Exclusionary Contracts under Asymmetric Information

(**work in progress**)

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Abstract

We extend the exclusionary model of Aghion and Bolton (1987) to a situation in which the incumbent has the option to choose from different type of contracts (e.g., exclusive dealing contracts, rebate contacts) and the retailer is better informed about demand. We show that the optimal strategy for the incumbent is to offer a menu of rebate contracts equipped with upfront payments, as opposed to menus of exclusive dealing contracts or of two/three part tariffs. Unlike in Aghion and Bolton (1987), in our model asymmetric information forces the incumbent to offer less exclusionary contracts, so much that sometimes some of them do not exclude at all (which happens when they do not include upfront payments). The incumbent still offers these non-exclusionary contracts to prevent inefficient entry. (JEL L42, K21, L12, D86)

1 Introduction

One of the most controversial issues in antitrust and competition policy is the potential exclusionary effects of exclusive deals, discount contracts (e.g., rebates), and related practices. This controversy dates back at least to United States v. United Shoe Machinery (1922) and Standard Fashion v. Magrane Houston (1922) and has remained very much alive since then, as illustrated by recent rulings in EU Commission v. Michelin II (2001) and AMD v. Intel (2005).

What makes these rulings controversial is that these practices can arise without an exclusionary motive and, more importantly, be efficient. Exclusivity, either de jure through explicit

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provisions or *de facto* through discount schemes, may foster relationship-specific investments between manufacturers and retailers by solving hold-up problems (Segal and Whinston 2000a) and encouraging retailers’ loyalty (Marvel 1982). Rebates may also be used in a bilateral monopoly setting to avoid the double marginalization problem when demand is known to both sides, and as a screening device when demand is only known to downstream retailers (Kolay, Ordover and Shaffer, 2004), or simply to induce retailer’s selling effort (Conlon and Mortimer 2014).¹

According to the so-called Chicago critique (Posner 1976; Bork 1978), these efficiency gains is all that matters when evaluating these contracts because a downstream retailer would never sign an exclusive contract that reduces competition unless it is fully compensated for it, which the incumbent manufacturer cannot afford when the entrant is more efficient. We know now that the Chicago critique fails to hold when a contract signed by two parties can have some form of externality onto a third party absent at the negotiation table (i.e., when the third party’s payoff is not fully internalized in the signing parties’ maximization problem). In the “rent-shifting” models of Aghion and Bolton (1987) and Choné & Linnemer (2014), among others, there is a “seller-side” externality that arises when the signing parties have imperfect information about the entrant’s cost. The incumbent supplier and the retail buyer set the terms of their contract with an eye on extracting rents from a potential entrant; but in the presence of imperfect information rent extraction is incomplete and exclusion of some efficient rival suppliers emerges as a side effect.

In this paper we extend the rent-shifting model of Aghion and Bolton (A&B) to a situation where the incumbent must negotiate the terms of the contract with a buyer that is better informed about demand; an environment also considered by Kolay et al., (2004) and Denicolo and Calzolari (2013). We are not the first to introduce asymmetric information to a rent shifting model. A&B also extend their model in a similar fashion, except that in their model the privately informed agent is the incumbent, who knows about the true probability of entry. Like us, they find that for the incumbent to communicate his private information in a credible way he must offer exclusives that depart from the contracts he would offer under symmetric information. What is most interesting, however, is the direction of the distortion. In A&B, the incumbent signals his type by offering more exclusionary contracts, that is, contracts with

¹Exclusives can also be the result of fierce competition among two or more incumbent suppliers when they need to screen consumers (Calzolari and Denicolo, 2013).
higher liquidated damages. In contrast, in our case, the incumbent separates buyers by offering less exclusionary rebates. At times, the distortion will be such that the incumbent will offer non-exclusionary rebates.

In any case, that non-exclusionary rebates may emerge in equilibrium is entirely consistent with A&B’s (p. 396) original insight that adding informational constraints to the negotiation table does not necessarily mean that parties will move towards more exclusionary contracts. This insight was eventually lost because their asymmetric information model actually predicted the exact opposite, a mistake noted years later by Ziss (1996). Obviously, the difference between the two models opens up the more general question as to how the exclusionary potential of alternative contractual arrangements varies across different informational settings.

The rest of the paper is organized as follows. In the next section we present a model that follows A&B very closely. In Section 3 we introduce asymmetric information. We conclude in Section 4.

2 The Model

2.1 Model assumptions

Consider a two-period model with three risk-neutral agents, a single buyer and two suppliers. Buyer $B$ demands one unit of an infinitely divisible good at reservation value $v$. Supplier $I$ is an incumbent firm that has unlimited capacity to produce the good at a constant marginal cost $c_I \in (0, v)$. Supplier $E$, on the other hand, is a small firm that can produce at most $\lambda \in (0, 1)$ units of the good at a marginal cost $c_E \leq c_I$. We can think of $E$ either as a small firm that is already in the market looking to expand in $\lambda$ units or as a potential entrant with capacity $\lambda$ that faces no entry costs. In either case, the literal interpretation of $\lambda$ is one of production capacity but an alternative and more relevant interpretation is one of contestable demand, that is, the “contestable share” of the market for which the buyer is willing and able to find substitutes (European Commission, 2009). The size of this contestable share is known to both $I$ and $B$.

Note that letting $\lambda \in (0, 1)$ is our only departure from the A&B original model where $\lambda = 1$. While assuming $\lambda < 1$ does not alter any of the A&B results, most antitrust cases are precisely about a smaller firm trying to acquire some or more market share ($\lambda \ll 1$). Nevertheless our analysis covers the entire range of possible values of $\lambda$, except for $\lambda = 1$ because by construction this would invalidate the use of rebates. For a rebate scheme to be operational the incumbent
must sell something in both states of the world, with and without entry/expansion.

At date 1, $I$ makes a take-it-or-leave-it contract offer to $B$ (the specific form of the offer is specified below). At this time $c_E$ is unknown to both $I$ and $B$ but it is common knowledge that it distributes according to the cdf $F(\cdot)$, over the interval $[0, v]$, where $F/f$ is non-decreasing and $(1 - F)/f$ is non-increasing. At date 2, and having observed the contract signed between $I$ and $B$, $E$ makes a take-it-or-leave-it price offer to $B$ for its $\lambda$ units. We assume that $E$’s offer does not lead $I$ and $B$ to renegotiate their contract, which would be the case if $B$ is the only one informed about $E$’s price offer (and $c_E$ is still unknown to $I$ and possibly, but not necessarily, to $B$). $B$ then decides how much to buy from each supplier according to the conditions established in the contract and $E$’s offer. If for any reason $I$ and $B$ fail to sign a contract at date 1, $I$ and $E$ compete in the spot market by simultaneously setting linear prices. $I$ learns $c_E$ right before the opening of the spot.

2.2 Outside options

When $I$ and $B$ fail to sign a contract at date 1, $B$ is served through the spot market where $I$ and $E$ engage in simultaneous uniform pricing.

Lemma 1. Let $\hat{c} \equiv c_I + (1 - \lambda)(v - c_I)$. The equilibrium of the spot subgame for any given $c_I$ and $c_E$ is characterized as follows

1. When $c_E \geq \hat{c}$, there is a pure-strategy Nash equilibrium with prices $p_I = p_E = c_E$ and payoffs equal to $\pi_I = c_E - c_I$, $\pi_E = 0$ and $\pi_B = v - c_E < \lambda(v - c_I)$.

2. When $c_E < \hat{c}$, there is a mixed-strategy equilibrium with both firms randomizing over the support $[\hat{c}, v]$ and expected payoffs equal to $\pi_I^* = (1 - \lambda)(v - c_I)$, $\pi_E^* = \lambda(\hat{c} - c_E)$, and $\pi_B^* = \lambda(v - c_I) - \Gamma(c_E)$, where $\Gamma(c_E) > 0$ for all $c_E \in [0, \hat{c}]$.

Proof. See the Appendix.

Consistent with Kreps and Scheinkman (1983), the firm that faces no capacity constraints obtains at least its residual monopoly profit, that is, $(1 - \lambda)(v - c_I)$. And like others imperfectly
competitive spot markets (e.g., Mankiw and Whinston, 1986; Jeon and Menicucci, 2012; etc),
the spot here suffers from production inefficiencies unless the entrant’s cost is sufficiently high
or $\lambda = 1$. With positive probability $E$ will sell its $\lambda < 1$ units despite having a higher cost
($c_I < c_E \leq \hat{c}$) or sell nothing despite having a lower cost ($c_E < c_I$). Accounting for the possible
realizations of $c_E$, the payoffs in Lemma 1 serve to compute $I$ and $B$’s expected (outside) payoffs at
date 1 in case a contract is not signed.

**Lemma 2.** In the absence of a contract, $I$ and $B$ outside options, denoted, respectively, by $\bar{\pi}_I$
and $\bar{\pi}_B$, are equal to

$$
\bar{\pi}_I = (1 - \lambda)(v - c_I) + [1 - F(\hat{c})] \{\mathbb{E}(c_E \mid c_E > \hat{c}) - \hat{c}\}
$$
$$
\bar{\pi}_B = \lambda(v - c_I) - F(\hat{c})\mathbb{E}[\Gamma(c_E) \mid c_E \leq \hat{c}] - [1 - F(\hat{c})] \{\mathbb{E}(c_E \mid c_E > \hat{c}) - \hat{c}\}
$$

which add to

$$
\bar{\pi}_I + \bar{\pi}_B \equiv \bar{W} = v - c_I - F(\hat{c})\mathbb{E}[\Gamma(c_E) \mid c_E \leq \hat{c}] < v - c_I
$$

**Proof.** Immediate from Lemma 1.

The last expression in the lemma tells us that the spot market inefficiency documented in
Lemma 1 can affect the negotiation between $I$ and $B$ in a fundamental way. If $I$ and $B$ fail
to sign a contract their overall payoff, $\bar{W}$, is strictly less than the payoff in the absence of
entry/expansion, which is $v - c_I$. Therefore, just preventing these coalition losses —equal to
$\mathbb{E}[\Gamma(c_E) \mid c_E \leq \hat{c}]$ times the probability $E$ may sell in the spot— should be enough reason for
$I$ and $B$ to sign a contract that at the very least blocks $E$ from trading with $B$.5

### 2.3 Rebate and exclusive dealing contracts

We will present two common contracts found in the literature and in real life. Consider first the
all-unit retroactive rebate contract $(r, R, \bar{Q})$, where $r$ is the list price, $\bar{Q}$ is a pre-specified sales
threshold above which the rebate applies, and $R$ is a percentage discount off list price applied
to all units provided $\bar{Q}$ has been reached. Under this contractual arrangement $B$ faces price $r$
when purchasing $q \in (0, \bar{Q})$ units from $I$ and $r - R$ when purchasing above that amount. In
this unit demand case, it is easy to see that $I$ will set $\bar{Q} = 1$ in order to maximize (expected)

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5 There may be other inefficiencies when trading in the spot (e.g., higher transaction costs, agency costs, buyer
switching costs, etc) or inefficiencies may vary depending on the spot clearing mechanism. We come back to
these issues later in the section.
rent extraction.⁶

If \( B \) signs the contract, \( E \) can still induce \( B \) to buy \( \lambda \) units from him if she is compensated for the forgone rebate. For that to be the case, \( E \)'s price offer \( x \) must satisfy

\[ v - (1 - \lambda)r - \lambda x \geq v - r + R \]

or \( x \leq r - R/\lambda \). If \( E \) decides to expand/enter it will offer exactly \( x = r - R/\lambda \), which sets the probability of entry at date 1 equal to \( F(r - R/\lambda) \).

The cutoff price \( x = r - R/\lambda \), sometimes known as the effective price for the contestable demand, represents the opportunity cost the buyer faces when purchasing from an alternative supplier. This price differs from \( r - R \) because \( \lambda < 1 \), which is what allows \( I \) to leverage his position. Since \( I \) will make sure that \( B \) buys at least \( 1 - \lambda \) units from him, \( B \) will end up paying \( r - R \) regardless of entry; hence, \( I \)'s rebate program can be written as

\[
\max_{r,R} E\pi_I(r, R) = (1 - \lambda)(r - c_I)F(r - R/\lambda) + (r - R - c_I) [1 - F(r - R/\lambda)]
\]

subject to \( v - r + R \geq \bar{x} \). The first term is the profit from selling \( 1 - \lambda \) units at price \( r \), which happens when there is entry and the rebate \( R \) is not granted, and the second term is the profit from selling all the units at price \( r - R \), which happens with probability \( 1 - F(r - R/\lambda) \).

Before solving the rebates program consider now an A&B exclusive dealing contract. An exclusive contract is composed of a wholesale price \( w \) at which \( B \) is free to buy as many units she likes and a penalty \( L \) that \( B \) pays \( I \) in case she breaches the exclusivity provision and buys from \( E \) (\( L \) stands for liquidated damages).⁷ Similar to a rebate contract, the effective price faced a potential entrant is \( w - L/\lambda \); and since \( B \) pays \( w \) for each unit regardless of entry, the A&B program reduces to

\[
\max_{w,L} E\pi_I(w, L) = [(1 - \lambda)(w - c_I) + L] F(w - L/\lambda) + (w - c_I) [1 - F(w - L/\lambda)]
\]

subject to \( v - w \geq \bar{x} \). In the case of entry, which happens with probability \( F(w - L/\lambda) \), \( I \) sells \( 1 - \lambda \) units at price \( w \) and gets compensated in \( L \) for the \( \lambda \) units \( B \) buys elsewhere; otherwise

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⁶In Section 4 we formally show that \( I \) cannot improve upon these two-step price schedules.

⁷As also noticed by Calzolari and Denicolo (2013), a seller can easily observe whether or not a buyer has purchased from an alternative supplier but not the exact quantity. Even if this quantity is observed, it would still be hard to be verified in court. Consequently, the incumbent relies on lump-sum penalties as opposed to unit penalties.
he is the only one selling at price \( w \).

Looking at (1) and (2) it appears that the rebates and exclusives work similarly in that both impose a penalty upon the buyer when switching supplier. In A&B the penalty is \( L \) while under the rebate contract it is the price increase from \( r - R \) to \( r \).\(^8\) This connection can be seen more formally by just relabeling \( w \) as \( r - R \) and \( L \) as \( (1 - \lambda)R \).\(^9\) The solution to both of these programs is the well known A&B exclusionary outcome

\[
\begin{align*}
    r^o - \frac{R^o}{\lambda} = w^o - \frac{L^o}{\lambda} = \tilde{c}_E \equiv c_I - \frac{F(\tilde{c}_E)}{f(\tilde{c}_E)}
\end{align*}
\]

(the rest of the solution is obtained from \( B \)'s ex-ante participation constraint holding with equality). It is clear that \( \tilde{c}_E < c_I \) and straightforward to verify that \( E \pi^o_I > \pi_I \) and \( w^o = r^o - R^o > c_I \). As first shown by A&B, these contracts are not only profitable for both \( I \) and \( B \) to sign, but they have anticompetitive implications in that they block the entry/expansion of some efficient rivals, those with costs \( c_E \in [\tilde{c}_E, c_I] \).

In principle rebates and exclusives appear to achieve the same exclusionary outcome, yet, they operate quite differently. In an exclusive contract the transfer of rents from \( E \) to \( I \) is done directly through the payment of liquidated damages while in a rebate contract is done indirectly by charging a high price for the \( 1 - \lambda \) inframarginal units \( B \) has no option but to buy from \( I \).

Facing this constraint, a discount contract appear as an alternative and effective exclusionary tool. There is however another fundamental difference between rebates and exclusives. Unlike exclusives, rebates are not equipped with an ex-ante commitment to transfer rents from \( B \) to \( I \) (in A&B, \( B \) agrees at date 1 to transfer the penalty \( L \) paid by \( E \) to \( I \), in the event of entry). A rebate contract only specifies a price schedule to the buyer, which by definition makes it easier to terminate —using the terminology brought up in *Allied Orthopedic v. Tyco*. Furthermore, this “easy terminability” of a rebate contract implies that \( B \)'s purchasing and trading decisions occur ex-post, at date 2. This subtle but crucial difference imposes an additional participation constraint on the buyer side. At date 2, \( B \) will not be purchasing units in equilibrium at prices above its reservation price \( v \), from either supplier. Since this requires \( r \leq v \), it can be established

\( ^8 \)Note that if \( \lambda = 1 \) the “penalty” still carries through under the A&B contract but not under the rebate contract, which is why we impose \( \lambda < 1 \).

\( ^9 \)Note that this apparent equivalence also extends to other discount contracts, namely, two-part tariffs, which are composed of a wholesale price \( p \) and a fixed payment \( T \). The connection between rebates and two-part tariffs is immediate: both schemes charge a low price for the \( \lambda \) contestable units, \( r - R/\lambda = p \), and a high price for the \( 1 - \lambda \) infra-marginal units, \( r = p + T/(1 - \lambda) \). We will come back to this connection at end of the section.
Lemma 3. The solution to the “unrestricted” rebate program (1), as shown in (3), violates the buyer’s ex-post participation constraint, i.e., $r^o > v$.

Proof. From the relabeling of variables in programs (1) and (2) and using $\bar{\pi}_B = v - w^o$ and $L^o = \lambda(w^o - \tilde{c}_E)$, this yields

$$r^o - v = \frac{L^o}{\lambda(1 - \lambda)} + \tilde{c}_E - v = \left(\frac{1}{1 - \lambda}\right) [\lambda(v - \tilde{c}_E) - \bar{\pi}_B]$$

But from Lemma 2 we know that $\bar{\pi}_B < \lambda(v - c_I)$, therefore

$$r^o - v > \left(\frac{1}{1 - \lambda}\right) [\lambda(v - \tilde{c}_E) - \lambda(v - c_I)] = \left(\frac{\lambda}{1 - \lambda}\right) (c_I - \tilde{c}_E) > 0$$

which finishes the proof.$\blacksquare$

The rebate $(r^o, R^o)$ does not allow for both optimal rent extraction and rent distribution because $B$’ ex-post individual rationality constraint is indeed binding. This would not be a problem had $B$ committed ex-ante to the transfer of the exclusionary rents ex-post. Thus, moving away from the optimal but unfeasible rebate $(r^o, R^o)$ brings up two important questions: would rebates of the from $(r \leq v, R)$ still be profitable for the incumbent to sign relative to sign nothing? and would those rebates still be anticompetitive?

Adding $B$’s ex-post participation constraint to the rebate program (1) provides answers to these questions.

Proposition 1. A rebate contract $(r \leq v, R)$ cannot be anticompetitive, i.e., $r - R/\lambda > c_I$.

Proof. For $I$ to offer the rebate contract $(r, R)$, it must be true that $E\pi_I(r, R) \geq \bar{\pi}_I$. Using $x = r - R/\lambda$ to replace $R = \lambda(r - x)$ in the expected payoff $E\pi_I(r, R)$ in (1), we obtain that condition $E\pi_I(r, R) - \bar{\pi}_I \geq 0$ is equivalent to

$$[(r - c_I)(1 - \lambda) - \bar{\pi}_I] + \lambda(x - c_I)[1 - F(x)] \geq 0 \quad (4)$$

But we know that $I$ cannot receive less than his residual monopoly profit, $\bar{\pi}_I \geq (1 - \lambda)(v - c_I)$, and that $B$ always buys something from $I$, $r \leq v$, so $(r - c_I)(1 - \lambda) - \bar{\pi}_I \leq 0$, which requires that the second term in (4) be non-negative, that is

$$\lambda(x - c_I)[1 - F(x)] \geq 0$$
And since \( F(x) < 1 \), we have that \( x \geq c_I \). ●

Furthermore,

**Proposition 2.** If \( \hat{\pi}_I + \hat{\pi}_B < v - c_I \), then there exists some effective price \( \hat{x} \in (c_I, v) \) such that all rebate contracts \((r \leq v, R)\) with \( r - R/\lambda < \hat{x} \) are profitable relative to signing nothing.

**Proof.** A contract \((r \leq v, R)\) is said to be profitable and feasible if it satisfies \( E\pi_I \geq \hat{\pi}_I \) and \( E\pi_B \geq \hat{\pi}_B \). Using \( x = r - R/\lambda \) to express the contract in terms of \( r \) and \( x \) (a notation we will use extensively in the next section), the two participation constraints can be rewritten as

\[
E\pi_I(r, x) = (1 - \lambda)(r - c_I) + \lambda(x - c_I)[1 - F(x)] \geq \hat{\pi}_I \quad (5)
\]

\[
E\pi_B(r, x) = v - r + \lambda(r - x) \geq \hat{\pi}_B \quad (6)
\]

The incumbent’s overall profit can be split between his secured payoff, \((1 - \lambda)(r - c_I)\), and the additional payoff for the remaining \( \lambda \) units, \( \lambda(x - c_I) \), in the event of no entry, which happens with probability \( 1 - F(x) \). Given \( r \leq v \), it is optimal for the incumbent to set \( r = v \). Replacing this together with \( \lambda(v - x) = \pi_B \) in (5) leads to

\[
v - c_I - \lambda(x - c_I)F(x) \geq \hat{\pi}_I + \hat{\pi}_B
\]

which reaches its maximum at \( x = \hat{x}_E < c_I \), as shown in (3), and is decreasing in \( x \) (recall that \( F/F \) is non-decreasing). Therefore, if \( \hat{\pi}_I + \hat{\pi}_B < v - c_I \) there must exist some \( \hat{x} \in (c_I, v) \) where \( E\pi_I(\hat{x}) = \pi_I + \pi_B \). ●

Propositions 1 and 2 convey two important messages: Rebates of the form \((r, R)\) are never anticompetitive, yet, they are profitable (below we ask whether or not they arise in equilibrium). There is however a simply way, ast least in theory, for a rebate contract to replicate an exclusive dealing contract: to include upfront payments as we discuss next.

### 2.4 Upfront payments in rebate contracts

Consider now a more complete rebate contract of the form \((r, R, Z)\), where \( Z \) is an upfront transfer from the \( B \) to \( I \) that is executed at date 1 and independent of whether \( B \) buys or not from \( I \) at date 2.\(^{10}\) An upfront payment solves \( B \)'s commitment problem by reducing the amount she needs to transfer expost to what is individually rational \((r \leq v)\).

\(^{10}\)A&B provides some examples on the use of upfront payments, see for example *Automatic Radio Manufacturing Co. v. Hazeltine Research Inc.* (1950). We are not aware of upfront transfers in rebate contracts between
In fact, there are many ways now to design the rebate \((r, R, Z)\) to replicate the A&B exclusionary outcome (3). One option is to set \(r = v, r - R/\lambda = \tilde{c}_E, \) and \(Z = \lambda(v - \tilde{c}_E) - \tilde{\pi}_B > 0\). An equally effective option is to make the rebate contract looks exactly like a two-part tariffs by setting \(R = 0, r = \tilde{c}_E, \) and \(Z = v - \tilde{c}_E - \tilde{\pi}_B\). While it is true that adding a positive discount, \(R > 0\), does not report extra benefits over a two-part tariffs, this is not always the case. In the next section it will be optimal for \(I\) to use a strictly positive discount, which places the two instruments apart. Since rebates are never inferior, and possibly superior, to two-part tariffs, from now on we can focus with no loss of generality on discount contracts of the form \((r, R, Z)\).

It is clear that for rebates to replicate exclusives in an A&B world we must observe upfront transfers. Interestingly, when discussing the Standard Fashion v. Magrane-Houston case, Marvel (1982) points to the emergence of upfront payments together with lower marginal prices following the outlaw of exclusivity contracts as evidence against any anticompetitive implications these exclusivity clauses might have had in the first place. What we have seen here points otherwise.

However, the introduction of upfront payments is not without cost for \(I\). As we will study next, there are many situations in which \(I\) and \(B\) must negotiate the terms of the rebate \((r, R, Z)\) under asymmetric information; for example, when \(B\) is better informed about demand. While the introduction of upfront payments allows \(I\) to restore optimal exclusion, it inevitably makes it more difficult for \(I\) to separate buyers as they all go after those rebates with the lowest upfront payments. At times, this separation effect will be large enough that \(I\) will find it optimal to offer non-exclusionary rebates.

### 3 Asymmetric information about demand

In many cases retailers are better informed about demand than manufactures (e.g., Kolay et al., 2004; Calzolari and Denicolo, 2013), so \(I\) must take into account additional informational constraints when negotiating with \(B\). Besides uncertainty about \(c_E\), \(I\) now faces an adverse selection problem.

We extend our model in the simplest possible way by borrowing from the asymmetric suppliers and retailers; for instance, they are not documented in FNE (2013) nor in Conlon and Mortimer (2014). Notice that slotting allowance do not qualify as upfront payments in our context because they are transfers from manufacturers to retailers. Unlike in Marx and Shafer (2007), slotting allowances are not strictly needed here (although they may arise in equilibrium, see Section 3.4) because our problem is exactly the opposite, the transferring of rents from retailers to manufacturers.
information model in Bolton and Dewatripont (2005, pp. 228-32). Thus,

$$\text{Demand} = \begin{cases} 
1 + \theta & \text{with probability } \rho_i \\
1 & \text{with probability } 1 - \rho_i
\end{cases}$$  \hspace{1cm} (7)$$

where \( \rho_i \) captures the sales environment \( B \) is in, which will often refer to as \( B \)'s type. The sales environment can take two values, i.e., \( \rho_i \in \{\rho_L, \rho_H\} \) with \( \rho_H > \rho_L \). \( I \) does not know \( B \)'s true type, it only has a prior that with probability \( \mu \) is high (\( \rho = \rho_H \)) and with probability \( 1 - \mu \) is low (\( \rho = \rho_L \)). To simplify things further, we will normalize \( \rho_L \) to zero.\(^{11}\)

Timing is as in Section 2 except for the lapse of time between dates 1 and 2 where \( B \) learns about the true demand before \( E \) makes his offer. Here we take the “contestable share” interpretation of \( \lambda \) in that \( E \) can sell up to \( \lambda(1 + \theta) \) units when total demand is high and up to \( \lambda \) units when total demand is low. Given this demand uncertainty, \( I \) will consider rebates contracts of the form \((r, R, Z)\) with \( R \) as a percentage discount off list price applied to all units provided that \( B \) has purchased exclusively from him. Furthermore, when \( R \) is a percentage discount, we can just pay attention, with no loss of generality, to contracts of the form \((r, x, Z)\), where \( x = r - R/\lambda \) is the effective price faced by \( E \).

\( I \)'s problem then is to offer a menu of contracts \((r_i, x_i, Z_i)\) to maximize his expected payoff subject to participation and informational constraints. In his negotiation with \( B \), \( I \) will look for ways to induce \( B \) to communicate truthfully the information she has. This explains why we often see sellers present buyers not a single option but a menu of options to choose from. \( I \)'s challenge is to fashion a menu of contracts that separate buyers at a minimum cost.

We are not the first to introduce asymmetric information to a rent shifting model. A&B also extend their model in a similar fashion, except that in their model the privately informed agent is \( I \), who knows about the true probability of entry. Like us, they find that for \( I \) to communicate his private information in a credible way he must offer exclusives that depart from the contracts he would offer under symmetric information. What is most interesting, however, is the direction of the distortion. In A&B, \( I \) signals his type by offering more exclusionary contracts, that is, contracts with higher liquidated damages. In contrast, in our case, \( I \) separates buyers by offering

\(^{11}\) As illustrated by Bolton and Dewatripont (2005), this model is flexible enough to accommodate to richer settings. For example \( \rho_i \) can be made equal to \( c\beta_i \), where \( \beta_i \) is \( B \)'s ability to influence demand when she is of type \( i \) and exerts an amount \( c \) of non-observable effort at private cost \( \psi(c) \). The conclusions derived from this richer model and the simpler model we present here are essentially the same (see the Online Appendix). The simpler model has an additional advantage, however: the only reason for \( I \) to offer rebates is the entry threat, otherwise he would approach \( B \) with a linear price equal to \( v \) (just like in the model in Section 2).
less exclusionary rebates. At times, the distortion will be such that \( I \) will offer non-exclusionary rebates.

### 3.1 Outside options and symmetric information

Before finding the menu of rebates that \( I \) will offer in equilibrium, we present two extreme outcomes that serve as benchmarks. One is when \( I \) and \( B \) do not sign a contract and trade in the spot market along with \( E \). In that case, parties’ expected payoffs at date 1 (outside options) depend on how much they know about \( B \)’s type:

\[
\bar{\pi}_B^H = (1 + \theta \rho_H)\bar{\pi}_B, \quad \bar{\pi}_B^L = \bar{\pi}_B, \quad \bar{\pi}_I^H = (1 + \mu \rho_H)\bar{\pi}_I, \quad \text{where } \bar{\pi}_B \text{ and } \bar{\pi}_I \text{ are parties’ outside options in the unit demand case (see Lemma 2).}
\]

The other extreme is when \( I \) can offer rebates under symmetric information, i.e., when he can tell buyers apart. The contract he will offer to buyer \( i \) is obtained from the program

\[
\max_{\rho_i, x_i, Z_i} \mathbb{E}[\pi_i^j] = (1 + \theta \rho_i)[(1 - \lambda)(r_i - c_I) + \lambda(x_i - c_I)\{1 - F(x_i)\}] + Z_i
\]

subject to \( r_i \leq v \), and \( B \)’s ex-ante participation constraint, i.e., \((1 + \theta \rho_i)A_i - Z_i \geq \bar{\pi}_B^j\), where

\[
A_i \equiv v - r_i + R_i = v - (1 - \lambda)r_i - \lambda x_i
\]

is \( B \)’s ex-post profit per-unit of demand under contract \( i \), which must be strictly positive for \( B \) to actually purchase from \( I \) at date 2.

Since the ex-ante participation constraint must be binding at the optimum, (8) can be expressed as

\[
\max_{r_i, x_i} \mathbb{E}[\pi_i^j] = (1 + \theta \rho_i)[v - c_I + \lambda(c_I - x_i)F(x_i)] - \bar{\pi}_B^j
\]

which leads to the following proposition:

**Proposition 3.** Under symmetric information \( I \) implements his first-best (i.e., the A\&B exclusionary outcome) with the rebate \((r_i^*, x_i^*, Z_i^*)\), where \( x_i^* = \tilde{c}_E, \quad r_i^* \in [\tilde{c}_E, v] \) and \( Z_i^* = (1 + \theta \rho_i)[v - (1 - \lambda)r_i^* - \lambda x_i^* - \bar{\pi}_B^j] \).

**Proof.** Immediate from above. □

As explained above, the introduction of upfront payments provides \( I \) with flexibility to move payments from date 2 to date 1 and vice versa while still implementing the first-best. Upfront payments can vary from a low level of \( Z_i^1 = (1 + \theta \rho_i)[\lambda(v - \tilde{c}_E) - \bar{\pi}_B] > 0 \) in the rebate \((v, \tilde{c}_E, Z_i^*)\)
to a high level of \( \bar{Z}_t^* = (1 + \theta \rho_t) [v - \hat{c}_E - \hat{\pi}_B] > 0 \) in the rebate \((\hat{c}_E, \hat{c}_E, \bar{Z}_t^*)\). This latter contract entails \( R^* = 0 \), which makes it a 2PT contract, confirming the equivalence of these two price arrangements under symmetric information. Rebates are nevertheless more flexible, a benefit that under asymmetric information does make a difference, as we will see next.\(^{12}\)

### 3.2 The cost of upfront payments

Consider now the most likely situation in which \( I \) cannot tell buyers apart. To get a hand on the problem, ask what would happen if \( I \) presents \( B \) with a menu of first-best rebates of Proposition 3; for example, the menu \((v, \hat{c}_E, \bar{Z}_t^*)\)? It is evident that regardless of her type, \( B \) will take the contract with the lowest upfront payment, that is, the one designed for the low type.\(^{13}\)

It appears at first that \( I \) has no choice but to distort the first-best menu \((r_i^*, x_i^*, \bar{Z}_t^*)\). Before doing that, however, it is worth asking if there is anything \( I \) can change in these rebate contracts so as to prevent buyers from mimicking each other. In their signaling problem, A&B show that \( I \) could in fact implement the first-best if he could extend the exclusive contracts to include list prices contingent on entry. They argue, however, that these contingent prices suffer from serious monitoring and enforcement problems (e.g., one of the two parties may “bribe” someone to enter) making their use unfeasible. Hence, in their model \( I \) has no choice but to distort the exclusives in order to signal his type in a credible way.

In our problem, there is also a way in which \( I \) could separate buyers while offering a first-best menu. Imagine again a menu of the form \((v, \hat{c}_E, \bar{Z}_t^*, Y_i)\) where \( Y \) is the maximum quantity that \( B \) can buy from \( I \), under the contract and otherwise. By setting \( Y_L = 1 \) and \( Y_H \) free, it can be shown that for at least small \( \lambda \)'s the high type is strictly better off taking the contract designed for her, say, the high-type contract. There are three reasons why these quantity limits are problematic. One is that we never see infinite marginal prices in practice; if anything, we see rebate contracts with marginal prices decreasing in sales. The second reason is that for larger \( \lambda \)'s is not clear if the high-type is still strictly better off taking the high-type contract. If demand happens to be \( 1 + \theta \), she can always by-pass the limit \( Y_L = 1 \) purchasing from \( E \) (although it is not clear the price \( B \) would pay \( E \) as it will depend on \( \theta \) and \( \lambda \)). But perhaps

\(^{12}\)It should be clear by now that A&B contracts, even if they do not face legal restrictions, are inferior to both 2PT and rebates as they fail to exclude optimally for different realizations of demand.

\(^{13}\)There is no loss of generality in focusing on \((v, \hat{c}_E, \bar{Z}_t)\) contracts for now. Below we formally show that it is always the high type who wants to mimic the low type and not vice versa.
the most important reason is that these quantity limits are time inconsistent. If \( B \) goes to the spot market to buy additional units, \( I \) will not resist but to compete with \( E \) in the spot for these units. This destroys any bite these limits can have reducing \( I \)'s problem to the choice of price schedules of the form \((r_i, x_i, Z_i)\).

If \( I \) is forced to move away from the contracts in Proposition 3, he will do so at the minimum cost by solving the program

\[
\max_{\{r_i, x_i, Z_i\}_{i=L,H}} \mathbb{E} \pi_I = \mu[(1 + \theta_H) \{(1 - \lambda)(r_H - c_I) + \lambda(x_H - c_I) \{1 - F(x_H)\}\} + Z_H] + (1 - \mu)\{(1 - \lambda)(r_L - c_I) + \lambda(x_L - c_I) \{1 - F(x_L)\} + Z_L\}
\]

subject to \( r_L, r_H \leq v \) and the following ex-ante participation and incentive compatibility constraints

\[
\begin{align*}
[IR_H] & \quad (1 + \theta_H) A_H - Z_H \geq \bar{\pi}^H_B \\
[IR_L] & \quad A_L - Z_L \geq \bar{\pi}^L_B \\
[IC_H] & \quad (1 + \theta_H) A_H - Z_H \geq (1 + \theta_H) A_L - Z_L \\
[IC_L] & \quad A_L - Z_L \geq A_H - Z_H
\end{align*}
\]

Given that there is a wide range of rebates that implement the first-best for each type (see Proposition 3), it is not immediately obvious who is going to mimic who for any pair of first-best contracts that \( I \) may offer, or more generally, whether the sorting of buyers is truly an issue for \( I \). It is easy to see for types not too different that \( I \) could well offer a pair of first-best rebates so that \( Z^*_L > Z^*_H \) (together with \( r^*_H = v \) and \( r^*_L = \hat{c}_E \)). However, when evaluating the incentive compatibility constraints for any pair of first-best contracts we obtain that

\[
\begin{align*}
[IC_H] & \quad r^*_L \geq \frac{v - \lambda \hat{c}_E - \bar{\pi}_B}{1 - \lambda} \\
[IC_L] & \quad r^*_H \leq \frac{v - \lambda \hat{c}_E - \bar{\pi}_B}{1 - \lambda}
\end{align*}
\]

which indicates that the first-best is not implementable as the \( IC_H \) requires \( r^*_L > v \) (see Lemma 3). The introduction of upfront payments allows \( I \) to implement the A&B outcome but it is precisely the introduction of these payments, in any of the formats of Proposition 3, what complicates the separation of buyers. The high type always takes the (first-best) contract of
the low type.

Before characterizing the (second-best) rebates menu, note that the 2PT contract \( (p = \tilde{c}_E, T = Z_i^*) \) — rebate of the form \( (\tilde{c}_E, \tilde{c}_E, Z_i^*) \) — suffer from a more acute separation problem. Under rebates, \( I \) can alleviate (not satisfy) the \( IC_H \) constraint by setting \( r_L \) equal to \( v \) before start giving up some surplus; under 2PT’s, the marginal price \( p \) cannot be risen above \( \tilde{c}_E \) without giving up surplus right away.

### 3.3 The second-best menu

We are now ready to solve \( I \)'s program (10), which is quite standard except perhaps for the fact that outside options are type dependent \( (\bar{v}_B > \bar{v}_B) \). As in Jullien (2000), for instance, this can have implications for information rents going to the high type (as we will see shortly, they may completely vanish for high values of \( \theta \)). In any case, we can still invoke the second-best optimality principle (e.g., Bolton and Dewatripont 2005) that at the optimum both \( IC_L \) and \( IR_L \) must be binding, which leads to the simpler program (the \( IC_L \) can be neglected as we saw above)

\[
\max_{(r, x)} \mathbb{E} \pi = \mu [ (1 + \theta \rho_H) [v - c_r + \lambda(c_L - x_H)F(x_H)] - \theta \rho_H A_L - \bar{\pi}_B ] \\
+ (1 - \mu) [v - c_r + \lambda(c_L - x_L)F(x_L)] - \bar{\pi}_B]
\]

The first thing to notice is that the second-best price \( r_H^* \) does not show up in the objective function, so it can be set freely as long as it does not violate the \( IC_L \) constraint. On the other hand, comparing (13) to (9) it is immediate that the effective price for the high type is the one in Proposition 3, i.e., \( x_H^* = x_H^* = \tilde{c}_E \), which is consistent with the usual no-distortion-at-the-top condition. Yet, the high type gets some informational rents to prevent her from mimicking the low type. Comparing again (13) to (9), these rents amount to the difference between what \( B \) gets under the second-best contract, \( \bar{\pi}_B + \theta \rho_H A_L \), and the first-best contract, \( \bar{\pi}_B \), that for any given \( \theta \) are equal to

\[
I(\theta) = \theta \rho_H [v - (1 - \lambda) r_L^* - \lambda x_L^* - \bar{\pi}_B] \geq 0
\]

where \( r_L^* \) and \( x_L^* \) are the second-best prices of the low-type contract.

The effect of \( r_L^* \) and \( x_L^* \) on \( I(\theta) \) tells us a great deal about the best way for \( I \) to separate the buyers. If anything, \( I \) would like to set both \( x_L^* \) and \( r_L^* \) above first-best levels. Since any increase in \( r_L \) reduces \( A_L \) in (13), it is optimal to set \( r_L^* = v \). As for \( x_L \), we have the first-order
condition

\[ \mu \theta \lambda \rho_H + (1 - \mu)[f(x_L)(c_I - x_L) - F(x_L)] = 0 \]  \hspace{1cm} (15) 

that yields \( x_{L}^{**} > \bar{c}_E \) (and increasing in \( \theta \)). Finally, the upfront payment is obtained directly by setting the \( IR_L \) condition to equality

\[ Z_{L}^{**} = \lambda(v - x_{L}^{**}) - \bar{\pi}_B \geq 0 \]  \hspace{1cm} (16)

To gain intuition as to why \( I \) separates the two buyers by offering less exclusionary contracts to the low type (i.e., \( x_{L}^{**} > \bar{c}_E \)), go back to the \( IC_H \) condition in program (10). Lowering the per-unit profit \( A_L \) together with the upfront payment \( Z_L \), so as to keep \( Z_L \) equal to \( A_L + \bar{\pi}_B \), is an effective tool to discourage the high type from mimicking the low type because the high type is anticipating a higher demand (this is captured by the term \( \theta \rho_H \) multiplying \( A_L \)). \( I \) can lower \( A_L \) by either increasing the list price \( r_L \), the effective price \( x_L \), or both. \( I \) would like to exclusively rely on \( r_L \) because any increase in \( x_L \) above \( \bar{c}_E \) destroys coalitional surplus. The problem for \( I \) is that \( B \)'s ex-post participation (\( r \leq v \)) prevents him from doing just that, so he has no choice but to move to less exclusionary contracts.

Our analysis so far indicates that when buyers are not that different (i.e., when \( \theta \) is small), \( I \) will offer a menu of two exclusionary contracts equipped with upfront payments. The interesting question for our analysis, however, is how the menu of contracts evolves as asymmetric information becomes truly relevant, that is, when the two potential buyers are sufficiently different. In the signaling model of A&B, for example, only one contract is offered in equilibrium when the costs of the two possible incumbents are sufficiently apart. In such a case, the high-cost incumbent offers the A&B exclusive contract while the low cost goes directly to the spot. Our result is also different in this regard in that \( I \) may always find it optimal to offer the menu even as we let \( \theta \to \infty \).

As usual in models of asymmetric information, one expects informational rents to be increasing in types heterogeneity (here in \( \theta \)) because separation becomes increasingly difficult for the principal. This is not immediately obvious in our model because both \( x_{L}^{**} \) and the outside option \( \bar{\pi}_B \) are also increasing in \( \theta \). In fact, information rents are not monotonic in \( \theta \), similar to the problem in Jullien (2000). From (14), it is clear that \( I(\theta) = \theta \rho_H[\lambda(v - x_{L}^{**}) - \bar{\pi}_B] = 0 \) when \( \theta = 0 \) and positive when \( \lambda(v - x_{L}^{**}) - \bar{\pi}_B > 0 \). Above some \( \theta \), however, these rents start
decreasing and totally disappear at $\hat{\theta}$, which is implicitly given by

$$x_L^{**}(\hat{\theta}) = v - \frac{\bar{\pi} B}{\lambda} > c_l$$  \hspace{1cm} (17)

where $x_L^{**}(\theta)$ is the solution to (15) for any given value of $\theta < \hat{\theta}$.

Expression (17) leads to three important observations. The first is that the upfront payment to the low type, $Z_L^{**}$, also vanishes at $\hat{\theta}$—see (16)—, which, according to Proposition 1, must necessarily result in a non-exclusionary rebate with an effective price $x_L^{**} > c_l$. The second observation is that the absence of information rents at $\hat{\theta}$ eliminates any need for additional distortions beyond that value. This together with Proposition 2 (that the profitability of a non-exclusionary contract falls with $x$) indicates that for all $\theta \geq \hat{\theta}$, the menu of contracts offered by $\mathcal{I}$ are $(r_H^*, x_H^*, Z_H^*)$ and $(r_L^* = v, x_L^* = v - \bar{\pi}/\lambda, Z_L^* = 0)$. This latter connects to perhaps the most important observation which is whether $\mathcal{I}$ will ever find it profitable to offer this menu as opposed to a single contract to the high type. Our main proposition establishes the conditions for this to be the case:

**Proposition 4.** When buyers are better informed about whether demand is likely to be high $(1 + \theta)$ or low $(1)$, the incumbent offers a menu that includes non-exclusionary rebates of the form $(r_L^* = v, x_L^* > c_l)$ as long as demand variation is sufficiently large i.e., $\theta \geq \hat{\theta}$, and the spot market is not that efficient, i.e., $\bar{\pi}_I + \bar{\pi}_B \leq v - c_l - \lambda(x_L^{**} - c_l)F(x_L^{**})$.

**Proof.** When $\theta \geq \hat{\theta}$, $I$ has a choice between offering the menu $(r_H^*, x_H^*, Z_H^*)$ and $(v, x_L^{**}(\hat{\theta}))$ and the single contract $(r_H^*, x_H^*, Z_H^*)$. Since the payoff from the high type is the same in either case, $I$ will offer the menu when the payoff from the low type is larger under the contract $(v, x_L^{**}(\hat{\theta}))$ than to trade in the spot, that is, when condition

$$v - c_l - \lambda(x_L^{**}(\hat{\theta}) - c_l)F(x_L^{**}(\hat{\theta})) \geq \bar{\pi}_I + \bar{\pi}_B$$  \hspace{1cm} (18)

holds.$\blacksquare$

Proposition 4 tells us that it is always optimal for $I$ offer the menu as opposed to a single offer when $\theta = \hat{\theta}$, but is silent about it when $\theta \in (0, \hat{\theta})$. The answer is not obvious because informational rents are non-monotonic in $\theta$. However, the payoff difference of the menu offer over the single offer is

$$\Delta \pi_I = -\mu \theta \rho_H [\lambda(v - x_L^*(\theta) - \bar{\pi}_B)] + (1 - \mu)[v - c_l + \lambda(c_l - x_L^*)F(x_L^*) - \bar{\pi}_I - \bar{\pi}_B]$$

17
Differentiating with respect to $\theta$ and using the envelope theorem yields

$$-\mu \rho_H [\lambda (v - x_L^{**}(\theta) - \bar{\pi}_E)] \leq 0$$

for all $\theta \leq \hat{\theta}$, which shows, together with Proposition 4, that the menu is offered in equilibrium for any $\theta$.

Another important result from Proposition 4 is that the absence of upfront payments when the incumbent is dominant, is a sufficient yet not necessary condition for the rebate contract to be not anticompetitive (i.e., $x > c_I$). The exact level of asymmetric information, say $\tilde{\theta}$, required to produce non-exclusionary contracts can be obtained directly from (15) by setting $x_L = c_I$ and solving for $\theta$. Since the solution $x_L^{**}(\theta)$ is increasing in $\theta$, $\tilde{\theta} < \hat{\theta}$, we can indeed observe in equilibrium non-exclusionary rebates exhibiting some upfront transfers, albeit significantly smaller than in exclusionary rebates.

More importantly, while Proposition 2 characterizes the set of all non-exclusionary rebates that would be profitable for $I$ to sign, Proposition 4 reduces that set to the ones that will be offered in equilibrium, provided that $\theta \geq \hat{\theta}$. Finding a non-empty equilibrium set requires the coalition to suffer losses of at least $\lambda (x_L^{**}(\hat{\theta}) - c_I) F(x_L^{**}(\hat{\theta}))$ when trading in the spot as opposed to trading under a long-term contract. A realistic and easy way to make the case is by invoking that long-term contracting usually saves on transaction/agency costs. But actually, all we need for (18) to hold is that spot competition is not that efficient. In the case of (simultaneous) linear pricing, our running assumption, Lemma 2 evaluates coalition losses at $F(\hat{\theta}) \mathbb{E}[\Gamma(c_E) \mid c_E \leq \hat{c}]$, which according to the following lemma, are large enough to ensure that, at least for small $\lambda$’s, non-exclusionary rebates are signed in equilibrium.

**Lemma 4.** When the spot is cleared through linear pricing, non-exclusionary rebates are signed in equilibrium for any distribution $F(\cdot)$ of $c_E$ and for all $\lambda$’s sufficiently close to zero.

**Proof.** To prove that $\xi \equiv F(\hat{\theta}) \mathbb{E}[\Gamma(c_E) \mid c_E \leq \hat{c}] - \lambda (x_L^{**}(\hat{\theta}) - c_I) F(x_L^{**}(\hat{\theta})) > 0$ note first that $\lim_{\lambda \to 0^+} \xi = 0$, since $\lim_{\lambda \to 0^+} F(\hat{\theta}) \mathbb{E}[\Gamma(c_E) \mid c_E \leq \hat{c}]$ and $(x_L^{**}(\hat{\theta}) - c_I) F(x_L^{**}(\hat{\theta}))$ is bounded. In addition, differentiating $\xi$ with respect to $\lambda$, it is possible to show, after a good amount of algebra, that $\lim_{\lambda \to 0^+} \partial \xi / \partial \lambda = (v - c_I)^2 f(v) > 0$. Hence, for $\lambda$’s sufficiently close to zero $\xi > 0$.

Without a functional form for $F(\cdot)$, it is impossible to be more precise about the range of $\lambda$’s over which (18) holds. For the uniform distribution, the range extends roughly all the way
to $\lambda = 0.5$. The reason for this limit is very intuitive. As $\lambda$ increases, the spot inefficiency falls and totally so when $\lambda \rightarrow 1$ (Bertrand competition). A fully efficient spot can also be obtained if we let $I$ use non-linear prices, i.e., setting different prices for orders of different sizes (see the Appendix). One could instead think of more inefficient pricing mechanisms ruling the spot. Suppose for instance, that linear prices are not simultaneously set but sequentially, with $I$ moving first because of his larger market share. In this case (see the Appendix), coalition losses in the spot amount to $\lambda(v - c_I)F(\hat{c})$ which is sufficient for (18) to hold for any $\lambda$ since $x_L^{*\star}(\hat{\theta}) < \hat{c} < v$ ($I$ will never set an effective price $x$ above $\hat{c}$ because he rather goes to the spot when $c_E \geq \hat{c}$).

A central result of Proposition 4 is that asymmetric information forces the contracting parties to move away from the anticompetitive rebates of Proposition 3, sometimes so much that they end up signing non-exclusionary rebates. The move towards less exclusionary contracts is entirely consistent with A&B’s (p. 396) insight that “informational constraints do not necessarily add up; they may cancel out.” This is a result worth emphasizing because, as pointed out by Ziss (1996), in the signaling model of A&B, parties move in the exact opposite direction, towards more exclusionary contracts. This difference opens up a more general question: under what circumstances additional informational asymmetries makes (inefficient) exclusion more difficult? In a recent paper, Miklos-Thal and Shaffer (2013) look at this question in the particular context of a naked-exclusion model. They find that the incumbent cannot profitable exclude a more efficient rival using the divide-and-conquer offers of Segal and Whinston (2000b) when buyers cannot observe each other’s offers. It is evident that more research in the general theme of informational asymmetries and exclusion is worth pursuing.

### 3.4 Upfront payments, exclusion and slotting allowances

At the end of Section 2 we asked if the absence of upfront payments necessarily means that the rebate is not anticompetitive for different distributions of parties’ outside options. We extend here this question to the asymmetric information model. As in Section 2.5, fix $\bar{\pi}_I + \bar{\pi}_B \equiv \bar{W} < v - c_I$ and let $\bar{\pi}_I$ and $\bar{\pi}_B$ to vary. The analysis in Section 2.5 indicated that when $\bar{\pi}_B \geq \lambda(v - \hat{c}_E)$, $B$’s expost participation constraint $r \leq v$ was not longer binding and, therefore, rebates of the form $(r, R)$ were enough to implement the A&B outcome. Suppose the same applies here so
the symmetric information rebates offered to each type are
\[
\left( r_i^* = \frac{v - \lambda \tilde{c}_E - \pi_B}{1 - \lambda}, x_i^* = \tilde{c}_E \right)
\]
for \( i = L, H \).

Interestingly, these rebates are not only type-independent but, more importantly, they perfectly separate the buyers while implementing the A&B exclusionary outcome. There is a simple intuition for this. Before, when \( \bar{\chi}_2 < \frac{v}{\lambda(v - \tilde{c}_E)} \), separation was problematic for \( I \) because the \( IC_H \) constraint required \( r_L^* \geq (v - \lambda \tilde{c}_E - \pi_B)/(1 - \lambda) \), which violated \( B \)'s ex-post participation. Now, when \( \pi_B \geq \lambda(v - \tilde{c}_E) \), \( I \) has room to raise \( r_L^* \) enough to achieve separation without violating \( B \)'s ex-post participation (i.e., \( r_L^* = r_H^* \leq v \)).

Unsurprisingly, the flexibility in the design of the first-best rebates of Proposition 3 is recovered here when separation is not longer a problem for \( I \), that is, when \( \pi_B \geq \lambda(v - \tilde{c}_E) \). Instead of offering the same rebate \( (r \leq v, x = \tilde{c}_E) \) to both types, \( I \) can very well offer the menu \( (r_H^*, x_H^*, Z_H^*) \) and \( (r_L^*, x_L^*, Z_L^*) \). For this menu to implement the first-best, separation must continue to hold. Thus, the IC constraints (11) and (12) leads to upfront payments
\[
Z_H^* = (1 + \theta p_H)(1 - \lambda) \left[ \frac{v - \lambda \tilde{c}_E - \pi_B}{1 - \lambda} - r_H^* \right] \geq 0
\]
\[
Z_L^* = (1 - \lambda) \left[ \frac{v - \lambda \tilde{c}_E - \pi_B}{1 - \lambda} - r_L^* \right] \leq 0
\]
It is interesting to observe that \( Z_L^* \) is a slotting allowance, an upfront payment from \( I \) to \( B \). Strictly speaking, there is no reason for slotting allowances to emerge in our model, but if they do it can only be in exclusionary rebates. Something else to keep in mind by antitrust authorities.

4 Final remarks

One of the most controversial issues in antitrust and competition policy is the exclusionary potential of exclusive contracts and related practices such as rebates. A common rebate contract includes a list price and a retroactive discount applied to all units purchased by the buyer once

\[14\]Note that rebates continue dominating alternative discount schemes even in the “first-best zone”, i.e., when \( \pi_B \geq \lambda(v - \tilde{c}_E) \). If \( I \) offers a menu of 2PT contracts with \( p_H = p_L = \tilde{c}_E \), both types will take the contract with the lowest fixed charge, preventing separation.
a pre-agreed sales threshold has been reached. We find that these rebate contracts cannot be used to block the efficient entry/expansion of rival suppliers; even when the retroactive discount is granted upon purchasing exclusively from the incumbent supplier. Since rebates only specify a price schedule, the buyer’s purchasing and trading decisions occur ex-post, after the rebate contract has been signed. This introduces a new participation constraint on the buyer side that severely limits the ex-post transfer of rents from the buyer to the incumbent, so much that eliminates any exclusionary potential these rebates may have.

A simple way for the incumbent to solve this rent transfer problem is by completing the rebate contract with upfront payments. In that way a rebate contract can fully replicate an exclusive dealing contract. However, the introduction of upfront payments is not without cost for the incumbent when, as often happens, he must negotiate the terms of the contract with a buyer that is better informed about demand. While in this asymmetric information environment rebates perform strictly better than alternative contracts such as two-part tariffs and exclusive dealing contracts, the incumbent cannot escape from a fundamental tradeoff when deciding on the menu of rebates to offer: upfront transfers help exclusion but obstruct the separation of buyers. At times, the separation effect will be large enough that the incumbent will find it optimal to offer non-exclusionary rebates, that is, rebates without upfront payments.

Our result that the introduction of asymmetric information to the negotiation between the incumbent and the retailer forces the incumbent to offer less or non-exclusionary contracts is consistent with A&B’s celebrated insight that “informational constraints do not necessarily add up; they may cancel out.” This is in sharp contrast with the results from their signaling model where the incumbent moves towards more exclusionary contracts. Explaining these opposing results under a more general theory of informational asymmetries and exclusion is worth pursuing in future research.

References


Spot pricing games

Brief characterization of three standard spot pricing games follow.

**Linear pricing** (L): As in Lemmas 1 and 2, uniform prices \( p_I \) and \( p_E \) are set simultaneously. To prove the existence of a mixed-strategy equilibrium for all \( c_E < \hat{c} \) consider the following equilibrium candidate. Suppose \( E \) randomizes over the connected interval \([\hat{c},v]\) according to the pdf

\[
g(x) = \frac{\hat{c} - c_I}{\lambda(x - c_I)^2} = \frac{(1 - \lambda)(v - c_I)}{\lambda(x - c_I)^2} \tag{19}
\]

It is easy to show that \( I \)'s best response is to randomize over same support \([\hat{c},v]\). Use \( G(x) = \int g(x)dx \) in \( \pi_I^x(p_I) = (1 - G(p_I))(p_I - c_I) + G(p_I)(1 - \lambda)(p_I - c_I) \) to obtain the desired result: \( \pi_I^x(p_I) = (1 - \lambda)(v - c_I) \) for all \( p_I \in [\hat{c},v] \), \( \pi_I^x(p_I < \hat{c}) < \hat{c} - c_I = (1 - \lambda)(v - c_I) \), and \( \pi_I^x(p_I > v) = 0 \). On the other hand, suppose \( I \) also randomizes over \([\hat{c},v]\) according to the pdf

\[
h(x) = \begin{cases} 
\frac{\hat{c} - c_E}{v - c_E} & \text{if } x = v \\
\frac{\hat{c} - c_E}{\ell(x - c_E)^2} & \text{if } x \in [\hat{c},v)
\end{cases}
\]

It remains to show that \( E \)'s best response to \( I \)'s play is also to randomize over the interval \([\hat{c},v]\). If \( E \) does so according to \( g(x) \) above, for example, yields the desired result: \( \pi_E^x(p_E) = \lambda(\hat{c} - c_E) \) for all \( p_E \in [\hat{c},v] \), \( \pi_E^x(p_E < \hat{c}) = \lambda(p_E - c_E) < \lambda(\hat{c} - c_E) \), and \( \pi_E^x(p_E > v) = 0 \).

We now use this mixed-strategy equilibrium to characterize the function \( \Gamma(c_E) \) in Lemmas 1 and 2. The expected price charged by \( I \) and \( B \) for all \( c_E < \hat{c} \) are

\[
p_I^x(c_E) = (\hat{c} - c_E) \ln \left( \frac{v - c_E}{\hat{c} - c_E} \right) + \left( \frac{v - \hat{c}}{v - c_E} \right) c_E + \left( \frac{\hat{c} - c_E}{v - c_E} \right)
\]

\[
p_E^x(c_E) = \frac{\hat{c} - c_I}{\lambda} \ln \left( \frac{v - c_I}{\hat{c} - c_I} \right) + \left( \frac{v - \hat{c}}{v - c_I} \right) c_I
\]

On the other hand, let \( m^x(c_E) \equiv \min \{p_I, p_E\} \), then

\[
\tilde{\pi}_B^x(c_E) = v - (1 - \lambda)p_I^x(c_E) - \lambda m^x(c_E) = \lambda(v - c_I) - \Gamma(c_E)
\]

where

\[
\Gamma(c_E) = -\frac{(v - c_I)(\hat{c} - c_E)(1 - \lambda)}{(c_I - c_E)} \ln \left[ \frac{(1 - \lambda)(v - c_E)}{\hat{c} - c_E} \right] \geq 0
\]
Sequential linear pricing (S): Uniform prices \( p_I \) and \( p_E \) are set sequentially. Since \( E \) observes \( p_I \) before choosing \( p_E \), he will price right below \( I \) for all \( p_I > c_E \); hence, \( I \)'s best option is to set \( p_I = v \) when \( c_E < \hat{c} \) and \( p = c_E \) otherwise. Thus, \( E \) will not produce when \( c_E \geq \hat{c} \) and price slightly below \( v \) when \( c_E < \hat{c} \). \( I \) and \( B \)'s outside options are then given by

\[
\begin{align*}
\pi^S_I &= (1 - \lambda)(v - c_I)F(\hat{c}) + [\mathbb{E}(c_E \mid c_E > c_I) - c_I][1 - F(\hat{c})] \\
\pi^S_B &= 0 + [v - \mathbb{E}(c_E \mid c_E > c_I)][1 - F(\hat{c})]
\end{align*}
\]

which leads to \( \pi^S_I + \pi^S_B = v - c_I - \lambda(v - c_I)F(\hat{c}) \).

Non-linear pricing (NL): \( I \) and \( E \) set prices simultaneously but \( I \) sets two different prices depending on order size. It is not difficult to see that \( E \) will only produce when is efficient, that is, when \( c_E \leq c_I \). This leads to outside options

\[
\begin{align*}
\pi^{NL}_I &= (1 - \lambda)(v - c_I) + \lambda[1 - F(c_I)] \{ \mathbb{E}(c_E \mid c_E > c_I) - c_I \} \\
\pi^{NL}_B &= \lambda(v - c_I) - \lambda[1 - F(c_I)] \{ \mathbb{E}(c_E \mid c_E > c_I) - c_I \}
\end{align*}
\]

and \( \pi^{NL}_I + \pi^{NL}_B = v - c_I \).