Naked Exclusion
By a Dominant Supplier:
Exclusive Contracting and Loyalty Discounts

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Recent literature has shown that an incumbent can use exclusive contracts to maintain supra-competitive prices, but only if he completely prevents a more efficient potential entrant from entering, and if the entrant is exogenously prevented from making exclusive offers. Such models cannot explain how exclusive contracts can lower welfare when they do not completely foreclose a small rival, when the rival can make exclusive offers, nor can they identify rudimentary relationships such as how a dominant supplier's size affects his incentive and ability to exclude and lower welfare. I formally model competition between a dominant input supplier and a small rival selling to competing downstream firms. I show that a dominant supplier can pay downstream firms for exclusivity, allowing it to maintain supra-competitive input prices, even when a small rival that is more efficient at serving some portion of the market can make exclusive offers. I also show exclusives need not completely exclude the small rival to cause competitive harm. The payment the dominant supplier makes for exclusivity must equal the incremental rents that the rival's input could generate if exactly one downstream firm sells goods using it.

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* The views expressed in this paper are those of the author and do not necessarily reflect those of the Federal Trade Commission.

1. Introduction

Why do exclusive arrangements in which a dominant input supplier pays downstream firms not to use a small rival's input cause such great antitrust concern? Intuitively there is a sense that a "large" supplier has both an incentive and an ability to use its size to prevent small sellers from making sales to the detriment of both consumer and overall welfare. I formalize this intuition by modeling dominance explicitly and showing that a supplier must be sufficiently large to exclude smaller rivals using exclusive contracts.

The recent literature regarding competitive harm from exclusive contracts looks at an incumbent monopolist offering downstream buyers exclusive contracts to prevent the entry of a rival who has not yet entered the market, rather than considering competition between two different size suppliers who both operate in the market.[1] While showing that equilibrium exclusive contracts can be harmful, these models have important practical limitations. First, they cannot shed light on important relationships such as the relationship between the dominant firm's market share and its ability and incentives to exclude a rival and lower welfare. Second, they only generate competitive harm when the rival cannot enter the market and can't offer its product to buyers. Thus, these models cannot explain how there can be competitive harm when a small rival actively sells its products in the market. Thus, they cannot explain (among other things) competitive harm from market share discounts with shares of less than 100%.

These problems stem from two artificial assumptions: First, only the incumbent can offer exclusive contracts. Second, the small rival is an entrant that can be prevented from sinking a fixed cost and entering.

My model eliminates these practical limitations by eliminating the two artificial assumptions. I replace them with a formal model of dominance of an input supplier based on

[1] E.g. Fumagalli and Motta (2006), Simpson and Wickelgren (2007a), Abito and Wright (2008) and earlier, Rasmusen et al. (1991), and Aghion and Bolton (1987). There is of course a vast literature presenting circumstances in which exclusive arrangements can increase social and consumer welfare. See e.g. Lafontaine and Slade (2008).

product differentiation. Essentially, an input supplier is dominant if a sufficiently large portion of end users will pay a sufficiently large premium for a final good with the supplier's input relative to a good with the smaller rivals' inputs. A smaller rival sells an input for which a small segment will pay at most a small premium for final goods based on it. I then model a dominant supplier and a smaller rival as having the same strategy set, so they both can offer exclusive contracts simultaneously to competing downstream final goods producers who use these inputs to produce their final goods.

The analysis is as follows: When downstream producers are homogenous and have no capacity constraint, one supplier can exclude his rival if he pays *every* downstream producer enough for them not to use his rival's input. The demand for the dominant supplier's input is so great that he could never be excluded in this way. The dominant supplier's input generates such a large share of the market's rents, that he could always outbid the small rival for at least one producer, preventing that producer from being exclusive to the small rival.

Thus, the small rival always faces competition from the dominant supplier. This means the best the small rival can do is try to prevent the dominant supplier from excluding him. The rival could do this by paying one producer enough to reject the exclusivity offer from the dominant supplier. The most the small rival can pay to any one producer to reject such an exclusive offer is the rents that the small rival can generate in competition.

This implies that the dominant supplier can offer to each producer (and each will accept) a payment equal to these rents in exchange for exclusivity. This establishes the dominant supplier as the input monopolist. If the additional rents the dominant supplier earns through exclusivity exceed the sum of the payments he must make to the producers, then he excludes the rival. The rents he earns from exclusion finance the payments for exclusion.

Thus, I show that a dominant input supplier can sign downstream producers to exclusive contracts and set the monopoly price for his input while a small rival is in the market, offers his input at marginal cost, and is more efficient at serving a small segment of the market. I extend this result to the case of the dominant supplier offering market share discounts, which are payments made to a producer in exchange for the producer using the supplier's input in a specified share of its final goods. This limits the size of the market in which the rival's input may be used, which establishes the dominant supplier as a monopolist over the remainder of the market allowing him to sell at supra-competitive prices.[2] Thus, competitive harm occurs even though the small rival makes positive sales to each producer.

Markets in which exclusionary behavior occurs when a small rival is already in and will continue to be in the market constitute an important set of cases. Many private antitrust actions that challenge exclusive dealing or loyalty discounting are brought by a smaller rival that is already in the market and making sales.[3] Similarly, there are government suits that assail the use of exclusive dealing or loyalty discounts by a dominant supplier when competing with a smaller rival.[4]

In a recently settled civil action the FTC clearly believed that exclusionary contracts used by Intel were harmful even though AMD was in the market and making positive sales when it wrote:

> "These practices [use of exclusive contracts] severely limited the number of instances in which OEMs [original equipment manufacturers]selling non-Intel-based PCs competed directly against OEMs selling Intel-based PCs, especially in servers and in commercial desktops and notebooks. *When an OEM selling Intel-based PCs competed against OEMs selling AMD-based PCs, Intel often had to*

[2] If a small set of end users will pay more for the rival's input than others who prefer it, it may be more cost effective to allow producers to serve them with the rival's input rather than paying them for using a less preferred input. The share restriction constrains producers to serve *only these* end users with the rival's input.

[3] See e.g. Concord Boat Corp. v**.** Brunswick Corp.,207 F.3d 1039 (8th. Cir. 2000) in which several boat makers sued stern drive engine manufacturer Brunswick for using market share discounts when selling engines, excluding other engine manufacturers. In AMD v Intel, AMD sued Intel for use of exclusive arrangements with Original Equipment Manufacturers (OEMs). See "Settlement agreement between Advanced Micro Devices and Intel Corporation," (2009). See also Masimo Corp. v. Tyco Health Care Group, L.P., No. CV-02-4770 MRP, 2004 U.S. Dist. LEXIS 26916 (C.D. Cal. June 10, 2004) in which Masimo Corp challenged Tyco's use of bundled discounts, which Masimo alleged foreclosed a significant portion of the pulse oximetry market**.**

[4] For example, in a recent suit against a dominant battery separator supplier the FTC stated, "Daramic threatened to withhold volumes of separators requested by certain customers to pressure them [customers] to enter exclusive supply agreements with Daramic, and thereby foreclose Microporous from expanding its business with those customers." See, "In the Matter of Polypore International" (2008) paragraph 40. More recently the E.C. found that Intel had among other things used exclusive dealing to reduce competition with AMD. See "Antitrust: Commission imposes fine of €1.06 bn on Intel for abuse of dominant position; orders Intel to cease illegal practices" (2009). The FTC filed a complaint against McCormick spice for making payments to grocery chains as part of agreements that …"restrict[ed] the ability of customers to deal in the products of competing spice suppliers. See "In the matter of McCormick Spice" (2000).

sell CPUs at competitive prices. When such competition was eliminated, Intel could sell CPUs at supra-competitive prices. Consequently, it [Intel] was able simultaneously to charge above-competitive prices and at the same time to exclude its rivals, resulting in both higher prices and fewer choices for consumers."[5]

This passage suggests that the FTC believed Intel used payments for exclusivity to reduce number of customers for which AMD competed directly, which reduced the number of customers for which Intel's needed to lower its prices. This paper presents a model consistent with this idea.

I develop the analysis in a simple model with inelastic market demand, and competing homogeneous downstream producers who buy inputs from two differentiated suppliers. This choice of demand structure has two important properties. First because demand in each segment is perfectly inelastic, each supplier of a scarce resource can extract its full incremental value with linear prices. Thus, there is no difference in my model between the suppliers offering linear prices (along with exclusivity payments) and the suppliers offering two part tariffs. Consequently extracting uncaptured quasi-rents is not a motivation for exclusivity as it is in earlier literature.[6]

Second, this demand along with homogeneous producers implies that producers earn no quasi-rents when competing against other producers using the same input. This eliminates the possibility of "punishment strategies" on the part of the dominant supplier. If a producer were earning quasi-rents by using the dominant supplier's inputs, the dominant supplier could threaten not to sell the producer these inputs, or raise the price of these inputs if the producer were not exclusive to the dominant supplier. Eliminating the quasi-rents eliminates such strategies and allows the model to focus on explicit payments in exchange for exclusivity.[7]

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[5] See In the Matter of Intel Corporation (2010) at 48341. Emphasis added.

[6] Mathewson and Winter (1987) explicitly looked at competition between a large and small input supplier. They showed exclusive contracts could extract downstream quasi-rents that were left uncaptured by linear input prices. Since in my model downstream firms earn no quasi-rents in the non-exclusion equilibrium, my explanation differs from theirs Their analysis is appropriate only where there is little downstream competition.

[7] In a companion piece, DeGraba (2009), I show that a dominant supplier can use the threat of punishments to induce downstream firms to accept exclusives. One formal difference between payment strategies and punishment strategies is that downstream firms are better off in the game with payment strategies relative to the benchmark game in which exclusives are prohibited. With punishment strategies these firms are worse off under exclusion that in the game in which exclusion is prohibited.

Briefly, the contributions of this paper include: i) formally modeling dominance of an input supplier competing against a smaller rival and selling to downstream competitors, thus eliminating the "incumbent/entrant paradigm" ii) showing market share discounts with threshold levels of less than 100%, which allow the small rival to make strictly positive sales, lower welfare, iii) showing that the incentive to exclude includes savings from reducing competition in segments in which the small rival would not make sales, but would exert competitive pressure, iv) showing that exclusivity payments need not result in below cost effective prices to lower welfare, v) providing conditions that help determine if increased downstream product differentiation will make exclusion easier or harder, and vi) providing a model in which all pertinent calculations can be shown on a single graph.

Section 2 explains how my results relate to the existing literature in more detail. Section 3 presents a numerical example in which only the less efficient input supplier can offer exclusive contracts, showing this assumption leads to his exclusion. Section 4 presents the formal model of dominance due to demand asymmetry, and shows exclusive contracts can prevent the small rival from making sales, and reduce welfare. Section 5 shows near exclusive contracts can allow the small rival to make positive sales, but still reduce welfare.

2. Related Literature

My paper extends the literature on competitive harm from exclusive contracts when downstream buyers are competing firms. The three most recent papers in this literature are Fumagalli and Motta (2006), Simpson and Wickelgren (2007a), Abito and Wright (2008). These papers seem to trace their origins in two earlier papers, Rasmusen, Ramseyer and Wiley (1991), (RRW-SW) [8] and Aghion and Bolton (1987), which considered buyers who were end users.[9]

Both Aghion and Bolton (1987) and (RRW-SW) considered an incumbent monopolist with an incentive to exclude a potential entrant who had yet to sink a fixed cost to enter the market. In

[8] Segal and Whinston (2000) expanded Rasmusen et al.'s results and so are cited as a unit.
[9] Innes and Sexton look at coalitions of buyers that promote entry, but these buyers are end users.

Aghion and Bolton (1987) an incumbent and an end user customer sign a contract that commits the customer to pay the incumbent a penalty if she buys from the entrant. Therefore, the entrant must compensate the customer for this payment if it enters. If the entrant is only somewhat more efficient than the incumbent, then the entrant is unable to under-price profitably the incumbent and compensate the customer, and so is excluded to the detriment of welfare.

In (RRW-SW) the entrant must sell to *n* end user customers to recover its fixed entry cost. If the incumbent signs at least all but *n*-2 customers to exclusive contracts, then the entrant does not sink the fixed cost, allowing the incumbent to charge a monopoly price.

Fumagalli and Motta (2006) replace the end user customers in (RRW-SW) with competing firms. They argue that if the firms are very differentiated then they behave very similarly to end users in (RRW-SW) and a coordination failure can prevent entry by limiting the size of the market to which the entrant can sell. However, they argue that when downstream firms are homogenous Bertrand competitors a single buyer can give the entrant access to the entire market so the coordination failure is eliminated and exclusion is impossible.[10]

Simpson and Wickelgren (2007) largely replace end users in Aghion and Bolton (1987) with competing downstream retailers who are required to pay expectation damages to the incumbent equal to the incumbent's full lost monopoly rents if they buy from the entrant. This paper is the first to emphasize that competition among homogeneous downstream firms can limit the value downstream firms obtain from buying a low priced input from the entrant, because downstream competition will pass most of this savings on to end users in the form of lower prices. Thus, unlike Fumagalli and Motta they find that if the downstream firms are Bertrand competitors, exclusive contracts (with an expectations payment) can exclude the entrant and lower welfare.

Abito and Wright (2008) rely neither on an Aghion and Bolton-like damages payment nor a coordination failure among downstream firms. They show that with near homogeneous downstream

[10] But Wright (2009) shows that the Fumagalli and Motta results are not general, showing that allowing upstream suppliers to use two part tariffs can result in a coordination failure and exclusion when downstream firms are homogeneous Bertrand competitors if the fixed costs are large enough.

competition, exclusive contracts can prevent entry using only the assumptions that the entrant cannot make exclusive offers and that it must sink a fixed cost to enter. With linear pricing they find that more homogeneity between the two downstream competitors makes exclusion easier as well. When the upstream firms use two part tariffs they always find that entry can be prevented in equilibrium.

My paper extends the progression by replacing the assumptions that the small rival can not make exclusivity offers and its need to sink a cost of entry with a formal model of co-existing competing upstream suppliers where one is dominant due to demand asymmetries. This allows for a model in which exclusionary contracts are used, are harmful and allow the small rival to make strictly positive sales in some cases. It also facilitates a more in depth analysis of the effect of downstream firm differentiation on the likelihood exclusive contracts lower welfare.

An earlier line of the literature exemplified by Mathewson and Winter (1987) (MW) looked explicitly at competition between a large and small supplier when the downstream market consists of exactly a monopolist retailer. In that paper the suppliers set linear prices, and so because of double marginalization, leave some of the rents in the hands of the downstream retailer. The dominant supplier uses exclusive contracts to capture some of these otherwise uncaptured rents. Having only this tool at his disposal, the dominant supplier offers the retailer an "all or nothing" proposition. When there is a large disparity in the sizes of the upstream competitors and significant substitution between the upstream inputs, exclusive deals by the incumbent result in lower prices but initially increase in welfare. Even greater disparity then decreases welfare and might increase prices. As the disparity in demand gets larger exclusives can lower welfare and raise prices slightly relative to the no exclusive equilibrium.

The mechanism in MW is completely different from that in this paper. In this paper exclusive contracts prevent input price competition, which downstream competition would pass through to end users (just as Simpson and Wickelgren (2007a), Fumagalli and Motta (2006), and Abito and Wright (2008)). There is no downstream competition in MW so their paper cannot address this issue. MW show exclusive contracts are used to capture quasi-rents that would be uncaptured if exclusives were prohibited. Since in my model no quasi-rents are generated in the non-exclusion equilibrium, the mechanism in MW cannot be related to the results in my paper.

The practical effect of this is that MW is not appropriate for evaluating the effects of exclusive contracts by an input supplier who sells to downstream producers among which there is significant competition. Thus, MW would have little to say about the use of exclusivity in the Intel case, or Concord Boat, where the price of the input played an important role in the ability of downstream firms to compete against each other. However, in a case such as *Standard Fashions v. Magrane-Houston Co*,[11] in which downstream buyers are effectively local monopolists and therefore do not compete, their analysis would be more appropriate.

Finally, MW rely on restricting the dominant firm from using pricing contracts that allow it to extract much of the downstream rents it generates. This subjects their analysis to the criticism that inefficient exclusive contracts are used only because more efficient contracts that don't use exclusivity are artificially ruled out.[12]

My paper is not subject to this criticism. In the benchmark market with no exclusivity, every firm that is a monopolist over some aspect of the final good captures all of the rents associated with that aspect. There is no incentive for the dominant supplier to use exclusivity as a way of extracting otherwise uncaptured rents from infra-marginal units.

A recent paper that departs from this progression is Ordover and Shaffer (2007). It provides a model in which customers purchase in each of two periods, there are switching costs, and the small competing seller is capital constrained. In this case the unconstrained seller can offer exclusives and with a price that yields a negative profit in the first period to end user

[11] See Standard Fashions Co. v. Margrane-Houston Co., 258 U. S. 346 (1922).

[12] O'Brien and Schaffer (1997) shows that allowing two part tariffs results in exclusion equilibria being Pareto dominated by more efficient non-exclusion equilibria in an MW like model. However, some recent papers in this area point out that we often see firms using simple linear contracts. They argue that there may be other complications in the market that prevent the monopolist from extracting all available rents, but which do not affect their abilities to use tying to extract the rents. Two examples are Greenlee, Reitman and Sibley (2008) in which buyers are final goods users and Simpson and Wickelgren (2007b) in which buyers are competing downstream firms. Both show tying can lower welfare.

customers and the capital constrained seller cannot match this offer. In the second period the switching cost allows the unconstrained firm to charge the monopoly price. My paper offers a different set of conditions that generate exclusive contracts in that I do not need a sales externality across periods nor a capital constraint on the part of the excluded seller to generate my results.

3. Numerical example – equilibrium with first mover advantage

I present a numerical example in which a single end user prefers a final good with supplier *R*'s input to a final good with supplier *D*'s. With no exclusive contracts only *R* makes sales in equilibrium, which is efficient. Allowing only *D* to offer exclusive contracts results in *D* excluding *R* by paying each downstream producer the difference between the end user's willingness to pay for a unit with *D*'s input and a unit with *R*'s. This reduces welfare. In the subsequent section I eliminate the artificial advantage for *D*, but show that if *D* is sufficiently dominant, then the exclusionary results of this section are preserved.

There is a final good that can be produced by two competing downstream producers, indexed by $j \in \{1, 2\}$, by using either input, *d*, supplied by a dominant input supplier *D*, or with input, *r*, supplied by a rival supplier *R*. Suppliers' marginal cost of supplying the input is zero. The suppliers sell the input to the producers by setting a producer specific transfer price t_{ij} where $i \in \{d, r\}$ indexes the input seller.[13] Producers convert a unit of the input into a unit of the final good at zero marginal cost. Thus, the producers' marginal cost is the price of the input used. (Producer will always refer to downstream firms; suppliers are upstream firms)

There is a single end user who demands one unit of the final good. She will pay $9 for a unit made from *d*, (a *d*-based unit) and $10 for one made from *r* (an *r*-based unit). The end user views the final goods from both producers as identical except for the input used.

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[13] The subscript convention will be that the first subscript tells who is making the offer, the next subscript indicates to whom the offer is made, and the last, if used, will indicate either "in which market" or "which input is used" if the second subscript already implies "in which market." Thus t_{ij} is set by a supplier, *i*, and offered to a producer, *j*, and in section 4 p_{jsi} indicates a price offered by producer *j*, to customers in segment *s* for a good using input *i*.

Each producer states a price, p_{ji}, for his final good (i denoting the input used). The end user observes which input each producer uses, and purchases one unit of the final good from the producer that offers the highest surplus. In case of ties among identical offers the end user chooses one of the producers at random. If two offers provide identical surplus, but only one producer earns a strictly positive profit, the end user buys from that producer.[14] If both producers earn zero profits, but only one purchases from a supplier that earns a positive profit, then she purchases from that producer. The producer that is ultimately chosen by the end user pays his t_{ij} to the supplier.

This structure can be used to construct the following three stage game:

In stage 1, suppliers simultaneously announce their t_{ij}'s to each of the producers. In stage 2 the producers observe the prices and announce their p_{ji}'s. In stage 3 the end user observes prices and the input each producer uses and chooses from which producer to purchase. All offers, decisions, prices and input choices are common knowledge.

The payoff to the end user is her consumer surplus. The payoff to each producer is his sales revenue less his input cost. The payoff to each supplier is the sales revenue from the sale of his input. Equilibria are subgame perfect.

Observation 1. In equilibrium D sets $t_{dj} = 0$ and R sets $t_{rj} = \$1$. At least one producer sets a price for the r-based unit of \$1. The other producer can either set a d-based unit price of \$0 or an r-based unit for a price of \$1. The end user purchases an r-based unit.

Outline of proof of existence:[15]

The end user can not gain by deviating. At the prices stated the end user is indifferent between a d-based unit and an r-based unit and so chooses an r-based unit.

No producer could gain by deviating. At the given prices both producers earn a 0 payoff. Any producer of the r-based unit cannot gain by increasing his price because the end user would

[14] The reason is that if an end user would choose the seller making zero profit, the seller that would make a positive profit would have an incentive to make a slightly lower priced offer to ensure the sale.
[15] The proof of Observation 3 implies uniqueness so the uniqueness proof is omitted to save space.

switch to the other producer. Any producer of a *d*-based unit could not gain by raising his price because he would still not make a sale. If either producer lowered his price he would make a sale, but earn a negative payoff. No producer could gain by changing the product he offered.

No supplier could gain by changing his prices. *D* could only make a sale by offering a negative price. Any increase in *R*'s price would result in him losing the sale to *D* and earning 0. Lowering t_{rj} decrease *R*'s sales revenue. *QED*

This equilibrium yields the results one would expect from a Bertrand equilibrium with no demand elasticity. The end user receives a surplus of $9, which is her willingness to pay, less the producer's marginal cost. *R* earns $1, which is his incremental value to the end user relative to *D*. Producers earn 0 since they provide no scarce resource. *D* earns 0 because he makes no sale.

I now assume there is a stage 0 in which only *D* can offer each producer a payment in exchange for exclusivity. Having received offers, producers announce if they will accept exclusivity. *D* and *R* observe acceptance decisions and make price offers to each producer. Producers observe these prices and then announce if they intend to honor their exclusivity commitment. If any producer breaches then the suppliers can make another lower price offer to any producer(s).[16] Producers then make offers to the end user who purchases one unit. Any producer who does not purchase from *R* receives the exclusivity payment offered by *D*.

Observation 2. In equilibrium *D* offers each producer $1 to be exclusive. Each producer accepts. *R* sets $t_{rj} = 0$ and *D* sets $t_{dj} = \$9$. Neither producer breaches. Both producers set $p_{jd} = \$9$, and earn a payoff of $1. If at least one producer were to breach, *D* would set the price of *d* equal to 0. *D* earns a payoff of $7.

[16] Alternatively we could assume that *D* makes exclusivity offers (observed by all parties), suppliers make price offers to producers, producers make offers to the end user and if *D* observes an *r*-based unit being offered he can make a lower price offer to the non-breaching firm and the end user takes a second round of bids.

Outline of proof of existence:[17]

The end user can do no better by deviating. She is indifferent between purchasing and not purchasing the *d*-based unit at \$9.

If both producers agree to exclusivity, *D* can do no better than to charge \$9 for *d*. This price extracts the maximum willingness to pay from the end user.

If at least one producer breaches, *D* can do no better than setting $t_{dj} = 0$ if the minimum $t_{rj} \leq 1$. The resulting subgame has *D* setting $t_{dj} = 0$ and *R* setting $t_{rj} = 1$. This results in the price of the *r*-based unit equaling \$1.

If he accepts a \$1 payment for exclusivity, producer *i* has no incentive to breach for $t_{ri} \geq 0$. A producer earns \$1 if he maintains exclusivity. Given *D*'s pricing strategy in the event of breach, no producer could earn more than \$1 by breaching.

No producer can earn more than \$1 by refusing a payment of \$1. If producer *j* refuses exclusivity the unique equilibrium of the resulting subgame is for *D* to set $t_{dj} = 0$ and for *R* to set $t_{rj} = 1$. Producer *j* would earn 0.

D can do no better by offering a different payment for exclusivity. A higher payment reduces his payoff. A lower payment would result in a producer breaching for a small but strictly positive transfer price for *r*. *QED*

This result says that if *R* is unable to offer exclusive contracts, then *D* establishes a monopoly in the input market by paying each producer the difference between the end user's willingness to pay for an *r*-based unit and her willingness to pay for a *d*-based unit to be exclusive to *D*. The mechanism can be understood as follows.

Since *R* cannot establish himself as a monopolist, the most he can hope to do is fend off *D*'s efforts to establish a monopoly through exclusive contracts. *R* must do this while facing competition from *D*. The only rent that he can earn in competition is the incremental value of *r* relative to *d*,

[17] Corollary 1 proves uniqueness so the uniqueness proof is omitted to save space.

which in this example is \$1. So the most that *R* can profitably offer a producer (by setting a price of 0 for *r*) to breach exclusivity is \$1. Thus, *D* need only pay each of the producers \$1 to make each one indifferent between staying exclusive and being the only producer to breach exclusivity.

Since there are two producers, it only costs *D* \$2 to exclude *R*, become the input monopolist, and extract the \$9 monopoly rents. So *D* gets the downstream producers to establish himself as the input monopolist, and then shares part of the monopoly profits with the producers in exchange.

This model has several interesting features. First, suppliers can change their prices if a producer breaches is critical.[18] In equilibrium the price of *r* is 0 while the price of *d* is \$9. The reason a producer does not breach is that if he does, *D* will reduce the price of *d* from \$9 to 0 to the exclusive producer, and the breaching producer would be able to only earn 1, the incremental value of *r* over *d*. This captures the intuition in Simpson and Wickelgren (2007a) and Abito and Wright (2008) that lower input prices are passed on to end users in competition and don't benefit the producers when competition is intense.

Second, this example does not employ the assumption that *R* must sink some fixed cost to enter as does much of the previous literature. In this example the small rival is already in the market and sets a price equal to marginal cost in equilibrium. Exclusion does not keep him from entering. It simply keeps him from making any sales.

This means the exclusivity payment must reflect the fact that at the time the producers set prices, they could still choose to purchase inputs from the rival at marginal cost. Thus, the exclusivity payment must equal the most a single producer could earn by breaching exclusivity, which is the incremental value of the rival's input over the dominant supplier's input.

This equilibrium is not the result of a coordination failure as it is in Rasmusen *et al*. This means there is no equilibrium in which *R* is not excluded. Further producers are not worse off as a result of exclusion as they are in Rasmusen *et al*. Nor does the uniqueness require that the

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[18] This assumption simply recognizes that, if a producer breaches, there is increased competition from *R* at the end user level, and the dominant supplier responds to this increased competition by lowering prices.

dominant supplier favor one group of direct buyers over another as in Segal and Whinston (2000). In my model all producers prefer the exclusivity payments to the equilibrium in which exclusives are prohibited (in which producers would earn 0). This result suggests that downstream firms' "asking" for exclusives is not evidence that such contracts are pro-competitive.

This equilibrium does not require explicit breach payments as in Aghion and Bolton (1987) or Simpson and Wickelgren (2007a). A producer can only lose the explicit exclusivity payment if he breaches exclusivity. Thus, payments for exclusivity must be high enough to induce the producer to maintain exclusivity when the rival is still in the market. This is important empirically because exclusivity or near exclusivity is often an understood condition rather than an explicit contractual condition, so we would expect neither to find explicit breach damages clauses nor court proceedings seeking the awarding of such damages. Punishments for breaching exclusivity must be self enforcing.

Finally, the most important assumption is that the rival cannot make exclusive offers. If the rival could make exclusive offers, he could never be excluded. Because *R* generates a higher willingness to pay than *D*, *R* could offer producers more than *D* could offer. This first mover advantage is found in most of the recent literature. Perhaps the best justification for it is that an incumbent is in the market so he can make offers before the entrant appears. This is not entirely convincing,[19] and it makes the literal interpretation of models that use it tenuous in markets in which the small rival is already competing and continuing to compete during the exclusionary period.

In the next section I formally eliminate the need for the first mover advantage.

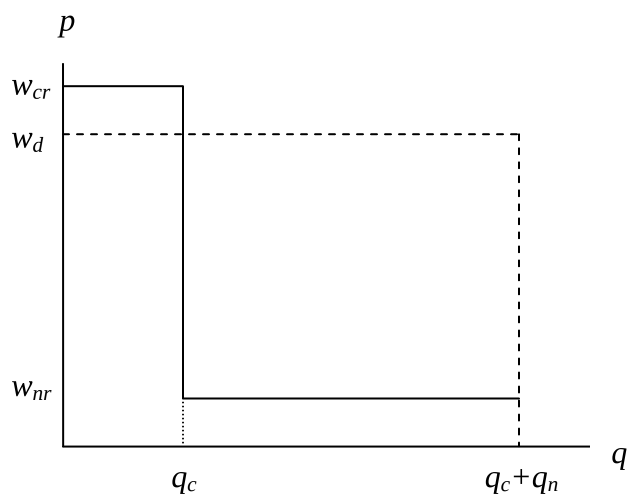
4. Formal Model

I now extend the model of the previous section by assuming that *D* is much larger than *R*, but that both suppliers can compete to be the exclusive supplier to each downstream producer.

[19] Examples of entrants making offers include facilities based telecom entrants seeking exclusive deals with entire multiple dwelling unit building owners as a condition of entering and providing telecom services.

There is a continuum of end users of mass q_c, called the contestable segment, who will pay w_{cr} for an r-based unit and $w_d \leq w_{cr}$ for a d-based unit.[20] There is a second continuum of end users of mass $q_n > q_c$, called the non-contestable segment, who will pay w_d for a d-based unit and $w_{nr} < w_d$ for an r-based unit, with w_{nr} "significantly less" than w_d. This formulation captures the notion that D sells a "must have product."[21] That is, a large portion of the market is willing to pay significantly more for a d-based unit than an r-based unit.[22] Figure 1 presents a graph of the market demand curves induced by these preferences. As I discuss later, the discontinuity in r types and the constant w_d just simplify exposition and play no substantive role in the results.

Figure 1 – demand for r-based and d-based units



Each supplier supplies his input at 0 marginal cost, and sells it by announcing a producer and segment specific per unit price, t_{ijs} where $s \in \{c, n\}$ denotes the segment. That is, suppliers can offer a different price for units used in final goods sold to the contestable segment than to the

[20] The results of this model will still go through if we assume $w_{cr} \leq w_d$. That would be the case in which the dominant supplier is at least as efficient as the rival at serving all customers in the market.

[21] One way to obtain this result is to assume that there are two attributes over which customers have different value, say productivity and probability of failure. r is more productive than d when r works, but d works for sure while r has some probability of failure, and a replacement r can be obtained with some time lag. There are then two types of end users, those that incur a large cost if r fails (e.g., end users that provide real time services who would be harmed if r failed) and those that would not suffer significantly incur virtually no loss if r failed. The former group would pay significantly more for the security of d and the latter group would pay extra for the additional productivity of r.

[22] Assuming that $w_{nr} = 0$ is also consistent with the small rival being capacity constrained, though that would involve a model with mixed strategy equilibria.

non-contestable segment. This can be accomplished for example by assuming *D* has a good sense of which end users have a high willingness to pay for an *r*-type unit.[23] *D* then announces a "list price" for all units and a rebate that is paid for units sold in competition with an *r*-based unit for such a customer, where the size of the rebate reflects the level of competition between *r* and *d* based units.[24] This interpretation is more consistent with end users being large customers that purchase through say a bidding or RFQ process rather than retail customers for which one price applies to a large group of end users.[25]

I assume customer segment is non-contractible, which means that the parties could never prove to a judge the willingness to pay of a given end user. Thus, they could not write a contract that based ex post payments on the identities of the customer to whom units are sold (i.e., exclusivity payments) however customer specific rebates can be made at the time of a sale to a customer if both *D* and the producer recognize that they will lose a sale if they don't offer the customer a final good price based on a low input price.

There are *f* producers all of whom can use *d* to produce a final good. $m \leq f$ of these producers can also use *r* to produce the final good. Each producer's marginal cost is equal to the price he pays for the input. He can thus have different marginal costs depending on which end users he serves and which inputs he uses. Producers can price discriminate between segments. Let p_{jsi} be producer *j*'s price for a good to customers in segment *s* using input *i*.

Given this structure I construct the following formal game:

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[23] This process is described in detail in "State of New York …" (2009) paragraphs 120-125. This also assumes arbitrage is not possible. *D* might do this by limiting the number of units on which he offers the low price, or he might not honor warranties on arbitraged units. Arbitrage might be naturally prevented if the contestable and non contestable markets are geographically separate, and transport is costly, or if contestable customers market require different attributes in the input than non-contestable customers.
[24] Institutionally when a downstream producer bids on an RFP they will often collaborate with key suppliers to produce a competitive bid. In such a situation the supplier can price on an end user by end user basis. Also suppliers of major components can often tell when a major end user has purchased a product using a competitors input. The supplier can then offer an end user specific discount to win back the business.
[25] This assumption only affects *D*'s behavior off the equilibrium path.

- In stage 1 the suppliers simultaneously offer payments, P_{ij}, to each producer in exchange for exclusivity. Producers announce which exclusive offers (if any) they will accept.
- In stage 2 suppliers observe who has accepted exclusive contracts and set input prices, t_{ijs}.
- In stage 3 producers observe prices, and if they accepted an exclusive offer, announce if they intend to breach.
- In stage 4 both suppliers observe if any producers announce they will breach. If a producer breaches, suppliers can offer lower prices, t_{ijs}, to any producer.[26]
- Producers observe the new prices, and set their final good prices to end users for each segment, p_{jsi}.[27]
- End users make their purchases.

I consider only subgame perfect Nash equilibria. Before presenting the main proposition, of this section, I provide an observation and two preliminary lemmas.

Observation 3. In the subgame beginning in sage 3 in which no producer has accepted exclusivity, the only equilibrium continuation has D setting $t_{djc} = 0$, and $t_{djn} = w_d - w_{nr}$, R setting $t_{rjc} = w_{cr}$-w_d, and $t_{rjn} = 0$ for all j, and end users buying r-based units in the c segment at $p_{jcr} = w_{cr} - w_d$ and d based units at $p_{jnr} = w_d - w_{nr}$.

Proof: Since both suppliers can price discriminate in the two markets and marginal costs are constant, the prices in the two markets are independent. Consider first market n. For any set of transfer price offers define $\delta_{ijn} \equiv w_{in} - t_{ijn}$ for $i \in \{d, r\}$ and $j \in \{1, 2, \ldots f\}$.[28] Let Δ denote the set of all δ_{ijn}. For any producer j' receiving an offer from supplier i' let $\Delta^{-j'i'n}$ be the set Δ excluding the difference associated with offer $t_{i'j'n}$. Finally let δ_{ijn}* denote the max of Δ, and $\delta_{ijn}^{-i'j'n}$* denote the

[26] One can think of stage 3 and 4 as representing a market in which the continuum of end users purchase over time. Then for example D can instantly observe if an end user of measure 0 purchases an r-based unit which would mean a producer breached an exclusivity agreement. He then adjusts his prices once he realizes the exclusivity has been breached.

[27] We can assume either that a producer can only set a segment specific price or a different price for each end user.

[28] Where I write w_d as w_{dn} for notional consistency and note that for the m-f producers that can not use input r there is no t offer

max of $\Delta^{-j'i'n}$. For any set of transfer prices only the producer(s) for which δ_{ijn} is a maximum of Δ can make sales in equilibrium using the input *i* for which δ_{ijn} is the max of Δ. This is because δ_{ijn} is the maximum surplus producer *j* can offer a customer using input *i* without pricing below cost. The subgame perfect $p_{jni} = w_{in} - \delta_{ijn}^{-i'j'n}*$. Suppose there were some equilibrium price $p_{jni}' > w_{in} - \delta_{ijn}^{-i'j'n}*$. Then the producer with the offer associated with $\delta_{ijn}^{-i'j'n}*$ could profitably offer a price that offered customers marginally more surplus than p_{jni}' and sell all the units.

Similarly, if $p_{jni}' < w_{in} - \delta_{ijn}^{-i'j'n}*$ then the producer could marginally raise his price and offer customers more surplus than $\delta_{ijn}*^{-}$ which no other producer could match if this producer were the only producer receiving a transfer price yielding $\delta_{ijn}*$. If more than one producer had a transfer price that yielded $\delta_{ijn}*$ then $p_{jni}' < w_{in} - \delta_{ijn}^{-i'j'n}*$ implies $p_{jni}' < w_{in} - \delta_{ijn}*$ which implies a price below marginal cost and a negative payoff.

In any equilibrium continuation *R* sells no units. Consider any price configuration in which *R* sold positive units to a producer. *D* could always set a price to that producer marginally above *R*'s price and that producer would be better off purchasing from *D*. Thus *R* must earn 0 in this segment.

In any equilibrium continuation prices must be such that if *R* offered 0 to all producers, he would sell no units. If there were prices such that *R* could sell positive units at a price of 0 then there is some arbitrarily small positive price at which he could sell positive units and earn a positive payoff.[29] I can therefore limit the analysis to price configurations in which *R* offers at least one producer a transfer price of 0. In this case *D*'s optimal price is to set $t_{djn} = w_d - w_{nr}$ to at least two producers and a price no lower than $w_d - w_{nr}$ to the remaining producers.

The proof for segment *c* is identical in structure except of course *R* sells all the inputs into this segment. *QED*

[29] Recall that indifferent consumers purchase from the seller whose price is above marginal cost and if all producers set marginal cost prices they purchase from those producers who purchased from a supplier whose price is above marginal cost.

Observation 3 just says that if no exclusives agreements are reached, then each segment would have the expected Bertrand equilibrium input and final good prices. This equilibrium maximizes social surplus.

Lemma 1. If $(w_d - w_{nr})q_n > (w_{cr}q_c + w_{nr}q_n)/f$ then in every subgame perfect continuation in which R offers payments for exclusivity where the sum of the payments is not greater than $(w_{cr}q_c + w_{nr}q_n)$, (which is the maximum monopoly profit R could generate) not all producers are exclusive to R.

Proof:

R cannot profitably pay more than a total of $w_{cr}q_c + w_{nr}q_n$ to the f producers for exclusivity since his monopoly profits are capped at $w_{cr}q_c + w_{nr}q_n$. Dividing this among f producers means that (at least) one producer must receive no more than $(w_{cr}q_c + w_{nr}q_n)/f$ for being exclusive to R. If all producers were to accept exclusivity to R then D would earn 0. D could always offer one producer, j', receiving no more than $(w_{cr}q_c + w_{nr}q_n)/f$ a transfer price $t_{dj'n}$ such that $[w_d - w_{nr} - t_{dj'n}]q_n = (w_{cr}q_c + w_{nr}q_n)/f$, and $t_{dj'c} = 0$ and offer a price to no other producer.

Producer j' would breach exclusivity with R. R would then set $t_{rjn} = 0$ and D would make no other offers to producers. Given that price, j' would set $p_{j'nd} = w_d - w_{nr}$ and earn $(w_{cr}q_c + w_{nr}q_n)/f$. D would earn $t_{dj'n}q_n$. This is the most D could earn conditional on j' earning $(w_{cr}q_c + w_{nr}q_n)/f$. Further conditional on D offering $t_{dj'n}$ to j', D cannot earn greater revenue by offering any other producer(s) any other price.

Thus, the continuation after all producers accept exclusivity to R (where the sum of the payments does not exceed $(w_{cr}q_c + w_{nr}q_n)$) will have one producer breaching exclusivity and earning a profit selling d-based units equal to the maximum payment R could offer him for exclusivity. *QED*

Lemma 1 formalizes the intuitive notion that a small rival could not monopolize the entire market using exclusives because the dominant supplier would lose a large profit by not selling to segment n. He would therefore offer at least one producer a low enough price so that the producer could earn more profits selling in the non-contestable segment than the payment that the small rival offered for exclusivity.[30]

Lemma 2 now presents the important implication of lemma 1, which is analogous to the result of Observation 1 in the previous section.

***Lemma* 2.** r-based units cannot generate rents in excess of $(w_{cr} - w_d)q_c$ if D competes in the c segment.

Proof:

Suppose that D sets $t_{djc} = 0$ for at least one producer. Then, R's best response is to set $t_{rjc} = w_{cr} - w_d$, and D's best response to that is $t_{djc} = 0$. The equilibrium of this subgame is for producers to set $p_{jcd} = 0$ and $p_{jcr} = w_{cr} - w_d$ resulting in total segment sales of $(w_{cr} - w_d)q_c$.

There is no equilibrium in which R sells positive units at any $t_{rjc} > w_{cr} - w_d$ for all j. If R set $t_{rjc}' > w_{cr} - w_d$ for all j, then D could set $t_{djc} > 0$ by an arbitrarily small amount and make positive profits while R earned 0 in the c segment. If R set $t_{rjc} > w_{cr} - w_d$ for some producers and $t_{rjc} = w_{cr} - w_d$ for the rest, then only those producers receiving $t_{rjc} = w_{cr} - w_d$ would make sales in equilibrium. *QED*

Lemma 2 says that the highest rent R could generate is the difference between the value of his input and the value of the dominant supplier's input in the contestable segment, if D competes in this segment. That is, in the absence of exclusivity to R, there will be competition in the contestable segment, which will drive R's rents down to r's incremental value relative to d to c segment end users. Without exclusives, the prices in the c segment collapse to the Bertrand prices.

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[30] Some might be worried that in a more complex model D's offer of $t_{dj'n}$ might be subject to opportunistic behavior by D in later stages of the game (i.e., different price offers to other producers). This possibility could easily be eliminated by inserting another stage into the game in which once suppliers observe who has accepted exclusivity, a supplier gets to make counter-offers of a payment for exclusivity if all of the producers have agreed to exclusivity with the other supplier. In this case D could just offer producer j' a fixed payment marginally larger than the largest payment R could offer in exchange for exclusivity. Such a payment would not be subject to any potential ex-post pricing opportunism on the part of D.

The two lemmas together say that even though he has an opportunity to offer exclusive contracts, *R* cannot monopolize the market by signing up all producers to exclusives. Thus, he is relegated to fending off *D*'s attempts to monopolize the market, but he has only the difference between his input's value and the dominant supplier's input's value in the contestable segment with which to work. Proposition 1 now states the conditions under which this is not enough.

Proposition 1. If $w_d q_c + w_{nr} q_n > m(w_{cr}\text{-}w_d)q_c$ and $(w_d - w_{nr})q_n > (w_{cr} q_c + w_{nr} q_n)/f$, then there exists an equilibrium in which *D* pays each of the producers $P_{dj} = (w_{cr}\text{-}w_d)q_c$ to be *D*-exclusive and each accepts. *R* makes no exclusivity offer. *D* sets $t_{djc} = w_d$ and *d*-based units are sold to all end users in both segments of the market at a price of w_d. If one or more producers breach, *D* sets $t_{djc} = 0$ for units sold in the contestable market and $t_{djn} = (w_d - w_{nr})$ for units sold in the non-contestable market.

Further if all producers accept an exclusive offer with $P_{dj} = (w_{cr}\text{-}w_d)q_c$ then *R* offers one randomly chosen producer a $t_{rjs} = 0$ and the remaining *m*-1 producers $t_{rjs} = w_{cr}\text{-}w_d$. If any set of producers accepts a payment, $P_{dj} < (w_{cr}\text{-}w_d)q_c$ for *D*-exclusivity, *R* offers the producer, *j*', that accepted the lowest such payment a price $t_{rj'c} = (w_{cr}\text{-}w_d) - P_{di}/q_c$ and the producer breaches the exclusivity agreement. That producer sets $p_{j'cr} = w_{cr}\text{-}w_d$. *R* offers all other producers $t_{r\text{-}j'c} = (w_{cr}\text{-}w_d)$.

Proof:

In the proposed equilibrium each producer earns a payoff of $(w_{cr}\text{-}w_d)q_c$. *D* receives a payoff of $w_d q_c + w_d q_n - m(w_{cr}\text{-}w_d)q_c$. *R* earns a payoff of zero as do all end users.

Suppose one producer deviated by breaching his exclusive contract in response to a price offer between 0 and $w_{cr}\text{-}w_d$ from *R*. Then in the proposed equilibrium's continuation *D* would offer $t_{djc} = 0$ to producers not *R*-exclusive and *R* would still sell at the price that induced the breach. The equilibrium p_{jcr} would equal $w_{cr}\text{-}w_d$ and p_{jcd} would equal 0. The producer that sold the *r*-based good could not earn more than $(w_{cr}\text{-}w_d)q_c$, so he could not profit by breaching. *R* could not profit by offering a price less than 0 to induce a breach. Thus, there is no deviation involving a breach that could make the deviating producer and *R* jointly better off.

If one producer deviated by simply refusing to accept an exclusive offer, then the only continuation would be for R to set $t_{rjc} = w_{cr}-w_d$ to the non-exclusive producer and for D to set $t_{djc} = 0$ for any unit sold by a D-exclusive producer to the contestable segment. In the continuation equilibrium the producer would earn a payoff of 0, which is less than the $(w_{cr}-w_d)q_c$ he would earn accepting exclusivity.

D could not profitably deviate by offering any producer a P_{dj} less than $(w_{cr}-w_d)q_c$ for exclusivity. If he did, R would offer a transfer price to that producer that would allow him to earn more profit than the exclusivity payment. The producer would accept and D would earn zero from the competitive segment.

Finally Lemmas 1 and 2 imply that R could not benefit by deviating and offering any set of producers a positive payment for exclusivity. *QED*

Proposition 1 shows conditions under which exclusion can occur. Corollary 1 shows that under the conditions of proposition 1, exclusion is the unique equilibrium outcome.

Corollary 1. If $w_d q_c + w_{nr} q_n > m(w_{cr}-w_d)q_c$ then there does not exist an equilibrium in which D does not offer exclusive contracts and R sells positive quantities in the contestable segment.

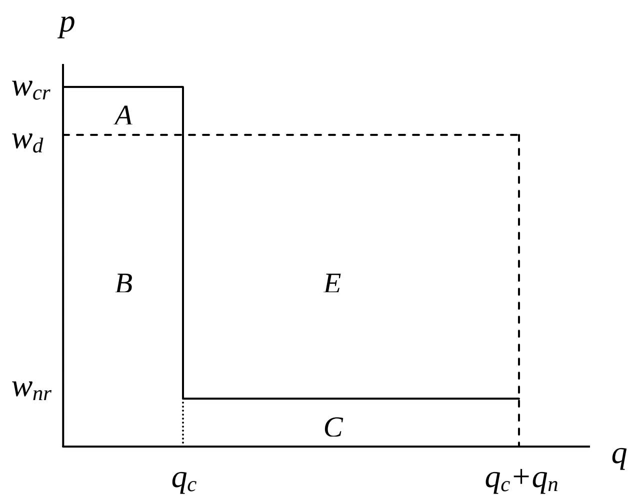
Proof:

D would earn zero profit from the contestable segment and only $(w_d-w_{nr})q_n$ in the non-contestable segment in an equilibrium in which no exclusives were offered and R sold positive quantities. If D were to deviate and adopted the strategy in proposition 1 above, it would be individually rational for each producer to accept exclusivity and not breach, and D would earn the profits outlined in proposition 1, which exceed $(w_d-w_{nr})q_n$. *QED*

The main intuition behind proposition 1 is the same as in the previous section. If there is competition for the contestable segment, then D earns 0 and R generates only the difference between the value of his input and D's input. If the monopoly profits from the contestable segment plus the increased revenue from reduced competition in the non-contestable segment is sufficiently large, *D* pays each producer for exclusivity, making *D* a monopolist in the market.

R cannot induce all of the producers to be exclusive to himself because *D* can always offer one producer some of the profit from the non-contestable segment (which *D* would lose if all producers were exclusive to *R*) to forgo exclusivity to *R*. Thus, *D* will always compete in the contested segment. On the other hand *R* can only offer his input's incremental value to one producer to induce him not to be exclusive to *D*. Therefore *D* only need offer each producer *R*'s incremental value to induce him to be *D*-exclusive.[31] If this incremental value times the number of producers who could use *r* is less than the monopoly profit from the contestable segment plus the additional revenue from the non-contestable segment resulting from *R* not competing in that segment, then *D* has an incentive to pay the producers to exclude *R*.

Figure 2 – demand for *r*-based and *d*-based units



The conditions of proposition 1 have simple graphical interpretations. In Figure 2 above *A* is the incremental value generated by *R* in the contestable segment, *B* is the profit *D* would make in the contestable segment if he could monopolize it, *E* is the incremental value *D* generates in the non-contestable segment and *C* is the value *R* generates in the non-contestable segment and

[31] Notice that here again the producers strictly prefer exclusivity to the competitive market as each earns 0 in the competitive market, while they are paid the small rival's incremental value to be exclusive to *D*.

represents the addition profit D would earn in the non-contestable segment if R were excluded. The first condition of proposition 1 says that $B+C > mA$. The second condition says that $E > (A+B+C)/f$.

The first condition highlights the two benefits that the dominant supplier receives from excluding a rival. First, excluding the small rival allows the dominant supplier to sell units in the contestable segment at the monopoly price when he would have sold no units at all in that segment without exclusivity. Second, eliminating the small rival eliminates price competition in the non-contestable segment, and allows the dominant supplier to charge a higher price, w_d, in that segment rather than $(w_d - w_{nr})$ which would occur without exclusivity. Even though he is less efficient in the non-contestable segment, the small rival would have imposed some competitive pressure on prices in that market in the absence of exclusivity. The exclusive contracts eliminated this competitive effect. This result has not been addressed by the current literature because it models only one market segment.

The second condition says the dominant supplier must generate more rents in his non-contestable segment than one producer must be paid to induce him not to be exclusive to R.

The welfare effects mirror those of the previous section. Exclusivity results in a reduction in social surplus relative to the benchmark (Observation 3) equilibrium because it allows the less efficient supplier to serve the contestable market. Consumer surplus is also lower because the exclusivity causes higher final goods prices in both segments. In this simple model the higher price does not lead to a reduction in social surplus because both segments have inelastic demand.

I could easily generate the traditional deadweight loss from an output reduction stemming from monopoly pricing by introduce a small mass of end users in either segment with a sufficiently low willingness to pay for a d-based unit. With a sufficiently low willingness to pay the dominant supplier would price his input at w_d, pricing these customers out of the market.[32]

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[32] Assume that suppliers and producers can distinguish between segments but cannot tell the high from the low willingness to pay customers within the segment. Assume that in segment s a mass of customers ε_s will pay $w_{d\varepsilon s} < w_d$ for a d-based unit where $(w_d - w_{d\varepsilon s})q_s > 2w_d\varepsilon_s$. D prices his input at w_d. under this condition.

Two rather intuitive comparative statics are that (holding all other parameters constant) reducing $w_{cr} - w_d$, or reducing q_c reduces the dominant supplier's cost of excluding the rival. When $w_{cr} = w_d$, D can exclude R by offering a payment of 0 since R has no rents to offer a producer for breaching exclusivity. Note the exclusivity would still make end users uniformly worse off relative to the benchmark in which only linear prices are allowed. This same result would hold of course if $w_{cr} < w_d$. This would be the case in which the dominant supplier was more efficient than the rival at serving all customers. Here customers would be worse off from the use of exclusives to exclude a less efficient rival.

Lowering m also reduces the cost of excluding the rival. m close to 1 can be interpreted as there being very few firms that provide complementary products for a small rival and the dominant supplier can exclude the rival by "poisoning the ecosystem" i.e., buying off the few firms that provide complements to the rival.

Interestingly, increasing w_{nr} increases the dominant supplier's incentive to exclude the small rival when the second condition of proposition 2 is not binding, because a higher w_{nr} means more competition in the non-contestable segment, which means lower profits for the dominant supplier if R is not excluded.[33]

This model depends a good deal on D's ability to price discriminate across segments. This allows him to compete away the benefits of lower prices in the contestable segment if producers were to breach exclusivity while maintaining high prices in the non contestable segment. This ability to lower its input price when an end user was considering purchasing a final good with a rival's input, while maintaining higher input prices when end users were not, was precisely the type of behavior in which the FTC believed Intel could engage.[34]

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[33] Increasing w_{nr} does tighten the second condition of proposition 1. However, one would think the first condition would be the binding constraint empirically as one would think a dominant supplier could always generate enough rents to induce one producer to remain exclusive to it.

[34] See quote from FTC Aid to Public Comment in this paper's introduction.

I have exogenously fixed f and m in this model. Because I have assumed homogeneous Bertrand competition and 0 fixed costs, something in the model must prevent infinitely many producers from entering the market in response to the dominant supplier's payments. Fixing f and m exogenously would be consistent with a number of potential market characteristics including i) that there are only finitely many entrepreneurs with the ability to produce the final good, ii) it takes several years of successful production to develop a reputation that allows a producer to make a significant volume of sales, iii) there is a long lead time for a new firm to gather the resources and expertise to begin production or iv) the existence of the current producers is a product of a sunk cost in the past that was paid for at a time when the industry was not so homogeneous. Thus, these "legacy" producers remain in the market, but no new producers have an incentive to enter.

These characteristics indicate that homogeneity in the product does not imply homogeneity across the universe of possible downstream producers. The theory requires that there be a sufficiently small number of producers that can be "bought off" for exclusives to cause harm. This is consistent with the law suits cited in the introduction, which typically accuse the dominant supplier of engaging in such behavior with respect to the largest downstream producers, but not fringe downstream producers, which no one would expect to expand significantly as a result of a low input price from the rival.

Returning to the cases in footnotes 3 and 4, these assumptions say that the slotting allowances paid by McCormick were not sufficient to induce a new grocery chain to enter at the scale of one of the largest grocery chains in an area. In the case of Intel, no one would expect that an OEM like eMachines would instantly be able to provide the global availability and client support necessary to compete significantly for multinational business end users.

This model also provides conditions under which exclusivity payments need not result in below cost effective prices to be anticompetitive. The so called price cost test to determine if a fixed payment is predatory prescribes allocating a payment for exclusivity over the incremental units sold by a downstream firm as a result of that exclusive agreement.[35] The exercise is to divide the payment by the incremental units to obtain an effective discount for these units, and then subtract this imputed discount from the observed price of the units. The payment can only be considered potentially anticompetitive[36] if the effective price of the incremental units is less than the incremental cost of producing these units after this attribution. In this model one condition that leads to anticompetitive exclusion, $w_d q_c > m(w_{cr}-w_d)q_c$ implies $w_d q_c/m > (w_{cr}-w_d)q_c$, which says the payment for exclusivity is less than the revenue from the sale of the incremental units, q_c/m. In figure 2 this condition is equivalent to $B > mA$. Thus, the effective price as calculated based on prices that would be observed in the exclusion equilibrium would not be below marginal cost, and so would not be considered to be potentially anticompetitive even though proposition 1 shows that such payments lower both overall welfare and consumer welfare while excluding a rival.

The intuition behind this result is that the simple price cost test is incomplete because it implicitly assumes that if an equally efficient rival offered a price just below the effective price, the downstream producer would purchase from the rival. That would be incorrect in this case, because if the producer purchased from the rival at a slightly lower price, that would result in increased price competition, which would cause the producer to sell at a lower price and thus earn a loss. So the price cost test can be invalid because it does not account for possible changes in equilibrium market price levels resulting from the producer breaking his exclusivity agreement.

This model also suggests that the small rival is unable to circumvent the exclusivity by vertically integrating forward into the downstream market by merging with one of the producers that can use r. In equilibrium the dominant supplier pays each of those downstream producers the incremental value of the small rival's input, which means the small rival would have to pay this amount to the producer's stockholders to induce them to merge. Since the payment is not enough

[35] See e.g., European Commission 2008 page 11, and Economides (2009) page 273.
[36] There would still need to be a theory of harm resulting from these low prices.

to compensate producer's stockholders to breech exclusivity as an independent producer, it would not be enough to induce them to cede ownership to the rival instead of accepting an exclusivity payment. Thus, not only can exclusivity payments prevent sales contracts between the small rival and producers, they can also prevent mergers or joint ventures between such parties.

My results also suggests that exclusive commitments do not need to be part of long term contracts to be exclusionary. This equilibrium does not require any player to commit to a strategy choice that he would prefer not to play when it came time to play. Thus, there is no interpretation in which any player has made a long term commitment. This model also does not require agreements to stretch over a period during which a small rival could enter.

Simpson and Wickelgren (2007a) and Abito and Wright (2008) argue that differentiation among downstream producers makes exclusion more difficult. It is simple to extend this model to show that some forms of differentiation among producers can make exclusion easier. Suppose that for each end user in the contestable segment a fraction λ of producers are perfect substitutes, while the other $(1-\lambda)$ are unacceptable, and that which producers are substitutes for a given end user is uniformly distributed across end users.[37] Under this assumption (and continuing the assumption that the dominant supplier can lower prices selectively to customers that are considering a product with a rival's input) the dominant supplier would only have to pay each produce λA instead of A to be exclusive, lowering the cost of exclusion and increasing the set of parameters for which exclusion is possible.

The intuition here is that differentiation can have at least two effects on producers. First it could soften price competition among producers. This increases the benefits from a low input price that downstream producers would keep, which makes paying for exclusion more expensive.

[37] Suppose that customers and producers were uniformly distributed around a Hotelling Circle of circumference 1 and each customer could travel 1/3 in either direction for free, but could go no further. Then 2/3 of the producers would be perfect substitutes and the other 1/3 would not be considered. Intuitively one could imagine customers being willing to deal with only producers with which they had a positive previous experience. Different customers would likely have different sets of producers with which they had good experiences.

This is the effect that dominates in the Simpson and Wickelgren, and Abito and Wright papers. A second effect is that differentiation limits the size of the market a producer could serve limiting the potential profits he could earn by breaching exclusivity, which lowers the payment the dominant supplier must make to induce exclusivity. The extension outlined above has only this second effect and so reduces *D*'s cost of inducing exclusivity.

The lack of demand elasticity or the discontinuous nature of willingness to pay for *r*-based units has no substantive effect on the results. The advantages of these assumptions are that the demand system is simple so as not to obscure the main results of the paper and to make it clear that allowing two part tariffs in the benchmark model would not change the results.

For example, if we were to replace the willingness to pay for the *r*-based good with a linear function between the points $(0, w_{cr})$ and $(q_n + q_c, w_{nr})$ and allow the suppliers to make end-user by end-user price reductions, one would get a benchmark model in which each supplier extracted his incremental value from each customer. This price discrimination is more consistent with end users being large enough to have their own individual bidding process for the final good and the suppliers offering customer specific input prices. When exclusives are allowed, the dominant supplier is able to exclude the rival and charge the monopoly input price.

The fact that the small rival can be inefficiently excluded without being forced to exit the market, suggests this model could be expanded to show that large single product loyalty discounts can be used in an anti-competitive manner. I show this in the next section.

5. Conditions under which the Small Rival makes strictly positive sales.

The previous section showed the small rival can be foreclosed from 100% of sales in the market, harming end users. I now extend the analysis to show end users can be harmed when *R* makes strictly positive sales. There are some rather simple ways to obtain such a result without additional formal modeling. For example, assume the condition of position 1 held for a market as depicted in figure 2. Now suppose there is a geographically separate final goods market in which all customers preferred r-based units. Assume there is no arbitrage between these markets. Assume also that adding this new market to the contestable segment to form a larger contestable segment would cause the conditions of proposition 1 to fail. Then in equilibrium D would monopolize the original market as described in proposition 1, but R would make sales in the geographically separate market. Notice here the value of not having to assume the small rival must spend a fixed cost to enter. The small rival can be active in some markets yet excluded from others.

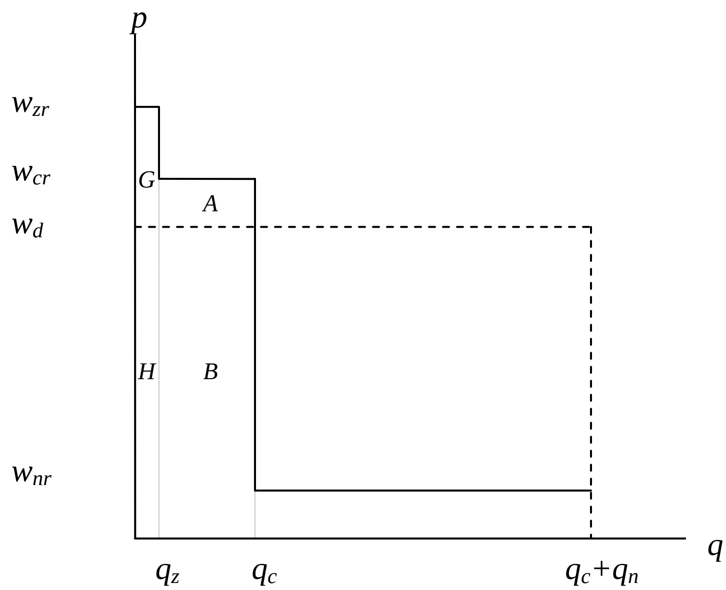
Another example is suggested by the differentiation extension outlined in the previous section. Suppose there is a single producer, Λ, who could serve only λ of the end users in the contestable market, and that Λ is exogenously required to sell only r-based units and cannot accept payments from D to refrain. In such a market D would pay the other producers $(1-\lambda)(w_{rc}-w_d)q_c$ to be exclusive and they would accept. d-based units would be sold at a price of w_d in the portion of the contestable segment in which Λ could not sell. D would set the transfer price of the λq_c units offered to end users for which Λ competed at zero, but sell none of them. Λ would sell λq_c r- based units at $w_{cr} - w_d$.

I now offer a formal analysis showing that the dominant supplier would use a market share discount when there is a small number of end users who value the rival's input very highly. In this case it is cheaper for the dominant supplier to let the producers serve these end users with the rival's input rather than try to compensate them for serving the end users with his own input.

I extend the model of the previous section by assuming that a portion of the contestable segment q_z is willing to pay $w_{zr} > w_{cr}$ for an r-based unit. Figure 3 below shows the resulting demand curve. The game proceeds as in section 4, with the addition that D can offer the payment for a producer using d for a percentage of his sales that is less than 100%.[38]

[38] Allowing R to also offer market share discounts raises the potential for collusion between the suppliers. This is beyond the scope of this paper and is considered in DeGraba (2009).

Figure 3 – demand for r-based and d-based units



Proposition 2. If $m(w_{zr} – w_d) > w_d$ and $w_d(q_c – q_z) + w_{nr}q_n > m(w_{cr}-w_d)(q_c – q_z)$ then there exists an equilibrium in which the dominant supplier offers each of the m producer a payment if his purchases of r as a fraction of total input purchases do not exceed $(q_z/m)/(q_z/m + (q_c-q_z)/f + q_n/f)$. Further the payment to each equals $(q_c-q_z)(w_{cr}-w_d)$.

Proof:

Lemma 3*:* If $m(w_{zr}–w_d) > w_d$,

then $w_d(q_c-q_z) – m(w_{cr}-w_d)(q_c-q_z) > w_dq_c - m(w_{zr}-w_d)q_z - m(w_{cr}-w_d)(q_c-q_z)$.

Proof: Subtracting the RHS of the second equality from the LHS yields $[m(w_{zr}–w_d) - w_d]q_z > 0$, which is true if and only if $m(w_{zr}–w_d) > w_d$.

Lemma 4: D offers each of the m producers a payment of $(q_c-q_z)(w_{cr}-w_d)$ if their purchases of r are no greater than $(q_z/m)/(q_z/m + (q_c-q_z)/f + q_n/f)$ of their input purchases. Each producer accepts. D offers $t_{djs} = w_d$ for all j and $s \in \{n, c\text{-}z\}$ and $t_{djz} = 0$. If a producer breaches the market share agreement, D will set $t_{djc} = 0$. R offers $t_{rjs} = w_{zr} – w_d$. At these prices no producer breaches.

The m producers offer r-based units at $w_{zr} – w_d$ to the q_z end users and offer only d-based units at w_d to the remaining end users. Each of the m producers sells q_z/m r-based units and

$(q_c\text{-}q_z)/f + q_n/f)$ d-based units and earns a payoff of $(q_c\text{-}q_z)(w_{cr}\text{-}w_d)$. R earns a payoff of $(w_{zr} - w_d)q_z$ and D's payoff is $w_d(q_n+q_c\text{-}q_z) - m(q_c\text{-}q_z)(w_{cr}\text{-}w_d)$.

Proof: At these prices no producer has an incentive to breach. Breach would cause D to lower the price in the c segment to 0 which means the q_z r-based units could be sold for no more than $w_{zr} - w_d$ and the $q_c\text{-}q_z$ units could be sold for no more than $w_{cr} - w_d$. Thus, no breaching producer could earn positive payoff from selling q_z units, and no more than $(w_{cr} - w_d)(q_c\text{-}q_z)$ from selling the $q_c - q_z$ units, which it already earns.

No producer has an incentive to offer units in the non-contestable segment because any unit sold there would cause a breach of the market share agreement and the loss of the fixed payment.

R has no incentive to set different prices to induce breach. At the current prices he earns $(w_{zr} - w_d)q_z$ and each of the m producers earns $(w_{cr} - w_d)(q_c\text{-}q_z)$. The maximum rent that can be earned from the c segment if D sets $t_{djc} = 0$ in case of breach is $(w_{zr} - w_d)q_z + (w_{cr} - w_d)(q_c\text{-}q_z)$. Since R would have to give a producer more than $(w_{cr} - w_d)(q_c\text{-}q_z)$ to breach, he would earn less than $(w_{zr} - w_d)q_z$. *QED*

Proposition 2 says that if there are end users with sufficiently high willingness to pay for an r-based unit, it is more profitable for D to allow those end users to be served by r-based units than to exclude r completely. In Figure 3 this says if $mG > H$, then D is better off extracting B and paying mA than extracting $H+B$ and paying $m(G+A)$. By choosing a market share discount in which the share is equal to the share of the entire market that the high willingness to pay end users constitute, D ensures that only those high willingness to pay end users are served by r-based units.

The social surplus of the competitive equilibrium is higher than the surplus of the market share discount equilibrium, which is higher than the surplus of the exclusive contract equilibrium. The competitive equilibrium is efficient since r-based units serve the contestable segment. In the market share discount equilibrium $q_c - q_z$ end users are served by d-based units, which is inefficient. In the exclusive equilibrium all q_c end users in the contestable segment are served by d-based units.

6. Discussion and Conclusion

The recent literature has modeled exclusion in the context of a potential entrant who is more efficient than a monopolist incumbent across the entire market. The incumbent excludes when the entrant is prevented from making exclusive offers. By contrast I present a model in which a small rival, who is already in the market, is more efficient at serving only a small segment of the market. If the dominant supplier has sufficiently large demand from the segment of the market that he serves more efficiently, then he can use exclusive contract to exclude the smaller rival. Such exclusivity reduces social and consumer surplus.

The contributions of this model include i) formally modeling dominance of an input supplier competing against a smaller rival and selling to downstream competitors ii) showing conditions under which a dominant supplier has to be sufficiently large to use exclusive contracts to exclude and lower welfare, ii) showing that a dominant supplier's use market share discounts with threshold levels of less than 100% lowers welfare, even though the rival sells positive amounts of its inputs, iii) showing formally that the so called "attribution test" will fail to detect many instances in which exclusion lowers welfare, iv) showing that the incentive to exclude includes savings from reducing competition in a market segment in which the small rival would not make sales, but would exert competitive pressure, and v) providing some conditions that help determine if increased product differentiation will make exclusion easier or harder.

The intuition that the dominant supplier simply pays each downstream supplier what it would earn if it used the rival supplier's input seems rather general. The exact size of this payment however will depend on the characteristics of downstream competition. This paper focused on demand conditions under which downstream producers earn no quasi-rents. Allowing for differentiation among the downstream producers that allows them to earn quasi-rents complicates the analysis. Here if selling the rival's inputs also increased the producer's quasi-rents relative to not selling it, then the exclusivity payments would have to cover those quasi-rents as well.

The potential for quasi-rents creates a much more interesting issue when considering exclusion. With differentiation each producer would earn quasi-rents from its sales in the non-contestable market, presumably to cover a strictly fixed cost of operating. In this case a dominant supplier would be an essential input in earning quasi-rents in the non-contestable segment. This would allow for a larger set of potentially observable behavior by the dominant supplier including threatening to raise the transfer price (or restrict the quantity) of inputs sold to a breaching producer, thereby threatening to reduce its quasi-rents in the non-contestable segment if the producer used the rival's input in the contestable segment.[39]

The complication arises because threatening to withhold inputs from a producer would likely lower the dominant supplier's profits as well. Each differentiated firm is best suited to sell to a certain group of customers and restricting inputs to this producer could reduce the dominant supplier's profits related to those customers. Thus, the supplier might be unwilling to carry out the threat if a producer breached exclusivity.

To solve this subgame perfection problem one would either need to develop a reputation model, in which the dominant supplier established a reputation for punishing producers that breached exclusivity, or present a model in which the dominant supplier allows the producers to retain quasi-rents by offering a below short run profit maximizing transfer price in exchange for exclusivity. In this case end users would benefit from the lower input price. Such a model would have to show that the end users benefits from the lower price are smaller than the benefits they would receive from the competition from the small rival if exclusivity were not allowed. DeGraba (2009) addresses these issues.

[39] Since the literature does not formally model two segments, this issue is not considered.

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