KONKURRANSE·
TILSYNET
Norwegian Competition Authority

Rapport 2/2020

Exclusive Contracts with Cournot Competition

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January 2020

Abstract

The Chicago-school's view of exclusive dealing posits that an incumbent firm would not find it profitable to exclude a more efficient entrant in the absence of pro-competitive efficiencies. According to this view, the compensation that would be needed to induce buyers to sign an exclusive with the incumbent would always be more than the incumbent could expect to gain. This is typically shown using simple monopoly models. Underlying the logic in these models, however, is a presumption that the incumbent's price would be bid down to its marginal cost in the event of entry. Assuming instead that firms would compete à la Cournot post entry, we show that the Chicago-school view systematically underestimates the incumbent's incentive for exclusion. Our findings suggest that anti-competitive exclusion can be profitable even in the case of a single buyer. We also show how Cournot competition affects post-Chicago models of exclusive dealing in which there are many buyers and the entrant has economies of scale.

Keywords: exclusive dealing, Cournot competition, entry deterrence

*We thank the "Det alminnelige prisreguleringsfond" through the Norwegian Competition Authority for financial support.

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1 Introduction

The Chicago-school's view of exclusive dealing holds that an incumbent firm cannot profitably foreclose a more efficient entrant by asking its buyers to sign an exclusive contract (see, for example, Posner, 1976, Bork, 1978, and Ramseyer and Rasmusen, 2014). The reason, according to this view, is that the compensation that would be needed to induce buyers to sign an exclusive with the incumbent would always be more than the incumbent could expect to gain (because of the deadweight loss that the incumbent's monopoly pricing would generate). As Whinston (2006) notes, this view has had, and continues to have, enormous influence on the making of public policy and how courts perceive these types of contracts.

It is now known, however, that the Chicago-school's view implicitly assumes that each buyer is pivotal in the sense that its purchases alone would be sufficient to induce entry. Rasmusen et al (1991) have shown, for example, that when this is not the case, the incumbent may be able to induce exclusion cheaply by exploiting coordination failures among the buyers. And, Segal and Whinston (2000) have shown that even in the absence of coordination failures, the incumbent may be able to profitably induce exclusion through the use of a "divide and conquer" strategy, as long as it does not have to sign up every buyer.[1] These post-Chicago models have also been influential. Specifically, they have done much to highlight the importance of scale economies as a key factor for courts and policymakers to consider.

In this paper, we take a different approach to critiquing the Chicago-school's view of exclusive dealing. We argue that the Chicago-school's view is not robust to its implicit assumption that firms would compete à la Bertrand post entry, and therefore that the incumbent's price would necessarily be bid down to its marginal cost in any post-entry game. Assuming instead that firms compete à la Cournot in the event of entry, we find that the Chicago-school systematically underestimates the incumbent's incentive for exclusion. We show that this effect can be sufficiently strong that anticompetitive exclusion can be profitable for the incumbent even in the case of a single buyer. Hence, contrary to the views of some,[2] we find that economies of scale are not a prerequisite for exclusion to be profitable.

[1] This assumes that the incumbent's contract offers are observable. When they are not observable, the efficacy of divide and conquer strategies may depend on buyers' beliefs (see Miklós-Thal and Shaffer, 2016).

[2] Conventional wisdom suggests that economies of scale are necessary for anticompetitive exclusion. See, for example, the European Commission's discussion paper on exclusionary abuses (European Commission, 2005). In it, DG Comp acknowledges that entry is much more costly when there are economies of scale, and concludes that "In assessing barriers to expansion and entry it is useful therefore to consider the minimum efficient scale in the market concerned (p. 14)." Elsewhere it is stated that, in addition to the degree of dominance of the incumbent, "Other market characteristic including the existence of network effects and *economies of scale* may also be relevant to establish a foreclosure effect. (p. 19)" See also Salop, 2006, who notes the importance of economies of scale for profitable exclusion (he refers to it as the entrant's minimum viable scale), and the Canadian Supreme Court's decision in Nutrasweet, 1990, as discussed in Winter, 2009.

We also investigate the effects of Cournot competition when there are multiple buyers and the entrant has economies of scale. We show that the incumbent's incentives for exclusion are larger in this case as well. Using a set-up similar to that in Segal and Whinston (2000), we find that, relative to the case of Bertrand competition, assuming that firms would compete à la Cournot post entry can lead to exclusionary outcomes over a wider range of entry costs. Exclusion is always anti-competitive in the set-up we consider, and unlike in Rasmusen et al's (1991) seminal work, there need not be any coordination failures among the buyers.

One might think that a change in competition from Bertrand to Cournot would have mostly ambiguous effects on an incumbent's ability to profitably foreclose a more efficient entrant (although the buyer's loss from exclusion would be smaller under Cournot than under Bertrand, the incumbent's gain from exclusion would also be smaller).[3] But this is not so because, unlike in the case of Bertrand competition, where the incumbent's gain from exclusion is equal to the price increase it can expect to achieve times the quantity it can expect to sell (which, as the Chicago school correctly points out, is always less than the buyer's loss), the gain to the incumbent in the Cournot case is equal to the price increase it can expect to achieve times the quantity it can expect to sell *plus* its profit margin under Cournot times the expected increase in its sales (in going from its Cournot quantity in the presence of entry to the monopoly quantity in the entrant's absence). This additional component to the incumbent's gain is not a transfer from the buyer, and hence is something that can go towards offsetting the buyer's deadweight loss. It has been missed in the literature because the incumbent's profit margin in the case of Bertrand competition is always zero.

This extra term also operates in (our version of) Segal and Whinston's set up with multiple buyers and economies of scale. But, in addition, there is another effect that arises in this case, one that also favors Cournot over Bertrand. In Segal and Whinston's set up, as in our set up, the incumbent earns profit from each of the unsigned buyers, but loses profit on each of the signed buyers, when entry is deterred. However, this loss is smaller under Cournot competition than under Bertrand competition, because the gain from each signed buyer relative to how much each signed buyer has to be compensated is increasing in the buyer's price, and prices under Cournot are higher than prices under Bertrand. All else equal, this results in an increased incentive for exclusion when firms compete à la Cournot.

Our bottom line conclusion is that anticompetitive exclusion can occur over a much wider set of circumstances (more likely to be profitable) when competition post entry would be Cournot than when it would be Bertrand. This has implications for public policy in that it

[3] The buyer's loss would be smaller under Cournot competition because the price reduction when entry occurs would be smaller than under Bertrand competition. The incumbent's gain under Cournot competition would be smaller because, under Cournot competition, the incumbent earns positive profit when entry occurs.

suggests a new factor for policymakers to consider — viz. the nature of competition post entry — when evaluating the potential profitability and welfare effects of exclusive dealing.

The rest of the paper proceeds as follows. In the next section, we extend the standard Chicago-school set up to the case of quantity competition. We find that the Chicago school systematically underestimates the effect of exclusion in this case. In Section 3, we allow for multiple buyers. Once gain, we find that incentives for exclusion are increased with quantity competition. Section 4 concludes the paper and suggests extensions for future research.

2 The model

As in the standard Chicago-school set up, we assume there are three players in our baseline model: an incumbent firm, a potential entrant, and a single buyer (later, we will extend the model to allow for a unit mass of buyers). The incumbent is assumed to be able to produce a single good at a marginal cost equal to $\overline{c}$. The potential entrant, in contrast, is assumed to be able to produce the same good, if it enters, at a marginal cost equal to c, where $0 \leq c < \overline{c}$. The entrant is thus assumed to have a unit cost advantage, which we denote by $\delta := \overline{c} - c$.

On the demand side, we let $D(p)$ denote the buyer's demand for the good as a function of the market price p. We assume that for all $p > 0$ such that $D(p) > 0$, $D(p)$ is downward sloping and continuously differentiable. We write the buyer's inverse demand as $p\left(Q\right)$, where Q is the total quantity supplied (i.e., if q_I denotes the quantity supplied by the incumbent and q_E denotes the quantity supplied by the entrant, then $Q = q_I + q_E$). It follows that for all $Q > 0$ such that $p\left(Q\right) > 0$, $p\left(Q\right)$ is also decreasing and continuously differentiable.

To ensure that there is a finite upper bound on the amount demanded at any positive price, we assume there exists some quantity $\overline{Q} > 0$ such that $p(Q) > 0$ for all $Q < \overline{Q}$, and $p(Q) = 0$ for all $Q \geq \overline{Q}$. In addition, we assume that for all $Q < \overline{Q}$, $p''\left(Q\right)$ is such that[4]

$$p'\left(Q\right) + p''\left(Q\right) q_i < 0.$$

These assumptions collectively ensure the existence of a unique Cournot equilibrium.[5]

Before the entrant has a chance to enter and produce the good, however, we assume that the incumbent can offer the buyer an exclusive contract at the start of the game that will keep the entrant out if accepted. The buyer, of course, is free to accept or reject it. But unlike in the standard Chicago-school set up, we assume that if the buyer does not accept the incumbent's offer and the entrant decides to enter, then competition between the firms

[4]This ensures that Cournot reaction functions are downward sloping when both sellers are active.

[5]They satisfy, for example, the necessary and sufficient conditions in Gaudet and Salant (1991).

post-entry will occur à la Cournot, not à la Bertrand, as is usually assumed to be the case.

Formally, we assume the game has three stages. At stage 1, the incumbent decides whether to offer the buyer an exclusive contract. If it does so, we assume that it takes the form $C = \{x\}$, where $x \geq 0$ denotes the lump-sum payment offered by the incumbent to the buyer if the contract is signed (later, we will allow for multiple buyers and discriminatory payments). At stage 2, and after having observed the outcome at stage 1, the entrant decides whether to enter the market and compete against the incumbent. Entry involves paying a non-zero entry cost, $\varepsilon > 0$. (We will assume that ε is low enough that the entrant will always find it profitable to enter if there is no signed contract between the buyer and the incumbent.) At stage 3, the incumbent and the entrant compete by simultaneously choosing how much quantity to supply the buyer, given that (a) the buyer did not sign the incumbent's contract at stage 1 and (b) the entrant chose to enter the market at stage 2. If the entrant did not enter the market at stage 2, or if the buyer signed the incumbent's contract at stage 1, then we assume the incumbent supplies the monopoly quantity and earns the monopoly profit.[6]

Lastly, we assume for convenience that both sellers are willing to supply positive quantities in equilibrium if entry occurs. This is tantamount to assuming that the entrant's cost advantage cannot be too large. Thus, we henceforth assume that $\delta < \overline{\delta}$, where $\overline{\delta} > 0$ is the minimum cost difference such that the incumbent's equilibrium quantity is zero post-entry.

2.1 Solving the model

In the presence of entry, we define q_I^C and q_E^C as the respective quantities that solve

$$\max_{q_I} \left(p\left(Q\right) - \overline{c}\right) q_I \Longleftrightarrow q_I = \frac{p\left(q_I + q_E\right) - \overline{c}}{-p'}$$

and

$$\max_{q_E} \left(p\left(Q\right) - c\right) q_E \Longleftrightarrow q_E = \frac{p\left(q_I + q_E\right) - c}{-p'}.$$

Our assumptions imply that these quantities are strictly positive and unique. They represent the equilibrium quantities of the firms in the post-entry game. Summing them up gives the aggregate quantity supplied in the market. We will refer to it as the Cournot quantity:

$$Q^C := q_I^C + q_E^C.$$

[6] As Whinston (2006) notes, two implicit assumptions are embedded in this set-up. First, it is assumed that when the incumbent and the buyer contract at stage 1, the entrant is not around to offer its own contract. Second, it is assumed that while the incumbent and the buyer can contract on exclusivity to keep the entrant out, they are unable to contract directly on the future quantity or price of the good. Whinston suggests this may be because the exact nature of the good that the buyer may want may as yet be unclear.

From the Cournot quantity, we obtain the corresponding Cournot price,

$$p^C := p\left(Q^C\right),$$

and the equilibrium Cournot profits of the incumbent and the entrant, respectively,

$$\pi_I^C := \left(p^C - \bar{c}\right) q_I^C$$

and

$$\pi_E^C := \left(p^C - c\right) q_E^C.$$

In the absence of entry, we assume that the incumbent will act as a monopolist. To this end, we let Q^M, p^M and π^M denote the respective monopoly quantity, price and profit:

$$Q^M := \arg\max_Q \left(p\left(Q\right) - \bar{c}\right) Q,$$

$$p^M := p\left(Q^M\right)$$

and

$$\pi^M := \left(p^M - \bar{c}\right) Q^M.$$

All else equal, it is clear that the buyer would be better off with entry than without entry. We can see this by comparing the surplus that it would expect to get if entry occurs,

$$S^C := \int_{p^C}^{\infty} D\left(s\right) ds = \int_0^{Q^C} p\left(v\right) dv - p^C Q^C, \tag{1}$$

with the surplus that it would expect to get if entry does not occur,

$$S^M := \int_{p^M}^{\infty} D\left(s\right) ds = \int_0^{Q^M} p\left(v\right) dv - p^M Q^M, \tag{2}$$

and then noting that $p^M > p^C$ (equivalently, $Q^C > Q^M$) necessarily implies that $S^C > S^M$.

It follows that the buyer must be compensated if it is to sign an exclusive contract. In particular, it must receive a payment of at least $S^C - S^M$ from the incumbent. Otherwise, the buyer would be better off not signing the contract and reaping the benefits of entry.

Let $x^* := S^C - S^M$ denote the minimum payment needed for exclusion. Then, after substituting the expression for S^C from (1), and the expression for S^M from (2), we obtain

$$x^* = \left(p^M - p^C\right) Q^M + \int_{Q^M}^{Q^C} p\left(v\right) dv - p^C \left(Q^C - Q^M\right). \tag{3}$$

The expression in (3) suggests that the buyer's loss from signing an exclusive contract can be decomposed into two components. The first component, $\left(p^M - p^C\right) Q^M$, represents the loss to the buyer (gain to the incumbent) from the higher price it will pay on the Q^M units that it purchases. With entry, the buyer would have paid p^C for each of these units. Absent entry, the buyer will be paying p^M for each of these units. The second component, i.e., the remaining terms in (3), represents the loss to the buyer from purchasing $Q^C - Q^M$ fewer units at the per-unit price that it would have been able to obtain if entry had occurred.

This second component, which represents a pure deadweight loss to society in the sense that neither the buyer nor the incumbent realize this surplus in the absence of entry, forms the crux of the Chicago-school argument that exclusion will not be privately profitable. According to the Chicago school, the incumbent will not generally have the means and/or the desire to pay the buyer for exclusion, because the loss to the buyer would be expected to exceed the gain to the incumbent by the resulting deadweight loss from monopoly pricing.

Our main insight is that the Chicago-school argument need not hold when the post-entry game is in quantities because it systematically *underestimates* the gain to the incumbent from deterring entry in this case. When competition is in quantities, the gain to the incumbent from exclusion is not just $\left(p^M - p^C\right) Q^M$ (which is the first component in (3)), but also $(p^C - \bar{c})$ times the extra quantity it would produce (which is $Q^M - q_I^C$) when entry is deterred. Although the extra term is a consequence of the firms' goods being substitutes in demand, it has been missed in the literature, because under Bertrand competition (as has been assumed), the incumbent's profit margin in the presence of entry is always zero.

Formally, let $G := \pi^M - \pi_I^C$ denote the incumbent's gain from exclusion. Then, after substituting the expressions for π^M and π_I^C from above into G, it is easy to see that

$$G = \left(p^M - p^C\right) Q^M + \left(Q^M - q_I^C\right) \left(p^C - \bar{c}\right). \tag{4}$$

The first component in (4) is the same as the first component in (3), but the second component, $\left(Q^M - q_I^C\right) \left(p^C - \bar{c}\right)$, has no counterpart in (3). It follows that whether the incumbent's gain from exclusion exceeds the buyer's loss from exclusion turns on whether the second component in (4) exceeds the second component in (3). If it does, then exclusion is privately profitable. If it does not, then exclusion is not privately profitable. Put differently, exclusion will be privately profitable for the incumbent if and only if $G - x^*$ is strictly positive, where

$$G - x^* = \left(Q^M - q_I^C\right) \left(p^C - \bar{c}\right) - \int_{Q^M}^{Q^C} p\left(v\right) dv - p^C \left(Q^C - Q^M\right). \tag{5}$$

Figure 1 captures the incumbent's tradeoff. For a representative $p(Q)$, $\bar{c}$, and c, it depicts the corresponding monopoly and Cournot prices, p^M and p^C, on the vertical axis, and the incumbent's Cournot quantity, q_I^C, the monopoly quantity, Q^m, and the Cournot quantity, Q^C, on the horizontal axis. Various areas are then named and shaded. As can be seen from this, the buyer's loss from exclusion is given by areas $A + B + C$, whereas the incumbent's gain from exclusion is given by areas $A + B + D$. It follows that whether or not exclusion will be privately profitable for the incumbent thus depends on the size of area D (which is the first component in (5)) versus the size of area C (which is the second component in (5)).

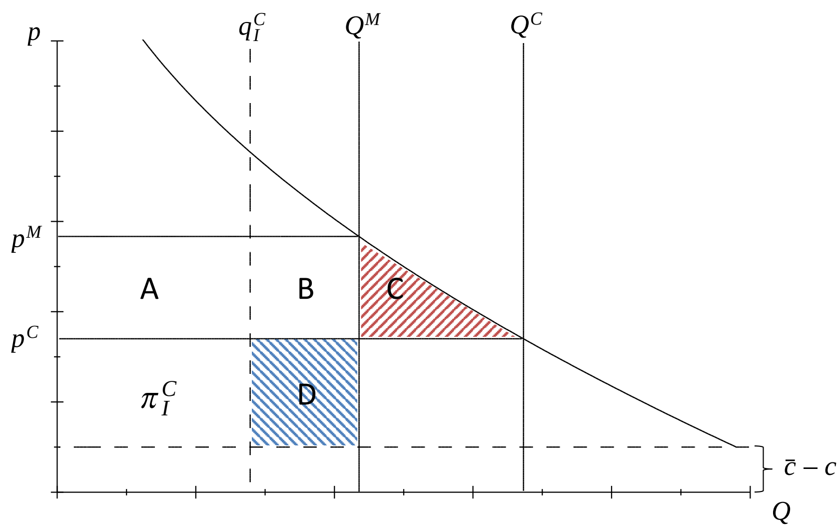

Figure 1

2.2 The Cournot advantage

The comparison between areas C and D turns out to be ambiguous in general. It depends on both the size of the entrant's cost advantage and the curvature of the buyer's demand. The easiest way to see this is by focusing on the bounds of δ. We know that δ is bounded below by zero on the one hand, and above by $\overline{\delta} > 0$ on the other. Consider first the case in which δ approaches its lower bound (i.e., the entrant's cost advantage goes to zero). Then, after canceling common terms and rearranging things, the limit of (5) can be written as

$$\lim_{\delta \to 0} (G - x^*) = \pi^C - \int_{Q^M}^{Q^C} (p(v) - \overline{c}) dv, \tag{6}$$

where π^C is the single-firm (symmetric) Cournot profit and Q^M and Q^C are the monopoly and symmetric Cournot quantities when marginal costs are equal to $\overline{c}$. From this, it is straightforward to show that there exist convex and concave demand functions such that (6) is strictly positive. It is also straightforward to show that (6) is strictly positive when the buyer's (inverse) demand is linear (i.e., $p(Q) = a - bQ$). See, for example, Section 2.2.1. This establishes that exclusion can be privately profitable for the incumbent when $\delta \to 0$.

However, the same cannot be said at the other end. Suppose instead that δ approaches its upper bound (so that the cost difference is large). Then, by the definition of $\overline{\delta}$, it follows that $q_I^C \to 0$ and $p^C \to \overline{c}$, which implies that $\left(Q^M - q_I^C\right)\left(p^C - \overline{c}\right) \to 0$. This means that

$$\lim_{\delta \to \overline{\delta}} G = \left(p^M - p^C\right) Q^M, \tag{7}$$

and therefore that

$$\lim_{\delta \to \overline{\delta}} (G - x^*) \;=\; -\left(\int_{Q^M}^{Q^C} p\,(v)\,dv - p^C\left(Q^C - Q^M\right)\right) \;<\; 0. \tag{8}$$

Here the limit of $G - x^*$ is strictly negative, implying that the incumbent's gain when δ approaches $\overline{\delta}$ is always outweighed by the buyer's loss. The reason is that area D vanishes when $\delta \to \overline{\delta}$, whereas area C does not (because $Q^C > Q^M$ even when $\delta \to \overline{\delta}$). The Chicago-school's view thus holds in this case: the deadweight loss to the buyer from the incumbent's monopoly pricing cannot be fully compensated when the cost difference is sufficiently large.

Combining our results in (6) and (8), we see that exclusion can be profitable for the incumbent for some δ, but not for all δ. The proposition below summarizes our findings.

Proposition 1. *(Single-buyer case) There exist $p(Q)$ such that exclusion can be profitable for the incumbent when the firms would otherwise compete à la Cournot post entry. For all such $p(Q)$, exclusion will be profitable for the incumbent if and only if δ is sufficiently small.*

Our results in Proposition 1 contrast with the case of Bertrand price competition, where it is well known that the incumbent's gain from exclusion is always exceeded by the buyer's loss from exclusion in the single-buyer case. We have shown above that this well-known Chicago-school argument overstates its case when the post-entry game is in quantities, however, because it systematically *underestimates* the incumbent's gain from deterring entry in this setting. Per Proposition 1, this extra gain can even be enough to outweigh the deadweight loss to the buyer for some $p(Q)$, as long as the entrant's cost advantage δ is not too large.

We have thus shown here that when firms compete in quantities, exclusion can sometimes be profitable for the incumbent even when the entrant produces the same good and there is only one buyer (thereby ruling out externalities across buyers as the reason for exclusion). It remains only to get a sense in our set-up of how small the cost difference must be before exclusion can be privately profitable. For this, we now turn to the case of linear demands.

2.2.1 Example with linear demands

Let $p(Q) = a - bQ$ and assume that $\delta \in (0, \overline{\delta})$. Profits under entry are equal to

$$\pi_I = (a - b(q_I + q_E) - \overline{c})\, q_I$$

and

$$\pi_E = (a - b(q_I + q_E) - c)\, q_E.$$

Setting up the first-order conditions and simultaneously solving them yields

$$q_I^C = \frac{1}{3b}(a - 2\overline{c} + c) \tag{9}$$

and

$$q_E^C = \frac{1}{3b}(a - 2c + \overline{c}), \tag{10}$$

from which it follows that the Cournot quantity, price, and equilibrium profits are

$$Q^C = q_I^C + q_E^C = \frac{2a - \overline{c} - c}{3b},$$

$$p^C = p\left(q_I^C + q_E^C\right) = \frac{1}{3}(a + \overline{c} + c),$$

$$\pi_I^C = \frac{(a - 2\overline{c} + c)^2}{9b}, \tag{11}$$

and

$$\pi_E^C = \frac{(a - 2c + \overline{c})^2}{9b}. \tag{12}$$

On the buyer side, the surplus the buyer would expect to get if entry occurs is thus

$$S^C = \frac{1}{2}\left(a - p^C\right)\left(q_I^C + q_E^C\right) = \frac{(2a - \overline{c} - c)^2}{18b}. \tag{13}$$

In the absence of entry, we have assumed that the incumbent will act as a monopolist. Solving for the monopoly quantity, price and profit in this case yields:

$$Q^M = \frac{a - \overline{c}}{2b},$$

$$p^M = p\left(Q^M\right) = \frac{a + \overline{c}}{2},$$

and

$$\pi_I^M = \frac{(a-\overline{c})^2}{4b}. \tag{14}$$

The surplus the buyer would expect to get in the absence of entry is thus

$$S^M = \frac{1}{2}\left(a - p^M\right) Q^M = \frac{(a-\overline{c})^2}{8b}. \tag{15}$$

For exclusion to be privately profitable for the incumbent, the loss to the buyer, i.e., $S^C - S^M$, must be smaller than the gain to the incumbent, i.e., $\pi_I^M - \pi_I^C$. This requires that

$$\pi_I^M - \pi_I^C - \left(S^C - S^M\right) > 0$$
$$\Updownarrow$$
$$\frac{(a-\overline{c})^2}{4b} - \frac{(a-2\overline{c}+c)^2}{9b} - \left(\frac{(2a-\overline{c}-c)^2}{18b} - \frac{(a-\overline{c})^2}{8b}\right) > 0$$
$$\Updownarrow$$
$$(a - 3\overline{c} + 2c)\,\frac{a+\overline{c}-2c}{24b} > 0.$$

Or, in other words, it must be that

$$\delta \; < \; \frac{a-c}{3}. \tag{16}$$

To see how the right-hand side of (16) compares to the upper bound of δ, note that $\overline{\delta}$ is defined to be the cost difference that would just make $q_I^C = 0$ in (9). Solving for this cost difference gives $\overline{\delta} = (a-c)/2$. Letting $\hat{\delta} := (a-c)/3$, it thus follows that entry will be excluded for all δ between 0 and $\hat{\delta}$, whereas it will not be excluded for all δ between $\hat{\delta}$ and $\overline{\delta}$.

Figure 2

The results for the case of linear demand are depicted in Figure 2 above. Here we can see that exclusion is profitable for the incumbent over the first two-thirds of the range of δ (suggesting that, at least in this case, the condition that δ must be sufficiently small is not particularly restrictive). Moreover, we can also see that once exclusion becomes profitable for the incumbent for some $\delta > 0$, it will remain profitable for all lower values of δ as well.

Notice that although exclusion is socially inefficient whenever it arises, the buyer is never worse off. The reason is that, with only one buyer, exclusion can only arise when the buyer agrees, and hence the buyer and the incumbent both have to be better off from deterring the entrant. Below we will show how exclusion can be facilitated more easily when firms compete à la Cournot even when there are multiple buyers and some of them are worse off.

3 Multiple buyers and economies of scale

The Chicago-school argument is typically exposited (as we have also done) in the context of a single buyer, where the buyer is implicitly assumed to be large enough to support entry by itself. The post Chicago-school synthesis that began with the seminal work of Rasmusen et al (1991), and which was extended by Segal and Whinston (2000), made note of this and suggested that if it were relaxed (i.e., if the entrant were to face non-trivial economies of scale such that multiple buyers would be needed to support entry), then, contrary to the Chicago-school's assertions, anti-competitive exclusion could indeed be privately profitable.[7]

Rasmusen et al's insight was to notice that when multiple buyers are needed to support entry, the incumbent might be able to profitably induce exclusion by exploiting coordination failures among them.[8] Segal and Whinston followed by showing that even in the absence of coordination failures, the incumbent might be able to profitably induce exclusion through a divide and conquer strategy, as long as it did not have to sign up every buyer to an exclusive. As in Rasmusen et al, however, this was shown assuming that firms compete à la Bertrand.

Segal and Whinston's idea is predicated on the observation that the greater the entrant's economies of scale, the fewer the number of buyers the incumbent will have to sign to induce exclusion. To see how it works, and ultimately to provide a framework in which to compare Bertrand versus Cournot competition, assume there exists a unit mass of identical buyers, each with an inverse demand function of $p(Q)$. Assume also that the timing of the game is the same as before, with the only difference being that in stage 1, the incumbent can make discriminatory "divide-and-conquer" contract offers. We will further assume that buyers can observe each other's contract offers before they accept or reject, and we will focus on perfectly-coalition proof Nash equilibria (PCPNE) in order to rule out coordination failures.

[7] Aghion and Bolton (1987) have also critiqued the Chicago-school's view that exclusive dealing could not be anticompetitive, but they did so in the context of rent-shifting via penalties for breach of contract, while retaining the assumption of a single buyer. Rasmusen et al's (1991) and Segal and Whinston's (2000) critique focused instead on externalities among buyers as the impetus for the incumbent's exclusion. See also Whinston (2006), and, more recently, Fumagalli et al (2018), for a discussion of the post-Chicago synthesis.

[8] Their insight can be understood by noting that if each buyer believes that every other buyer will be signing the incumbent's exclusive contract, then it too may be willing to sign, for little or no inducement.

Segal and Whinston's insight is that the incumbent's payments do not have to be profitable on a buyer-per-buyer basis when multiple buyers are needed to support entry. Rather, to determine whether exclusion would be profitable, the incumbent only has to compare the sum of the payments that would be needed to deter the entrant to the sum of the gains.

To continue, suppose, as in Segal and Whinston, that firms compete à la Bertrand post entry, so that in the event of entry, the equilibrium price to each buyer would be bid down to $\overline{c}$, resulting in a per-buyer profit of $\pi_I^B = 0$ for the incumbent, a per-buyer profit of $\pi_E^B = (\overline{c} - c)D(\overline{c})$ for the entrant, and a per-buyer surplus of $S^B = \int_{\overline{c}}^{\infty} D(s)\, ds$. Suppose also that the entrant would be deterred if and only if the incumbent signs at least $\alpha \in (0, 1]$ share of the buyers to an exclusive contract in stage 1. Then, as Segal and Whinston show, the condition for determining whether the incumbent can profitably deter the entrant is not

$$\pi^M - (S^B - S^M) \geq 0,$$

as it is in the classic Chicago-school case with a single buyer, but rather[9]

$$\pi^M - \alpha \left(S^B - S^M\right) \geq 0. \tag{17}$$

Segal and Whinston conclude from this that exclusion can sometimes be profitable (in contrast to the Chicago-school). Although the incumbent gains π^M when it excludes, its cost of exclusion is only $\alpha(S^B - S^M)$. Notice that exclusion will be profitable in this case if α is sufficiently close to zero, whereas it will not be profitable if α is sufficiently close to one. Since the left-hand-side of (17) is decreasing in α, it follows that there exists $\alpha \in (0, 1)$ such that the incumbent will just be indifferent between excluding the entrant or not. Let

$$\alpha^B := \frac{\pi^M}{S^B - S^M} \tag{18}$$

denote this critical value. α^B's interpretation is that it is the largest share of buyers that the incumbent would be willing to sign to an exclusive contract, given that each buyer would have to be compensated $S^B - S^M$ to sign.[10] If this would be enough to deter the entrant from entering, then exclusion will be profitable. Otherwise, exclusion will not be profitable.

[9] This follows from the fact that the incumbent gains π^M from all buyers when entry is deterred, even though it only needs to offer an exclusive contract with a payment of $S^B - S^M$ to α share of the buyers.

[10] Notice that any amount less than $S^B - S^M$ would be rejected because it would not be coalition proof.

3.1 The Cournot advantage

Segal and Whinston's finding that the incumbent's condition for profitable exclusion is more easily satisfied when multiple buyers are needed to support entry extends also to the case of Cournot competition. Similar to the Bertrand case, in the Cournot case, all buyers contribute equally to the incumbent's gain from exclusion, whereas only some of the buyers have to be compensated to induce it. Specifically, the incumbent's gain from exclusion in the Cournot case is $\pi^M - \pi_I^C$, whereas its cost to induce the exclusion (when multiple buyers are needed to support the entrant) is only $S^C - S^M$ times the share of buyers that it needs to sign up.

To be clear, we have already seen that regardless of how many buyers the incumbent needs to sign, even if it needs to sign every buyer, there exist $p(Q)$ and δ such that exclusion is always profitable for the incumbent. Specifically, this occurs for all $(p(Q), \delta) \in \xi$, where

$$\xi = \{(p(Q), \delta) \mid \pi^M - \pi_I^C - \left(S^C - S^M\right) \geq 0\}.$$

But, for all other combinations of $p(Q)$ and δ, specifically for all $(p(Q), \delta) \in \xi^{'}$, where

$$\xi^{'} = \{(p(Q), \delta) \mid \pi^M - \pi_I^C - \left(S^C - S^M\right) < 0\},$$

exclusion would not be profitable if all buyers had to be signed. In this case, it makes a difference how many buyers would need to be signed. As we did above, we can set up the relevant condition for determining whether the incumbent can profitably deter the entrant,

$$\pi^M - \pi_I^C - \alpha\left(S^C - S^M\right) \geq 0, \tag{19}$$

and then solve for the α that just makes the incumbent indifferent between excluding or not:

$$\alpha^C := \frac{\pi^M - \pi_I^C}{S^C - S^M}. \tag{20}$$

The interpretation of α^C is that it is the largest share of buyers that the incumbent would be willing to sign to an exclusive contract when the firms would otherwise compete à la Cournot. For $\alpha > \alpha^C$, exclusion would not be profitable, whereas for $\alpha < \alpha^C$, exclusion would be profitable. Comparing α^C to its analog in the Bertrand case, we obtain the following result:

Proposition 2. *(Multiple-buyer case) Relative to the case of Bertrand competition, the incumbent's incentives for exclusion are strengthened when there would otherwise be Cournot competition in the post entry game in the sense that $\alpha^C > \alpha^B$ for all cost differences $\delta < \overline{\delta}$.*

Proof: See appendix.

Proposition 2 states that α^C is greater than α^B for all feasible δ. On the one hand, this might be expected because, as we showed in Proposition 1, it necessarily holds for those settings in which exclusion would be profitable for the incumbent under Cournot even in the case of a single buyer (because then α^C is greater than one and we know that α^B is always less than one). On the other hand, Proposition 2 goes well beyond Proposition 1 in establishing that $\alpha^C > \alpha^B$ even when $\alpha^C < 1$ (i.e., it holds even when $S^C - S^M > \pi^M - \pi_I^C$).

The reason is that, in addition to area D, which arises in the Cournot case and was discussed in the previous section, there is another fundamental difference between the two cases. As can be seen from the proof of Proposition 2, it stems from the fact that the incumbent's gain relative to the buyer's loss is increasing in the price paid by the buyer for all feasible $p(Q)$. Since prices under Cournot are higher than prices under Bertrand for all $\delta < \overline{\delta}$, this means that the ratio of the profits gained relative to the buyer's loss will be unambiguously higher under Cournot than it is under Bertrand. All else equal, this implies an additional incentive for exclusion when the firms would otherwise compete à la Cournot.

3.2 Profitable exclusion

We now incorporate the entrant's decision whether to enter the market, and note that whether exclusion will be privately profitable for the incumbent will depend in general on the demand $p(Q)$, the entrant's cost advantage δ, and the size of the entrant's fixed cost ϵ.

There are two cases to consider when comparing Bertrand and Cournot competition.

Case 1: $(p(Q), \delta) \in \xi$

In this case, we know that exclusion is privately profitable for the incumbent for all $\epsilon \geq 0$ when firms compete à la Cournot, whereas it is only privately profitable under Bertrand competition if the fixed cost ϵ is large enough.[11] Cournot dominates Bertrand in this case.

Case 2: $(p(Q), \delta) \in \xi^{'}$

In this case, we know that exclusion will be privately profitable for the incumbent under Cournot if and only if the entrant would be deterred at $\alpha = \alpha^C$. Since the most the entrant can earn if it enters and sells to the unsigned buyers when α^C share of the buyers have signed an exclusive contract is $\left(1 - \alpha^C\right) \pi_E^C - \epsilon$, it follows that entry will be deterred if and only if

$$\epsilon \ > \ \epsilon^C := \left(1 - \alpha^C\right) \pi_E^C. \tag{21}$$

[11] This follows because $\alpha^B < 1$ implies that for ϵ small enough, the entrant would necessarily earn strictly positive profit when only $\alpha = \alpha^B$ share of the buyers are signed to an exclusive contract.

Similarly, we know in this case that exclusion will be privately profitable for the incumbent when firms would otherwise compete à la Bertrand post entry if and only if the entrant would be deterred at $\alpha = \alpha^B$. It follows that entry will be deterred in this case if and only if

$$\epsilon \;>\; \epsilon^B := \left(1 - \alpha^B\right) \pi_E^B. \tag{22}$$

We can thus see that in both instances, exclusion will be profitable for the incumbent if and only if the entrant's fixed costs are high enough. How high they have to be depends on the strength of the incumbent's gain from exclusion (which determines the critical values of α), and the entrant's expected profit on entering the market. Intuitively, the weaker the incumbent's gain from exclusion, and the greater the entrant's expected profit on entering the market, the higher the entrant's fixed costs will have to be for exclusion to be profitable.

As can be seen from (21) and (22), the thresholds differ between Bertrand and Cournot. This naturally raises the question, which threshold would we expect to be lower? In answering this question, note that on the one hand, we have already seen that the incumbent's gain from exclusion is always stronger in the Cournot case (weaker in the Bertrand case).[12] By itself, this suggests that we would normally expect $\epsilon^C < \epsilon^B$. On the other hand, we can see that the comparison between ϵ^C and ϵ^B also depends on the comparison between π_E^C and π_E^B, which can go either way. For any $p(Q)$ and δ sufficiently small, it is easy to see that $\pi_E^C > \pi_E^B$ (since the limit of π_E^B goes to zero as the entrant's cost advantage vanishes, whereas π_E^C remains bounded above zero). However, for larger δ, the pricing constraint that is imposed on the entrant from Bertrand competition weakens, which allows π_E^B to exceed π_E^C.[13] The latter, when combined with the fact that $\alpha^C > \alpha^B$, would then ensure that $\epsilon^C < \epsilon^B$.

The next proposition summarizes what we have learned from the two cases.

Proposition 3. *(Multiple-buyer case) The threshold of fixed costs above which exclusion would be profitable is lower under Cournot than under Bertrand if (i) $(p(Q), \delta) \in \xi$ or (ii) $\pi_E^B > \pi_E^C$. For any given $p(Q)$, a necessary condition for (i) to hold is that δ must be sufficiently small, while a necessary condition for (ii) to hold is that δ must be sufficiently large.*

Proposition 3 formalizes the notion that exclusion is more likely to be profitable for the incumbent when the firms compete à la Cournot post entry. Specifically, it offers sufficient conditions for the threshold of fixed costs to be lower under Cournot than under Bertrand.

[12] Proposition 2 implies that $\left(1 - \alpha^B\right) > \left(1 - \alpha^C\right)$ for all cost differences $\delta < \overline{\delta}$.

[13] Intuitively, with post-entry Bertrand competition, the entrant is able to capture the full demand of each non-signing buyer, and when the incumbent's costs are high, the entrant can do so at a relatively high price. With linear demand, for example, it can be shown that π_E^B is concave in $\overline{c}$ and π_E^C is convex in $\overline{c}$, implying that, for all c, there exists $\tilde{\delta}$ such that for all δ less than $\tilde{\delta}$, $\pi_E^B > \pi_E^C$, while for all δ greater than $\tilde{\delta}$, $\pi_E^B < \pi_E^C$.

The first condition, $(p(Q), \delta) \in \xi$, is the condition for when exclusion would be profitable for the incumbent in the Cournot case even it had to sign every buyer to an exclusive. It ensures that $\epsilon^C < \epsilon^B$, because ϵ^C is always less than zero in that case, whereas ϵ^B is always greater than zero. The second condition, $\pi_E^B > \pi_E^C$, ensures that $\epsilon^C < \epsilon^B$ even when ϵ^C is greater than zero. This follows because $\alpha^C > \alpha^B$ for all $\delta < \overline{\delta}$ as shown in Proposition 2.

These conditions are sufficient, but they are by no means necessary. There are many instances, for example, in which $\pi_E^B < \pi_E^C$, but this does not imply that $\epsilon^C > \epsilon^B$, even when ϵ^C is greater than zero. Moreover, we can see from the last sentence in Proposition 3 that, for any given $p(Q)$, values of δ that are sufficiently low that $\pi_E^B > \pi_E^C$ no longer holds make it 'more likely' that these same values would fall in the region in which $(p(Q), \delta) \in \xi$ would hold. Nevertheless, Proposition 3 leaves open the possibility that there might be intermediate values of δ in which exclusion would be more likely to arise under Bertrand than under Cournot. To explore this further, we turn now to the case of linear demands.

3.2.1 Example with linear demands

Let $p(Q) = a - bQ$ and assume that $\delta \in (0, \overline{\delta})$. Assume also that $\varepsilon < \min\left\{\pi_E^C, \pi_E^B\right\}$ (so that entry is always profitable if there are no signed buyers). Then, profits under entry are

$$\pi_I^C = \frac{(a - 2\overline{c} + c)^2}{9b}, \;\; \pi_E^C = \frac{(a - 2c + \overline{c})^2}{9b},$$

in the case of Cournot competition, and

$$\pi_I^B = 0, \;\; \pi_E^B = \frac{(a - \overline{c})(\overline{c} - c)}{b}$$

in the case of Bertrand competition. Comparing profits in the two cases, we have that

$$\begin{array}{c} \pi_E^B \; - \; \pi_E^C \;\; > \;\; 0 \\ \Updownarrow \\ 9(a - \overline{c})(\overline{c} - c) \; - \; (a - 2c + \overline{c})^2 \;\; > \;\; 0. \end{array}$$

Or, in other words, π_E^B is greater than π_E^C if and only if the cost difference is such that $\delta > \frac{a-c}{5}$. Combining this result with our finding in (16) in Section 2.2.1, we have that condition (i) in Proposition 3 holds for all $\delta \leq \frac{a-c}{5}$, conditions (i) and (ii) in Proposition 3 hold for all $\frac{a-c}{5} < \delta < \frac{a-c}{3}$, and condition (ii) in Proposition 3 holds for all $\delta \geq \frac{a-c}{3}$. Remarkably, this implies that $\epsilon^C < \epsilon^B$ throughout the entire range of δ when the buyers' demands are linear.

Proposition 4. *(Multiple-buyer case) With linear demands, the threshold of fixed costs above which exclusion would be profitable is always lower under Cournot than under Bertrand.*

Proposition 4 implies that exclusion will be profitable for the incumbent over a wider range of fixed costs when the firms compete à la Cournot than when they compete à la Bertrand. There are settings in which anticompetitive exclusion would not be profitable regardless of the form that competition would take post-entry, settings in which anticompetitive exclusion would be profitable under both Cournot and Bertrand competition, and settings in which anticompetitive exclusion would be profitable under Cournot competition but not under Bertrand competition. But it cannot be the case that anticompetitive exclusion would be profitable under Bertrand competition but not under Cournot competition.

The three feasible regions are depicted in Figure 3 below. In the upper-most region, which corresponds to relatively high entry costs, we have that exclusion is privately profitable under both Cournot and Bertrand competition. For any given cost advantage δ, this region occurs for all feasible $\epsilon > \epsilon^B$. In the middle region, which is bounded above by the curve $\epsilon = \epsilon^B$ and below by the curve $\epsilon = \epsilon^C$, exclusion is privately profitable under Cournot competition but not under Bertrand competition. And lastly, in the region at the bottom-right, which is bounded above by the curve $\epsilon = \epsilon^C$, exclusion is never privately profitable.

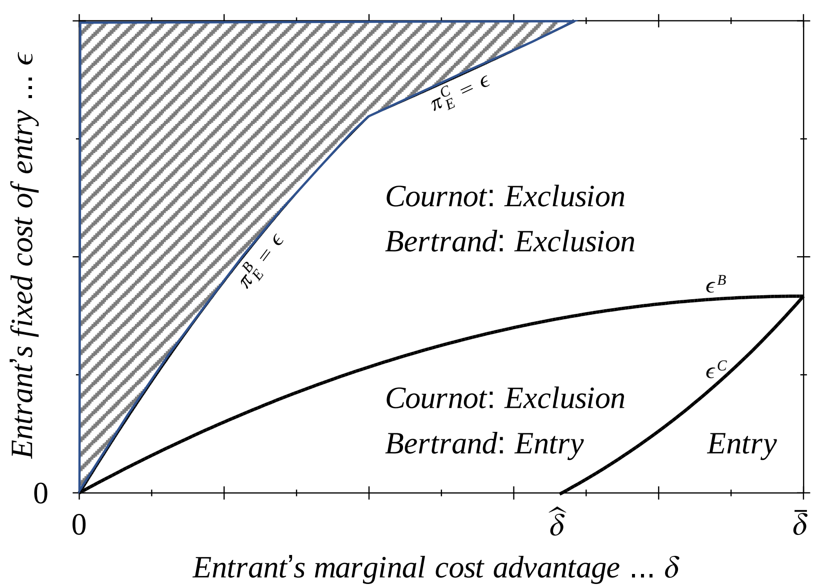

Figure 3

We can also see from Figure 3 that for arbitrarily small $\epsilon > 0$, exclusion is never privately profitable under Bertrand competition, but will be privately profitable under Cournot competition for all $\delta < \hat{\delta}$. For higher ϵ, exclusion may or may not be profitable, but if it is profitable, it will first become profitable for the incumbent when the firms would otherwise compete à la Cournot, and only later when the firms would otherwise compete à la Bertrand.

4 Conclusion

We have set out to show that exclusion will generally become easier for the incumbent when firms compete in quantities. We have shown this both for the case of a single buyer, and for the case of multiple buyers. The reason is that the ratio of the incumbent's gain from exclusion to the buyer's loss from exclusion is always higher in the Cournot case than it is in the Bertrand case. Importantly, there is also an additional term that appears in the incumbent's gain from exclusion in the Cournot case that is not a mere transfer from the buyer. Both effects strengthen the incumbent's incentives for exclusion all else being equal.

Our results thus contribute to the literature on exclusive dealing by showing that anti-competitive exclusion can indeed be privately profitable for the incumbent in the classic Chicago-school set-up, even in the single buyer case, even in the absence of rent-shifting motives, and even when the entrant has no economies of scale. They also suggest a new factor for courts and policymakers to consider – viz. the nature of the firms' competition post entry – when evaluating the potential profitability and welfare effects of exclusive contracts.

It should be noted that we have taken the form of post-entry competition as given. This may not be entirely innocuous. Although the incumbent might prefer to compete in quantities (as opposed to prices) all else equal, the entrant might not, especially if it would make exclusion more likely. At issue is whether we would expect post-entry competition to look more like a Bertrand game, or more like a Cournot game, and whether there are steps the firms might take to commit to one or the other outcome. Typically, one justifies Cournot competition as the outcome of a potentially more complicated multi-stage game in which capacity choices play an important role.[14] Although it is beyond the scope of the present paper, our results suggest that, all else equal, an entrant might do well to invest in additional capacity ex-ante so as to mitigate the effects of any capacity constraints ex-post. By doing so, it may be able to nudge the outcome closer to what we expect from price competition.

However, it should also be noted that beyond the transparent differences in the assumed post-entry competition, things are usually not so black and white. Instead, what really seems to matter for our results is the degree to which the incumbent's price would be bid down post-entry (e.g., would it be bid down to its marginal cost), and whether it would be able to

[14] Kreps and Scheinkman, 1983, were the first to offer this justification of Cournot competition.

make some sales at a positive mark-up. In suggesting that it would not, previous literature has taken, in our view, an extreme view of competition and perhaps relied too much on the assumption that the incumbent and entrant's goods are homogeneous. Relaxing this assumption (e.g., by allowing for some differentiation among the goods), while still assuming that firms compete in prices, might lead to similar results. We leave this for future research.

Appendix

Proof of Proposition 2: We need to show that $\alpha^C - \alpha^B > 0$ for all feasible δ. To this end, let the buyer's surplus at price $z > 0$ be denoted by $S^z := \int_z^\infty D(s)\,ds$, and define

$$\Phi(z) \;=\; \frac{(P^M - z)Q^M}{S^z - S^M}. \tag{A.1}$$

Then, it follows that for all $\delta < \overline{\delta}$,

$$\alpha^C - \alpha^B \;=\; \frac{\pi^M - \pi_I^C}{S^C - S^M} - \frac{\pi^M}{S^B - S^M} \tag{A.2}$$

$$\geq\; \frac{(P^M - P^C)Q^M}{S^C - S^M} - \frac{(P^M - \overline{c})Q^M}{S^B - S^M} \tag{A.3}$$

$$=\; \int_{\overline{c}}^{P^C} \frac{\partial \Phi(z)}{dz} dz. \tag{A.4}$$

Here, we can see that (A.4) is strictly positive given that $P^C > \overline{c}$ and

$$\frac{\partial \Phi(z)}{dz} \;=\; \frac{-(S^z - S^M)Q^M + (P^M - z)Q^M Q^z}{(S^z - S^M)^2} \tag{A.5}$$

$$=\; \frac{Q^M\left((P^M - z)Q^z - (S^z - S^M)\right)}{(S^z - S^M)^2},$$

which is positive, because $(S^z - S^M)^2 > 0$, $Q^M > 0$, and $(P^M - z)Q^z > (S^z - S^M)$.
Q.E.D.

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