of enforcing price discrimination, with a corresponding increase in consumer surplus. Such a situation is certainly possible in the example since the price discrimination could theoretically create $10 of additional total surplus by the elimination of the deadweight loss, leaving $5 over after paying for transaction costs of price discrimination. This example highlights that it is not just the change in market power, but also the change in the transaction costs of implementing various pricing mechanisms, that will matter for efficiency (and for total and consumer surplus) when one is evaluating a proposed merger. As this example with the dominant firm illustrates, an increase in market power which usually leads to an increase in deadweight loss resulting from a restriction of output can also have an output-expanding effect by lowering the transaction costs of engaging in nonlinear pricing.

There is one crucial insight regarding vertical mergers that emerges from this focus on transaction costs. Many times opponents of a vertical merger are worried about the possibility of vertical foreclosure in which the merged entity will restrict or foreclose supply to a rival. When that concern arises, one should ask why the foreclosure did not already occur pre-merger by contract. For example, if firms A and B merge (vertically integrate) and the merged firm now finds it profitable to cease supplying rivals to the previous firm B, then one should ask why pre-merger, firm A and B could not engage in a contract in which firm B pays firm A not to supply its rivals. If there are no transaction costs to such a contract, then if it is profitable for the merged firm to refuse to supply firm B’s rivals, it will be profitable to write such a contract pre-merger. One response is that such a contract would violate the antitrust laws. Even if that were true, detecting such a contract would likely be difficult especially in

\[4\] See also Katz (1987).
comparison to the extensive scrutiny that a merger entails. That is, if one is engaging in a vertical merger to foreclose, the authorities will hopefully figure that out, while if, instead, one is using contracts to foreclose (and no vertical integration), we suspect the former is a better way to achieve foreclosure and avoid detection. Another response is that it is too costly to write and enforce such contracts, but easy to accomplish the foreclosure by vertical integration. That might be true but evidence that the foreclosure achievable by vertical integration has in fact been done routinely by contract would cast doubt on such a claim. Only if it is too costly to negotiate contracts pre-merger that duplicate the foreclosure that is achievable post-merger should the foreclosure argument merit attention.⁵

III. Merger Simulation with Nonlinear Pricing

The previous section described why the form of the pricing mechanism, and whether it is altered by some antitrust event such as a merger, could matter to an antitrust analysis. The usual procedure in a merger analysis performed by an analyst or a government authority is to assume uniform pricing to a customer group both before and after the merger, and to ask whether the price to the group rises post-merger.⁶ Merger simulation has become a standard tool of merger analysis to implement this type of

⁵ Concerns with foreclosure often arise in mergers involving broadcasting. For example, in the 2014 Comcast - Time Warner Cable merger and in Newscorp’s acquisition of Direct TV in 2003, Carlton presented testimony on behalf of the merging parties on exactly this point.

⁶ See, e.g., Horizontal Merger Guidelines of the Department of Justice and FTC (2010).
analysis. In this section, we illustrate how the usual merger simulation approach can lead to erroneous conclusions when either pricing is initially non-linear or when pricing becomes non-linear as a result of the merger. We are unaware of any merger simulation model that has addressed the use of non-linear pricing.

We begin by using a merger simulation model as it is typically used in practice. Specifically, we begin with a demand system for the differentiated products of each firm, assume that there is a single price for each product and then solve for the equilibrium prices that emerge from a Bertrand equilibrium pre- and post-merger and compare the two equilibria. We then show what happens if we assume that either pre- or post-merger the firm is able to engage in nonlinear pricing. To illustrate our points, we adopt a simple form for the nonlinear pricing — a fixed fee plus variable linear pricing. We fully

7 Merger simulation was first described in the literature by Hausman and Zona (1994) and has since been utilized routinely by researchers, government agencies and courts. See e.g. Budzinski, Oliver, and Ruhmer (2009). For a critique of its use, see e.g. Carlton (2004).

8 We do not intend to claim the analysts, courts, or competition authorities are unaware of non-linear pricing. Our point is that the consequences of it for antitrust analysis seem to be unrecognized.

9 The use of nonlinear prices including two-part tariffs is widespread. For example, mobile phone contracts often consist of a monthly fee, a monthly data limit, and then an overage fee that increases with the incremental usage above the monthly data limit. The economics literature has studied the properties of nonlinear prices. For the two-part tariff we use, if consumers are homogenous in their demands, it is optimal for a profit-maximizing firm to set the variable fee equal to the marginal cost of incremental units and then earn profits through the fixed fee. When consumers are heterogeneous in their demands, the analysis becomes more complicated. In the usual case where the marginal consumer consumes less than the average consumer, it is optimal for a firm to set the usage fee above the marginal cost. If the firm incurs a cost to acquire a customer, then the access fee, in the usual case,
understand that one could adopt more complicated pricing schemes — indeed the logic of the previous section suggests that one should explain, not assume, why such complicated schemes are not being used. But since our main point is to illustrate the implications of altering the assumptions of uniform pricing, our approach suffices to make the point.

Even though the two-part tariff pricing structure we use is one of the simplest forms of nonlinear pricing and is in widespread use in many industries, we are unaware of any implementation of a merger simulation with two-part tariffs, so we need to figure out how to implement even that simplified form of nonlinear pricing in a merger simulation model. This section does that. We do, however, urge future research on the use of more complicated pricing schemes and regard our simulations as illustrative. We develop a model with two vertically differentiated firms in which heterogeneous consumers choose which firm’s differentiated product to consume (or the outside good) and how much to consume of that product. We use this model to address several questions:

- How do the welfare implications of a merger change when firms pre- and post-merger are able to set two-part tariffs versus when they are constrained to set a single price?
- To what extent can a change in pricing technology (e.g., a merged firm can set a two-part tariff whereas the stand-alone firms can set only a single uniform price) be considered a potential

may or may not exceed that cost, depending on the elasticity of demand and consumer heterogeneity. See, e.g., Armstrong and Vickers (2001), Carlton and Perloff (2005, especially Appendix 10A), Holmes (1989), Rochet and Stole (2002) and Tirole (1988). We note that two-part tariffs are not necessarily the socially efficient pricing mechanisms when the buyers are firms that compete with each other and have U-shaped average cost curves. See Ordover and Panzar (1982).
benefit of a merger, and when is that benefit most likely to alter the analyst’s evaluation of the desirability of the merger, using either consumer or total surplus?

a) Merger Simulation Model with Non-linear Pricing

We assume that two firms are vertically differentiated, with each firm offering a price schedule for its product that depends on the consumer’s consumption. Each firm sets a fixed fee $T$ and a per unit usage fee $p$. For example, a consumer may pay his mobile phone carrier a fixed monthly fee plus a fee based on monthly usage. Consumers are assumed to be heterogeneous and to consume only one type of product.

The model has the following elements:

- $p$ is the per-unit usage fee,
- $T$ is the fixed fee,
- $N$ is the number of consumers,
- $Q(p, T)$ is the total amount of the product demanded,
- $\alpha \in \{\alpha, \overline{\alpha}\}$ is a parameter that indexes consumers and that measures the intensity of demand with higher $\alpha$ indicating more intense demand (greater willingness to pay at any quantity),
- $f(\alpha)$ is the number of consumers of type $\alpha$,
- $S(p, \alpha)$ is the consumer surplus of customer type $\alpha$ in the absence of a fixed fee,
- $q(p, \alpha)$ is the demand curve of customer type $\alpha$,
- $m$ is the marginal cost of an incremental unit of output, and
- $M$ is the marginal cost of obtaining an incremental consumer.
We first consider the pricing incentives of two competing independent firms. We then consider the pricing incentives of a single firm setting the price schedules for both products.

i. Two Independent Firms

Suppose that there are two firms indexed by \((1,2)\). Assume these firms are vertically differentiated such that consumers with type \(\alpha \in (\alpha_1, \alpha)\) choose Firm 1 and consumers with type \(\alpha \in (\alpha_2, \alpha_1)\) choose Firm 2, where \(\alpha_1\) and \(\alpha_2\) are determined endogenously. Consumers with \(\alpha < \alpha_2\) choose to consume the outside good.

The profit function for Firm \(j\) is given by:

\[
\pi_j = (T_j - M_j)N_j(p_j, T_j) + (p_j - m_j)Q_j(p_j, T_j).
\]

(1)

The cut-off points, \(\{\alpha_1, \alpha_2\}\), are then characterized by:

\[
S_1(p_1, \alpha_1) - T_1 = S_2(p_2, \alpha_1) - T_2, \quad \text{and}
\]

(2)

\[
S_2(p_2, \alpha_2) = T_2.
\]

(3)

Equation (2) indicates that a consumer of type \(\alpha_1\) is indifferent between choosing product 1 and product 2. Equation (3) indicates that a consumer of type \(\alpha_2\) is indifferent between choosing product 2 and the outside good.

The numbers of consumers choosing Firms 1 and 2, respectively, are then given by:

\[
N_1(p_1, T_1) = \int_{\alpha_1}^{\alpha} f(\alpha) \, d\alpha, \quad \text{and}
\]

(4)

\[
N_2(p_2, T_2) = \int_{\alpha_2}^{\alpha_1} f(\alpha) \, d\alpha.
\]

(5)

The quantities demanded are given by:
\[ Q_1(p_1, T_1) = \int_{\alpha_1}^{\alpha_1} q(p_1, \alpha) f(\alpha) d\alpha, \quad \text{and} \]

\[ Q_2(p_2, T_2) = \int_{\alpha_2}^{\alpha_2} q(p_2, \alpha) f(\alpha) d\alpha. \]

The firms' first-order conditions are:

\[
(T_j - M_j)N_{j,p} + Q_j + (p_j - m_j)Q_{j,p} = 0, \quad \text{and} \\
(T_j - M_j)N_{j,T} + N_j + (p_j - m_j)Q_{j,T} = 0,
\]

where \( N_{j,p} \) is the partial derivative of the quantity associated with product \( j \) with respect to \( p \) and \( N_{j,T} \) is the analogous value with respect to \( T \). \( Q_{j,p} \) and \( NQ_{j,T} \) are similarly defined. Equation (8) represents four equations in four unknowns \( (T_1, T_2, p_1, p_2) \) and determines the equilibrium to the Bertrand pricing game when price schedules are two-part tariffs. In the Appendix, we simplify further these first order conditions.

ii. One Firm Producing both Products

Consider a merger between Firm 1 and Firm 2, where the combined firm continues to produce both products. The profit function is:

\[
\pi = (T_1 - M_1)N_1(p_1, T_1) + (p_1 - m_1)Q_1(p_1, T_1) \\
+ (T_2 - M_2)N_2(p_2, T_2) + (p_2 - m_2)Q_2(p_2, T_2).
\]

The first order conditions are:

\[
(T_1 - M_1)N_{1,p_1} + Q_1 + (p_1 - m_1)Q_{1,p_1} + (T_2 - M_2)N_{2,p_1} + (p_2 - m_2)Q_{2,p_1} = 0, \\
(T_1 - M_1)N_{1,T_1} + N_1 + (p_1 - m_1)Q_{1,T_1} + (T_2 - M_2)N_{2,T_1} + (p_2 - m_2)Q_{2,T_1} = 0, \\
(T_1 - M_1)N_{1,p_2} + (p_1 - m_1)Q_{1,p_2} + (T_2 - M_2)N_{2,p_2} + Q_2 + (p_2 - m_2)Q_{2,p_2} = 0, \quad \text{and} \\
(T_1 - M_1)N_{1,T_2} + (p_1 - m_1)Q_{1,T_2} + (T_2 - M_2)N_{2,T_2} + N_2 + (p_2 - m_2)Q_{2,T_2} = 0.
\]

We use Equations (8) and (10) to evaluate the change in prices (and the resulting changes in welfare) that arises from a merger of Firms 1 and 2.
b) Simulations

To illustrate the impact of the pricing technologies on the merger simulation results, we assume specific functional forms for demand and costs and the distribution of consumers. Specifically, we assume that consumer types indexed by $\alpha$ are distributed uniformly on $(0,1)$: $\alpha \sim U(0,1)$. We assume that demand is linear and is characterized by $q(p_j, \alpha) = X_j \alpha - p_j$ such that:

- $q(p_1, \alpha) = 12\alpha - p_1$, and
- $q(p_2, \alpha) = 5\alpha - p_2$.

Marginal costs are assumed to be constant with $m_1 = 5$, $m_2 = 1$, $M_1 = 5$, and $M_2 = 1$.

We consider three scenarios, differentiated by the pricing technology available to the firms:

- In the first scenario involving uniform pricing, we restrict firms to set $p = 0$. In other words, we allow firms to charge only a fixed access fee.\(^{10}\)
- In the second scenario also involving uniform pricing, we restrict firms to set $T = 0$. In other words, we allow firms to charge only a per unit usage fee.\(^{11}\)
- In the third scenario, we allow firms to set both $p$ and $T$.

We assume initially that the hypothetical merger results in no production efficiencies. In this case, one would expect that the merger will automatically reduce welfare as long as there is some

\(^{10}\) Such pricing commonly occurs with, for example, cable television (subscribers pay a fixed monthly fee and can watch unlimited content) and health clubs (members pay a monthly membership fee and can use the gym as much as they like).

\(^{11}\) Such pricing is the commonly assumed uniform per-unit pricing.
competition that gets eliminated between the firms, holding the pricing technology constant. Although this is a reasonable intuition, surprisingly, as we discuss below, it turns out that it is not always true—a confirmation that intuition from antitrust analysis based on uniform pricing may not always carry over to an antitrust analysis based on non-linear pricing.

Table 1 below reports the simulation results pre- and post-merger when either of the two types of uniform pricing are possible and when the two-part pricing is possible. The ability to use a particular pricing scheme will depend on the underlying transaction costs of implementation. The results illustrate three key points. First, for any given market structure, if instead of using uniform tariffs (of either form), it is possible to use (because of low transaction costs) two-part tariffs, then the use of two-part tariffs expands output and increases total surplus. This result occurs because, as expected, the additional pricing flexibility of the two-part tariff gives the firm the financial incentive and ability to eliminate some of the deadweight loss that arises from the distortion in usage pricing that arises from the use of a single price. So, for example, Total Surplus in cols. (1) and (3) is always below its value in col. (5). The same is true for cols. (2) and (4) compared to (6). Second, under the assumption that the same pricing technology is used pre- and post-merger, a merger of Firms 1 and 2 reduces welfare regardless of the pricing technology (e.g., compare Columns (1) and (2), Columns (3) and (4), and Columns (5) and (6)).

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12 The corresponding tables in Appendix B report the values of all choice parameters in the resulting Bertrand equilibrium.

13 We define total surplus as the sum of firm profits and consumer surplus for the relevant products. It is also true for the example chosen that consumer surplus rises with the use of two-part tariffs. The calculation of surplus and profits in the case of two-part tariffs would have to also subtract out any assumed extra transaction costs. We are assuming that those transaction costs are lower than the increase in profits from the use of the two-part tariffs.
Again, this is the expected result since any reduction in competition generally harms consumers regardless of the pricing structures used, as long as the same pricing structures are used pre-merger and post-merger. However, the amount of the reduction in surplus depends on the pricing structure. For example, total surplus declines by more in the case of $T = 0$, $\$0.15 (\$1.54-\$1.39)$, than it does in the case of two-part tariffs, $\$0.03 (\$2.06-\$2.03)$. This means that the harm from a merger depends on what pricing structure one assumes the firms follow. Somewhat surprisingly, this intuition that reduced competition always reduces total or consumer surplus in the absence of offsetting efficiencies turns out to be false in the case of two-part tariffs. The reason is as follows. With two firms competing with two-part tariffs, it is possible that the competition between the two makes it difficult for the firms to have high fixed fees (as in the example of a dominant firm with a competitive fringe in Section II). Absent this competition, one firm could coordinate the two two-part tariffs, charge a high fixed fee for at least one of them, and then use a low variable price for that product. This is a more efficient pricing mechanism post-merger than the pricing pre-merger and can lead to increased consumer and producer surplus.  

We provide in Appendix B, Table 5, the parameters and results of such a simulation in which in the presence of two-part tariffs, a merger leads to greater total consumer surplus and greater profits! Such a result is confirmation that intuition based on uniform pricing can lead one astray.

The third, and most important point, is that even in the absence of production efficiencies, the merger can be desirable if the merger allows the movement from use of a single price schedule to use of a two-part tariff price schedule, for any of the reasons discussed in the prior section. For example, if firms pre-merger are using say a uniform tariff ($T=0$) as in column (3), but post-merger the firm can use a two-part tariff, as in column (6), then total surplus rises post-merger from $\$1.54$ to $\$2.03$ and consumer

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14 We thank Sam Peltzman for this insight.
surplus rises from $0.90 to $0.97. One way of thinking of this result is that the merger is allowing the use of more efficient pricing technology and this generates gains to consumers and society that exceeds the harms from the elimination of competition.

Table 1: Illustrative Results with No Efficiencies

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<td>Total Consumer Surplus</td>
<td>$0.40</td>
<td>$0.31</td>
<td>$0.90</td>
<td>$0.72</td>
<td>$1.00</td>
<td>$0.97</td>
</tr>
<tr>
<td>Total Surplus</td>
<td>$0.89</td>
<td>$0.83</td>
<td>$1.54</td>
<td>$1.39</td>
<td>$2.06</td>
<td>$2.03</td>
</tr>
</tbody>
</table>

Let us now consider the typical case in which the merger generates some production efficiencies—the standard reason for mergers. There are two key points that are relevant for merger evaluation. First, since output is larger (and the increment to output from an efficiency producing merger is likely larger) when firms use a two-part tariff than when they do not, it follows that the efficiency gain from a merger is likely greater in the case when a two-part tariff is used than is in the case when a single pricing structure is used. To illustrate this point, we assume that the hypothetical merger reduces the marginal cost of producing only product 1 by $0.15, a reduction of only 3% in its marginal production costs of $5.00, an amount that is quite modest relative to typical claims for merger efficiencies. Table 2 below reports the merger simulation results pre- and post-merger for the two types of uniform pricing and the two-part pricing structures. A merger efficiency of this magnitude is sufficient to increase total (and
consumer) surplus in the case of two-part tariffs, but not in the case of the single pricing structures.\textsuperscript{15} That is, the merger should be approved if two-part tariffs are used but not if single pricing structures are used.

Second, and most importantly, to the extent that the merger also enables the use of a more efficient pricing structure for the reasons discussed in the prior section, such an effect can generate an additional merger benefit. Moreover, the combination of the two benefits – the production efficiency and the pricing technology efficiency – reinforce one another so that a merger that generates production and pricing efficiencies can generate much larger benefits than a merger analysis that fails to consider the efficiencies resulting from the new pricing structure. For example, consider the case of $T' = 0$. The pre-merger total surplus is $1.54$ (Table 1, Column (3)). With no efficiencies or change in pricing technology, the merger reduces total surplus to $1.39$ (Table 1, Column (4)). The $0.15$ efficiency in the per unit production costs of product 1 raises the post-merger welfare to $1.50$ (Table 2, Column (4)), so the merger still reduces total surplus. However, further incorporating the assumption of a switch to two-part tariffs as a result of the merger increases total surplus to $2.20$ (Table 2, Column (6)), making the merger look beneficial. This example illustrates that the welfare impact of lowering the transaction costs of using a more efficient pricing mechanism is potentially quite important, especially when efficiencies are involved. Indeed, it can change the entire conclusion about the social and consumer benefits of the merger.

\textsuperscript{15}The direction of the effect depends on the parameters of the problem. In some cases, a merger reduces welfare by more in the case of two-part tariffs and in other cases, such as the one illustrated here, a merger reduces welfare more in the case of uniform tariffs.
Table 2: Illustrative Results with Efficiencies

<table>
<thead>
<tr>
<th></th>
<th>(1) Uniform tariff ($p = 0$)</th>
<th>(2) Uniform tariff ($T = 0$)</th>
<th>(3) Two-part tariff</th>
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<td>Stand-alone</td>
<td>Merged</td>
<td>Stand-alone</td>
</tr>
<tr>
<td>$N_1$</td>
<td>0.01</td>
<td>0.01</td>
<td>0.19</td>
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<tr>
<td>$N_2$</td>
<td>0.18</td>
<td>0.16</td>
<td>0.33</td>
</tr>
<tr>
<td>$Q_1$</td>
<td>0.15</td>
<td>0.12</td>
<td>0.52</td>
</tr>
<tr>
<td>$Q_2$</td>
<td>0.79</td>
<td>0.72</td>
<td>0.26</td>
</tr>
<tr>
<td>Total Consumer Surplus</td>
<td>$0.40$</td>
<td>$0.32$</td>
<td>$0.90$</td>
</tr>
<tr>
<td>Total Surplus</td>
<td>$0.89$</td>
<td>$0.84$</td>
<td>$1.54$</td>
</tr>
</tbody>
</table>

These illustrative merger simulations demonstrate the basic point that the predictions of merger simulation models can vary substantially depending upon the pricing technology available to the firms. In some cases, a merger that is harmful under one pricing regime is beneficial under another regime. Moreover, when the merger itself enables the use of a more sophisticated pricing mechanism than uniform pricing, that efficiency must be accounted for. Accounting for that efficiency can turn an otherwise undesirable merger into a desirable one. This effect is likely to be especially important when the merger generates production efficiencies. Failure to account for the non-linear pricing structures that are used can produce misleading results. This is an important caveat to the use of existing merger simulation techniques.\(^{16}\)

IV. Transaction Costs and Coalitions

\(^{16}\) Indeed, we became especially aware of these limitations while Carlton served as an expert for ATT and T-Mobile on their proposed merger involving mobile telephony, where the use of non-linear pricing is likely to be of increasing importance in managing use of scarce spectrum.
We have seen how transaction costs influence the ability of a firm to engage in non-linear pricing and how failure to take that ability into account can lead to a misleading analysis of the consequences of antitrust conduct. Although we illustrated that point in the context of mergers, it is obvious that the point applies to any conduct under antitrust scrutiny. But there is a further insight that comes from thinking about transaction costs and it leads to a unified way of thinking about antitrust.

It is traditional to think of antitrust as consisting of firms exploiting consumers. For example, a cartel of firms forms and raises price to consumers. Although that is one example of antitrust harm, there are many others in which it is not just firms that are part of the coalition that benefits from the antitrust conduct.17 For example, consider an industry consisting of one large buyer and numerous other buyers facing an industry that wants to act like a cartel. Without the acquiescence of the large buyer, the cartel may fail. The large buyer could strategically shift sales to induce price competition among the cartel members and destabilize the cartel. But the cartel, recognizing this fact, could go to the large buyer and say “we will give you a much lower price than your rivals so you will prosper as a result of the cartel.” In that case, the cartel could be thought of as consisting of the firms plus the large buyer. Whether the large buyer actually participates in the cartel, or whether he just sees that he gets a low price and prospers and so has no incentive to destabilize the cartel is irrelevant to the point that the cartel conduct succeeds because of the low transaction costs of identifying the destabilizing force facing the cartel, i.e., the large buyer, and the elimination of that buyer’s incentive to destabilize. (Of course, whether the large buyer actually participates in the cartel could have legal ramifications as to whether he is liable under Section 1 of the Sherman Act and also whether he could be a member of a class claiming damages once the cartel is discovered.)

17 Aghion and Bolton (1987) is an important exception.
The insight from this example of a cartel with a large buyer is that a general way to think about antitrust is as the formation of one coalition that exploit the rest of the population. We can think of the possible coalitions as consisting of some subset of current consumers, future consumers, current distributors, future distributors, current forms and future firms. Transaction costs will influence which coalitions can form and cannot form.  

By figuring out where transaction costs are likely to be high or low for coalition formation, we can identify the circumstances under which one should expect antitrust harms to emerge. For example, suppose it is possible to get an industry standard passed that will protect current firms from future, more efficient entrants with a new technology. Future consumers are harmed but if those consumers do not yet exist, it is hard to see how a group of them can be formed to essentially bribe the current firms from taking this inefficient action. As far as we can tell, all of horizontal and vertical antitrust behavior can be characterized as the creation of a coalition to exploit the remainder of the current and future population of economic agents. This exploitation may or may not lead to social inefficiency but it is certainly likely to do so. Once antitrust is viewed as the formation of one coalition against all other economic agents, it is possible to use a common framework to understand several recent types of claimed antitrust conduct such as vertical foreclosure, the setting of industry standards with the associated requirements to license on fair reasonable and non-discriminatory terms, and the harm  

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18 Cooperative game theory, especially the theory of the core, is the relevant tool to analyze coalition formation. See, e.g., Mas-Colell, Whinston, and Green (1995), p.657. See also Telser (1987, 2006). The cost of coalition formation is typically taken to be zero. Telser (1997) is a notable exception. Our view is that further analysis of coalition formation in the presence of transaction costs is a fruitful area of research.
imposed on cash customers by credit card companies that forbid merchants from surcharging credit cards customers. The analysis of each of these situations revolves around understanding why certain coalitions can more easily form than others. We refer the reader to our paper Carlton and Keating (2015) for a more detailed discussion.

V. Conclusion

As Coase observed long ago, whenever there is deadweight loss, there is a profitable incentive for private market transactions to eliminate it. Transaction costs prevent the complete elimination of deadweight loss. The standard antitrust analysis of deadweight loss as arising from uniform pricing is likely to be inaccurate in many settings where pricing is more complicated than uniform pricing. For example, it is well-known that in many business-to-business transactions, prices are individually negotiated and can be nonlinear. When analyzing any conduct, one should use the actual pricing mechanisms used with and without the conduct under analysis in order to properly assess the antitrust consequences of the conduct. Failure to do so can lead to erroneous results, as the simulation results with nonlinear pricing showed. The lowering of transaction costs to enable more refined pricing mechanisms can be thought of as providing a possible efficiency for various conduct that often comes under antitrust scrutiny. The observation that it is transaction costs of forming various coalitions that impedes the elimination of deadweight loss leads to the realization that all antitrust harm -- horizontal and vertical -- arises from a coalition of some groups with low transaction costs forming to exploit the left-out industry participants who face higher transaction costs of organizing into their own coalitions.

References


Appendix A  Derivation of Equilibrium Equations to Bertrand Competition with Two-Part Tariffs

Below we derive the optimality conditions with respect to the fixed prices $T$ and the usage prices $p$. We show how to express each derivative in Equations (8) and (10) as functions of all known parameters and the four unknown choice variables. The merger simulation then simply solves the four equations derived from Equations (8) and (10).

- **Derivatives of surplus functions with respect to $p$’s (holding $T$ fixed)** are:

  \[ \alpha_{1,p_1} = -\frac{S_{1,p_1}}{(S_{1,\alpha_1} - S_{2,\alpha_1})}, \]

  \[ \alpha_{1,p_2} = -\frac{S_{2,p_2}}{(S_{2,\alpha_1} - S_{1,\alpha_1})}, \]

  \[ \alpha_{2,p_1} = 0, \text{ and} \]

  \[ \alpha_{2,p_2} = -\frac{S_{2,p_2}}{S_{2,\alpha_2}}. \]

- **Derivatives of surplus functions with respect to $T$’s (holding $p$ fixed)** are:

  \[ \alpha_{1,T_1} = \frac{1}{(S_{1,\alpha_1} - S_{2,\alpha_1})}, \]

  \[ \alpha_{1,T_2} = \frac{1}{(S_{2,\alpha_1} - S_{1,\alpha_1})}, \]

  \[ \alpha_{2,T_1} = 0, \text{ and} \]

  \[ \alpha_{2,T_2} = \frac{1}{S_{2,\alpha_2}}. \]

- **Derivatives of $N$ functions with respect to $p$’s (holding $T$ fixed)** are:
\[ N_{1,p_1} = -f(\alpha_1) \alpha_{1,p_1} \]
\[ = \frac{S_{1,p_1}}{(S_{1,\alpha_1} - S_{2,\alpha_1})} f(\alpha_1), \]
\[ N_{1,p_2} = -f(\alpha_1) \alpha_{1,p_2} \]
\[ = \frac{S_{2,p_2}}{(S_{2,\alpha_1} - S_{1,\alpha_1})} f(\alpha_1), \]
\[ N_{2,p_1} = f(\alpha_1) \alpha_{1,p_1} - f(\alpha_2) \alpha_{2,p_1} \]
\[ = -\frac{S_{1,p_1}}{(S_{1,\alpha_1} - S_{2,\alpha_1})} f(\alpha_1), \quad \text{and} \]
\[ N_{2,p_2} = f(\alpha_1) \alpha_{1,p_2} - f(\alpha_2) \alpha_{2,p_2} \]
\[ = \frac{S_{2,p_2}}{S_{2,\alpha_2}} f(\alpha_2) - \frac{S_{2,p_2}}{(S_{2,\alpha_1} - S_{1,\alpha_1})} f(\alpha_1). \]

- Derivatives of \( N \) functions with respect to \( T \)'s (holding \( p \) fixed) are:

\[ N_{1,T_1} = -f(\alpha_1) \alpha_{1,T_1} \]
\[ = -\frac{1}{(S_{1,\alpha_1} - S_{2,\alpha_1})} f(\alpha_1), \]
\[ N_{1,T_2} = -f(\alpha_1) \alpha_{1,T_2} \]
\[ = -\frac{1}{(S_{2,\alpha_1} - S_{1,\alpha_1})} f(\alpha_1), \]
\[ N_{2,T_1} = f(\alpha_1) \alpha_{1,T_1} - f(\alpha_2) \alpha_{2,T_1} \]
\[ = \frac{1}{(S_{1,\alpha_1} - S_{2,\alpha_1})} f(\alpha_1), \quad \text{and} \]
\[ N_{2,T_2} = f(\alpha_1) \alpha_{1,T_2} - f(\alpha_2) \alpha_{2,T_2} \]
\[ = \frac{1}{(S_{2,\alpha_1} - S_{1,\alpha_1})} f(\alpha_1) - \frac{1}{S_{2,\alpha_2}} f(\alpha_2). \]
• Derivatives of Q functions with respect to \( p \)'s (holding \( T \) fixed) are:\textsuperscript{19}

\[
Q_{1,p_1} = \int_{\alpha_1} \frac{\partial q(p_1, \alpha)}{\partial p_1} f(\alpha) \, d\alpha - q(p_1, \alpha_1) f(\alpha_1) \alpha_{1,p_1} = \frac{Q_1}{p_1} \epsilon_{11} + \frac{S_{1,p_1}}{(S_{1,\alpha_1} - S_{2,\alpha_1})} q(p_1, \alpha_1) f(\alpha_1),
\]

\[
Q_{1,p_2} = \int_{\alpha_1} \frac{\partial q(p_1, \alpha)}{\partial p_2} f(\alpha) \, d\alpha - q(p_1, \alpha_1) f(\alpha_1) \alpha_{1,p_2} = \frac{Q_1}{p_2} \epsilon_{12} + \frac{S_{2,p_2}}{(S_{2,\alpha_1} - S_{1,\alpha_1})} q(p_1, \alpha_1) f(\alpha_1),
\]

\[
Q_{2,p_1} = \int_{\alpha_2} \frac{\partial q(p_2, \alpha)}{\partial p_1} f(\alpha) \, d\alpha + q(p_2, \alpha_1) f(\alpha_1) \alpha_{1,p_1} - q(p_2, \alpha_2) f(\alpha_2) \alpha_{2,p_1} = \frac{Q_2}{p_1} \epsilon_{21} - \frac{S_{1,p_1}}{(S_{1,\alpha_1} - S_{2,\alpha_1})} q(p_2, \alpha_1) f(\alpha_1), \text{ and}
\]

\[
Q_{2,p_2} = \int_{\alpha_2} \frac{\partial q(p_2, \alpha)}{\partial p_2} f(\alpha) \, d\alpha + q(p_2, \alpha_1) f(\alpha_1) \alpha_{1,p_2} - q(p_2, \alpha_2) f(\alpha_2) \alpha_{2,p_2} = \frac{Q_2}{p_2} \epsilon_{22} + \frac{S_{2,p_2}}{S_{2,\alpha_2}} q(p_2, \alpha_2) f(\alpha_2) - \frac{S_{2,p_2}}{(S_{2,\alpha_1} - S_{1,\alpha_1})} q(p_2, \alpha_1) f(\alpha_1),
\]

where

\[
\epsilon_{11} = \int_{\alpha_1} \frac{Q_1}{q_1} \frac{\partial q(p_1, \alpha)}{\partial p_1} f(\alpha) \, d\alpha,
\]

\textsuperscript{19} Note that the cross-derivatives of demand are equal to zero. In other words, conditional on choosing product \( i \), the price of product \( j \) does not impact consumption.
\[ \epsilon_{12} = \int_{\alpha_1}^{\alpha_2} q_1 p_2 \frac{\partial q(p_1, \alpha)}{\partial p_2} f(\alpha) d\alpha = 0, \]

\[ \epsilon_{21} = \int_{\alpha_2}^{\alpha_1} q_2 p_1 \frac{\partial q(p_2, \alpha)}{\partial p_1} f(\alpha) d\alpha = 0, \]

\[ \epsilon_{22} = \int_{\alpha_2}^{\alpha_1} q_2 p_2 \frac{\partial q(p_2, \alpha)}{\partial p_2} f(\alpha) d\alpha. \]

- Derivatives of \( Q \) functions with respect to \( T \)’s (holding \( p \) fixed) are:

\[ Q_{1,T_1} = -q(p_1, \alpha_1) f(\alpha_1) \alpha_{1,T_1} = -\frac{1}{(S_{1,\alpha_1} - S_{2,\alpha_1})} q(p_1, \alpha_1) f(\alpha_1), \]

\[ Q_{1,p_2} = -q(p_1, \alpha_1) f(\alpha_1) \alpha_{1,p_2} = -\frac{1}{(S_{2,\alpha_1} - S_{1,\alpha_1})} q(p_1, \alpha_1) f(\alpha_1), \]

\[ Q_{2,p_1} = q(p_2, \alpha_1) f(\alpha_1) \alpha_{2,p_1} - q(p_2, \alpha_2) f(\alpha_2) \alpha_{2,p_1} = \frac{1}{(S_{1,\alpha_1} - S_{2,\alpha_1})} q(p_2, \alpha_1) f(\alpha_1), \] and

\[ Q_{2,p_2} = q(p_2, \alpha_1) f(\alpha_1) \alpha_{2,p_2} - q(p_2, \alpha_2) f(\alpha_2) \alpha_{2,p_2} = \frac{1}{(S_{2,\alpha_1} - S_{1,\alpha_1})} q(p_2, \alpha_1) f(\alpha_1) - \frac{1}{S_{2,\alpha_2}} q(p_2, \alpha_2) f(\alpha_2). \]
### Table 3: Illustrative Results with No Efficiencies (Full Parameter Set)

<table>
<thead>
<tr>
<th></th>
<th>(1) Uniform tariff ((p = 0))</th>
<th>(2) Uniform tariff ((T = 0))</th>
<th>(3) Two-part tariff</th>
</tr>
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<tbody>
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<tr>
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### Table 4: Illustrative Results with Efficiencies (Full Parameter Set)

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<th>Two-part tariff</th>
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Table 5: Illustrative Results with Increase in Consumer Surplus from Merger (Full Parameter Set)

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