Efficient Exclusion[1]

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Abstract

In their influential paper, Aghion and Bolton (1987) argue that a buyer and a seller may agree on high liquidation damages in order to extract rents from future suppliers. As this may distort future trade, it may be socially wasteful.

We argue that Aghion and Bolton's' analysis of entry is incomplete in some respects, as there is only one potential entrant in their model. We construct a model with many potential entrants. Entry is costly, so entering suppliers have to earn a quasi-rent in order to recoup their entry costs. Reducing the entrants' profits by the help of a breach penalty reduces the probability of entry, and this reduces the attractiveness of breach penalties for the contracting parties.

We show that the initial buyer and seller only have incentives to include a positive breach penalty if there is excessive entry without it, in which case the breach penalty is welfare improving.

Key words: Exclusive contracts, breach penalties, entry, efficiency

JEL codes: L42

1 Introduction

In their influential paper, Aghion and Bolton (1987) argue that a buyer and a seller may have incentives to use partly exclusive contracts in a way that harms welfare. They show that liquidation damages awarded to the seller in the event of breach of contract by the buyer (hereafter breach penalties) may be used to extract rents from future suppliers entering the market at a later stage. As a by-product of rent extraction, the most efficient supplier is not always chosen, thus harming economic efficiency.

Aghion and Boltons' insights have been highly influential and widely applied. Their findings appear in leading textbooks (Church and Ware 2000, Motta 2004, Pepall, Richards and Norman 2002) as well as in policy analyses. In the ongoing debate surrounding EUs article 82 on dominance, the paper plays a key role. For instance, in a report on Article 82 prepared by the prestigious Economic Advisory Group for Competition Policy in EU (antitrust group) concerning article 82 (Gual et al 2005), one reads (with explicit reference to Aghion and Bolton):

"For example, an exclusive dealing contract that makes entry more difficult may be used to extract rents from a potential entrant."

Regarding rebates, the report continues:

"Thus, the rebate is analogous to a penalty paid by the entrant; it plays the role of an entry fee, designed to extract some of the efficiency gains of new entrants, and by the same token it creates a barrier to entry".

In this paper we argue that Aghion and Bolton's' analysis of entry is incomplete in some respects, as they only allow for one potential entrant, who's cost structure is exogenous (independent of the breach penalty). By contrast, in our model there are many potential entrants. The probability of entry as well as the cost distribution of the preferred entrant (if more than one) depend on the contract chosen by the initial buyer and seller. We find that this dramatically changes the results of the analysis. Under reasonable assumptions, the initial buyer and seller set a positive breach penalty if and only if this is (constrained) efficient. If a regulator excludes the use of breach penalty, welfare is reduced.

We model entry as follows: There is a sunk cost associated with entry. The production cost for a given supplier is stochastic at the entry stage, and realized after the entry cost is incurred. In the equilibrium of the entry game, the expected quasi-rent for an entrant exactly equals the entry cost. Reducing entrants' quasi-profits by a breach penalty reduces the number of entrants, and this reduces the attractiveness of breach penalties. We show that with Bertrand competition between the suppliers *ex post*, the optimal breach penalty is zero. If the return to entrants exceed (fall short of) the return under Bertrand competition, there will be excessive (insufficient) entry in the absence of a breach penalty, and a strictly positive (negative) breach penalty is called for by the initial buyer and seller. In all cases, the breach penalty is constrained efficient.

Our results hinge on the assumption that there are more than one potential entrant at the contracting stage, and that these potential entrants are *ex ante* identical. We find this consistent with the assumption that the entrants are not present at the contracting stage, and at this point have no vested interests in the project. If they had vested interests at this stage, they would approach the contracting buyer and seller and made their interests heard at the time when the contract was negotiated. This anonymity indicates that there are many potential entrants, and that none of them are identified as having a unique productivity advantage in this particular relationship. Quasi-rents and the relationship-specific productivity associated with this particular delivery must be attributed to investments undertaken after the contract between the initial buyer and seller is signed.

Our insights also apply if the initial seller undertakes investments. Spier and Whinston (1995) argue the initial buyer and seller may have a common incentive to over-invest in cost-reducing technology, in order to extract rents from the entrants. With endogenous entry this is no longer the case, as over-investments also reduce the entry of new suppliers.

We argue that a breach penalty in a contractual setting is analogous to a reservation price above the seller's valuation in an auction. With an exogenous number of participants, it is optimal to set the reservation price above the seller's evaluation. If there is competition between auctions, it is usually optimal to set the reservation price equal to the seller's valuation, see for instance McAffee (1993) and Peters (1997). A number of studies discuss breach penalties as a remedy for rent extraction, and how this may give rise to an inefficient allocation of resources. A seminal paper (in addition to Aghion and Bolton) is Diamond and Maskin (1977), who analyze breach

penalties in a search context. A third important paper is Rasmussen *et al* (1991) who show that if there are many buyers that cannot coordinate their actions, a seller can bribe some of them to write an exclusive contract and thereby prevent entry (see also Whinston 2000). Fumagalli and Motta (2006) show in a recent paper that naked exclusion cannot be a profitable strategy if the buyers don't have market power in the market for their final product.

Innes and Sexton (1994) argue that a breach penalty may be *warranted* if the buyer and the entrant collude against the initial supplier. Finally, Marx and Shaffer (1999) consider a retailer monopolist negotiating sequentially with two suppliers. If the initial contract specifies a price below marginal costs, this may affect the bargaining game with the second supplier and enables the monopolist to extract more of the second supplier's rents.

To our knowledge there are no papers that explicitly model entry in the Aghion-Bolton model. Spier and Whinston (*op.cit.*) argue that with perfect competition among entrants, the initial buyer and seller have no incentives to set a breach penalty. However, in their model, that is simply because there are no rents to extract from the suppliers. In our model, by contrast, there are rents to extract, but it may not be in the buyer's and seller's interest to do so.

The paper is organized as follows: In the next section we set up the model. Then we show that with Bertrand competition, a breach penalty is profitable with exogenous entry but not with endogenous entry. In section 3 we derive similar results for cost-reducing investments. In section 4 we show that a positive (negative) breach penalty is warranted if the entrants earn excessive (insufficient) quasi-rents after entry. In the last section we offer some concluding remarks.

2   The model

Consider a buyer that demands one unit of an indivisible good, and has a willingness to pay for this good equal to 1. A seller can supply the good at cost $c^* < 1$, and the buyer and the seller writes a contract. We refer to the buyer and the seller as the incumbent agents, and the contract as the initial contract. Before trade takes place, new suppliers may enter the market and replace the incumbent seller.

The initial contract is of the form (P^0, P^*, B), where P^0 denotes a "sign-on fee" paid by the buyer to the seller, P^* denotes payment from the buyer

to the seller at delivery, and B denotes a breach penalty paid by the buyer to the seller if the buyer switches to a new supplier. The initial contract maximizes the incumbent agents' joint expected surplus. Without loss of generality we assume that $P^* = c^*$. The up-front payment P^0 can be used to share the surplus between the buyer and the seller so that P^* is superfluous.

The timing of the model is as follows:

1. B and S agree on the contract.

2. A fixed number N of potential entrants independently and simultaneously consider whether they will enter the market.

3. There is a sunk cost k associated with entering the market.

4. After the sunk cost is incurred, production cost c is realized. The cost c is drawn from a continuous distribution function F, with density f.

5. The entrants (if any) make price offers to the buyer. The buyer chooses the supplier that offers the lowest price (including the breach penalty).

6. Trade takes place.

We study a symmetric equilibrium in which all firms enter the market with equal probability q. The number of entrants is thus binomially distributed with parameters (N, q). The expected number of entrants is $\lambda = Nq$. A higher value of λ is thus associated with more entry. Note that as $N \to \infty$, the distribution of the number of entrants converges to the Poisson distribution with parameter λ.

We first study Bertrand competition. If there is only one entrant, it obtains a profit of $\max[c^* - B - c_i, 0]$, where c_i is the realized cost. If more than one firm enter, the profit of entrant i is strictly positive only if its cost is strictly lower than the other entrants' costs, and in addition $c^* - B > c_i$. In this event, the firm's profit is $\min[c^* - B, c_{-i}] - c_i$, where c_{-i} is the lowest cost among the other entrants.[1]

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[1]Note is that it is not crucial that the entrants observe each other's costs, as long as the distribution of costs is drawn from the same distribution for all the entrants. Suppose firms have private information about their costs, and submit bids as in a first price auction. Then we know from the revenue equivalence theorem that the allocation and expected profits will be the same as with Bertrand competition.

Let $P^N(c)$ denote the probability that an entrant with costs lower than c appears given N and q (we depress the dependence on q). It follows that $P^N(c) = 1 - [1 - qF(c)]^N$, which is increasing in q for all c. For a given firm that enters, the probability that it will meet another entrant with costs below c is $P^{N-1}(c)$.[2] Let p^N and p^{N-1} denote the respective densities. The expected profit of an entrant with cost $c_i < c^* - B$ is thus

$$\pi(c_i) = \int_{c_i}^{c^*-B} (c - c_i)p^{N-1}(c)dc + (1 - P^{N-1}(c^* - B))(c^* - B - c_i)$$

In the appendix we show that the expected profits $\Pi = E^c\pi(c)$ can be written as

$$\Pi = \int_0^{c^*-B} (1 - P^{N-1}(c))F(c)dc \qquad (1)$$

Since P^{N-1} is increasing in q for all c, it follows that Π is decreasing in q, and hence also in λ (more competitors hurt profits). Below it is convenient to write Π as a function of λ and B. Then the partial derivative $\Pi_\lambda < 0$. We also write P^N and p^N as functions of λ, $p^N(c, \lambda)$ and $P^N(c, \lambda)$, but take us the liberty to suppress the dependence on λ whenever that is convenient.

2.1 Exogenous entry

We first study the model when entry, represented by the parameter $\lambda = Nq$, is considered exogenous by B and S. This is analogous with Aghion and Bolton's assumption that the distribution of the entrant's costs is exogenous.

The buyer and the seller choose the breach penalty B so as to maximize expected joint profits. Let $W^I(B, \lambda)$ denote the sum of the initial agents' expected profits, $W^E(B, \lambda)$ the expected gross profit for all the entrants (entry costs not subtracted), and $W(B, \lambda) = W^I + W^E$ the sum of all the firms' expected gross profits. Then

$$W(B, \lambda) = 1 - c^* + \int_0^{c^*-B} (c^* - c)p^N(c, \lambda)dc \qquad (2)$$

It is easy to show that $W^E = \lambda\Pi$, where Π is given by (1).[3] The incumbent agents set B so as to maximize $W^I(B, \lambda) = W(B, \lambda) - W^E(B, \lambda)$, treating λ

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[2] As $N \to \infty$, $P^N(c) = P^{N-1}(c) = P(c)$, where $P(c) = 1 - e^{-\lambda F(c)}$.

[3] Expected gross profit is $\Sigma_{i=1}^N q\Pi = Nq\Pi = \lambda\Pi$.

as exogenous. The first order condition for maximum is thus that $W_B - W_B^E = 0$, (where footscript B denotes partial derivative with respect to B) or from (2) and (1),

$$-Bp^N(c^* - B) + \lambda(1 - P^{N-1}(c^* - B))F(c^* - B) = 0$$

The first term represents the effect of B on W. Obviously, W is maximized for $B = 0$. The second term represents rent extraction, as the breach penalty transfers profits from the entrants to the incumbents. The optimal breach penalty can be written as[4]

$$B = \frac{F(c^* - B)}{f(c^* - B)} \tag{3}$$

As in Aghion and Bolton, the incumbent agents set a strictly positive breach penalty. This is harmful to welfare but profitable to the incumbents as the breach penalty shifts profits from the entrants to the incumbents.

2.2 Endogenous entry

Equilibrium in the entry game requires that $\Pi = k$. Thus, for any given B, (1) defines λ as a function of B, $\lambda = \lambda(B)$ (since P^{N-1} is a function of λ). Note that $\lambda'(B) < 0$. As W^I is increasing in λ, it follows that the incumbents are more reluctant to increase the breach penalty when they realize that this will influence the entry decisions of suppliers.

In the appendix we show that in the absence of breach penalties, the social and the private value of entry coincide:

Lemma 1 *With Bertrand competition and no breach penalty, $W_\lambda = \Pi$.*

The surplus of the initial agents is $W^I = W(B, \lambda) - \lambda(B)k$, and the first order condition for maximum can be written as

$$W_B + \lambda'(B)(W_\lambda - k) = 0$$

At $B = 0$, $W_B = 0$, and from lemma (1) it thus follows that the first order conditions are satisfied at $B = 0$. Furthermore, as the derivative is strictly

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[4]The second order conditions are satisfied if the rate F/f is increasing in c, and this corresponds to the standard hazard rate assumptions in the literature on optimal contracts. See for instance Laffont and Tirole (1993).

positive for all $B < 0$ and strictly negative for all $B > 0$, it follows that $B = 0$ uniquely maximizes W^I.

A planner maximizes aggregate profits less entry costs. Since $B = 0$ both imply optimal entry and optimal allocation of production on firms, $B = 0$ is socially optimal.

Proposition 1 *With endogenous entry and Bertrand competition, the incumbents maximize profit by setting the breach penalty equal to zero. This is also socially optimal.*

When the breach penalty is zero, an entrant is paid exactly its marginal contribution to aggregate profits. That is, the entire cost advantage $c^* - c_i$ if it is the only firm that enters, its cost advantage $c_{-i} - c_i$ over the other entrants with costs below c^* if it is the most efficient firm that enters, and zero otherwise. This ensures that the optimal number of suppliers enter the market. Furthermore, as all the entrants are on their participation constraint, all profits less entrance costs are allocated to the incumbents.[5]

3 Investments by the incumbent seller

Spier and Whinston (1995) show that, in the presence of renegotiation between the incumbent buyer and seller, breach penalties have no bite. They further argue that cost-reducing investments by the initial seller may act as a substitute for breach-penalties, as lower costs reduce the price the buyer has to pay if a more efficient supplier enters. The initial seller will therefore over-invest.[6]

Suppose the sellers' costs c^* depend on investments i undertaken by the seller, so that $c^* = c^*(i)$. We assume that i is chosen so as to maximize joint profits. We follow Spier and Whinston and rule out breach penalties. Aggregate gross profits can then be written

$$W(i, \lambda) = 1 - c^*(i) + \int_0^{c^*(i)} (c^*(i) - c)p^N(c, \lambda)dc \qquad (4)$$

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[5]This efficiency result corresponds to the so-called Mortensen rule for efficiency in matching models, see Mortensen (1982) and Julien, Kennes and King (2004).

[6]Their result resemblances findings in the auction literature regarding the seller's problem to commit to a reservation price (Burguet and Sakovics 1996).

Suppose first that the initial buyer and seller treat the amount of entry, defined by λ, as exogenous. The incumbents choose i so as to maximize $W^I - i = W - W^E - i$. From (1) and (4) it follows that the first order condition can be written as

$$\frac{dW^I}{di} = -(1 - P^N(c^*))c^{*\prime}(i) - \lambda[1 - P^{N-1}(c^*)]F(c^*)c^{*\prime}(i) = 1 \qquad (5)$$

The first term reflects the social gain from investments: with probability $(1 - P^N)$ the incumbent supplier produces the good, in which case the investments reduce costs by $-c^{*\prime}(i)$ units. The second term reflects rent extraction. With probability $\lambda(1 - P^{N-1}(c^*))F(c^*)$ exactly one incumbent with lower costs than c^* enters, and in this case the price falls by $-c^{*\prime}(i)$ units.

Suppose then instead that the initial agents take into account that λ depends on c^* in such a way that the zero profit condition holds. It follows from the free entry condition that we can write $\lambda = \lambda(i)$. The incumbents choose i so as to maximize

$$W^I(i, \lambda(i)) - i = W(i, \lambda(i)) - \lambda(i)k - i$$

with first order condition

$$-(1 - P^N(c^*))c^{*\prime}(i) + \lambda'(i)[W_\lambda - k] = 1$$

From lemma 1 it follows that the last term is zero. Thus the first order condition simplifies to $-(1 - P^N(c^*))c^{*\prime}(i) = 1$, which is also the first order condition to the planner's maximization problem.

Proposition 2 *Suppose the initial supplier can undertake cost-reducing investments. With free entry, the incumbent buyer and seller will choose the socially optimal (first best) investment level.*

The intuition is exactly the same as for our earlier efficiency results. The initial agents have the opportunity to extract rents from the entrants. However, they do not have an incentive to do so, as this will reduce the amount of entry.

4 Non-zero breach penalties

In this subsection we show that if prices are not set in a Bertrand fashion, entry will not be optimal, and this may call for breach penalties (positive or negative).

In some markets there may be too much entry. As an example, suppose entrants who do not have the lowest costs withdraw from the market without submitting bids. This is a weakly dominant strategy for the entrant. At the same time, this increases the profits of entering the market dramatically; without a breach penalty, the entire surplus created by entry is allocated to the entrants. Since the entrants obtain zero profit, this surplus is spent on entry costs. Aggregate net profits (entry costs subtracted) is thus reduced to $1 - c^*$, i.e., the same as if there had been no entry at all! This is clearly not optimal. Similar (but weaker) effects may also occur if the agents bargain over the price and the competing agents have left the scene when bargaining takes place. We may also have too much entry for other reasons. In our concluding remarks we argue that rent seeking may lead to excessive entry.

In other situations there may be insufficient entry. Suppose the buyer has a downward sloping demand curve $D(p)$, and that the suppliers only use linear prices. If more than one firm enters with lower costs than c^*, entry will reduce prices, and demand will expand. As a result, the social value of entry may exceed the private value to the entrants.

Without specifying the competition regime, let $\widetilde{\Pi}(\lambda; B)$ denote a reduced-form expected profit function to an entrant, showing the expected quasi-rent when entering the market. As above, let $\Pi(\lambda; B)$ denote the expected quasi-rent to an entrant under Bertrand competition (given by equation 1).

We say that we have *excessive compensation to entrants* whenever $\widetilde{\Pi}(B, \lambda) > \Pi(B, \lambda)$. Analogously, we have *insufficient compensation to entrants* whenever $\widetilde{\Pi}(B, \lambda) < \Pi(B, \lambda)$. We assume that the different competition regimes give rise to the same aggregate profits $W(B, \lambda)$. This is true if, in all competition regimes, the entrant with the lowest cost is chosen provided that its costs are lower than $c^* - B$. We say that a breach penalty B^* is *constrained efficient* if the planner, if she could choose the breach penalty but nothing else, would set $B = B^*$.

As before, the incumbent firm maximizes $W(B, \lambda(B)) - \lambda(B)k$, with first order condition

$$W_B - \lambda'(B)[W_\lambda - k] = 0$$

At $B = 0$ the first term is zero. It thus follows that the incumbents set a strictly positive (negative) breach penalty whenever $W_\lambda(\lambda(0), 0)$ is strictly lower (higher) than the entry cost k. Recall from Lemma 1 that $W_\lambda = k$ with Bertrand competition. Thus the incumbents set a strictly positive breach

penalty if there is excessive compensation to the entrants, and a strictly negative breach penalty if there is insufficient compensation to entrants.

Finally, the constrained efficient solution maximizes net profits $W - \lambda k$, which is the same as maximizing W^I. It thus follows that the incumbents choice of breach penalty is constrained efficient:

Proposition 3 *The incumbents set a strictly positive breach penalty if there is excessive compensation to the entrants, and a strictly negative breach penalty if there is insufficient compensation to entrants. In both cases, the incumbents choose the constrained efficient breach penalty.*

To understand why the breach penalty is constrained efficient, note that there are no externalities in the model. Increasing B does not reduce the *ex ante* profit of the entrants, which is zero anyway. It follows that the interests of the incumbent agents and of the planner are aligned.

Although the breach penalty enhances efficiency, first best cannot be achieved. This is because reducing entry by a breach penalty comes at a cost, as it distorts *ex post* efficiency.[7]

5   Concluding remarks

We have discussed the extent to which an incumbent buyer and seller have incentives to extract rents from entering suppliers by using a breach penalty. We argue that as long as the entrants obtain zero profits *ex ante*, and there is Bertrand competition between the suppliers *ex post*, the optimal breach penalty is zero. A positive (negative) breach penalty will only be profitable to the incumbents if the entrants have too strong (weak) incentives to enter. Even in this case, the breach penalty that maximizes profits is constrained efficient.

We conjecture that rent extraction in general is less attractive when entry is taken into account, and that the social and the private incentives to extract rents from the entrants generally coincide as long as the entrants obtain zero profits.

For instance, Bernheim and Whinston (1998) model a more complex environment, where one buyer and *two* sellers are present at the contracting stage. Later on, a new *buyer* may arrive. Bernheim and Whinston show

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[7]First best may be obtained if we allow for entry fees.

that the initial agents' joint profit may be maximized if one of the sellers is excluded from the market, as this will reduce the competition for delivery to the entering buyer. With endogenous entry of new buyers, such rent extraction will reduce the probability of entry. We conjecture that when the incumbent buyer and seller take entry into account, the incentive to exclude one of the sellers will be eliminated.

Our critical assumption is that all entrants obtain zero profits. This may not be the case in entry games with a more coordinated structure. Suppose for instance that firms enter sequentially. The first firms that enter will then have an advantage over firms that enter at a later stage, and obtain positive expected profits. This opens up for profitable rent extraction by the incumbents. Note the resemblance to the auction literature, where it is shown that the integer problem may make it optimal to set a positive breach penalty (see for instance Engelbrecht-Wiggans 1993).

However, an unattractive feature of sequential entry as described above is that an important ingredient, the sequence in which firms enter, is not modelled. Furthermore, *ex ante* identical suppliers obtain different *ex ante* profits. Presumably suppliers would engage in activities that would enhance their prospects of being the first firm to enter.

We will discuss the latter point in more detail. Suppose the entrants, by incurring a cost (effort) r, may improve their chances of entering first. This may for instance reflect that an entrant may use resources to speed up the entry process. Assume that r does not create social value, i.e., is a complete waste. Potential entrants choose r simultaneously and independently, and the sequence at which they enter equals their ranking of their effort r. This pre-entry game is a tournament (all pay auction), possibly with several prices. See Fudenberg and Tirole (1985), Clark and Riis (1998), or Klemperer (2004) for a survey.

There is no pure strategy equilibrium in this tournament. However, one can easily show that in any equilibrium, all participants obtain zero profits. Thus, the aggregate effort is exactly equal to the net expected profit when entering the market. As a result, (*ex ante*) profits to the entering firms have no social value, as this will be dissipated in the pre-entry game anyway.

When the incumbent agents set the breach penalty, they trade off rent extraction from the entrants and *ex post* efficient trade, and when doing so they do not put any weight on rents to the entrant. However, rent to the entrant has no social value, as it is dissipated in the pre-entry game. The planner thus faces exactly the same trade-off as the incumbent agents when

setting the breach penalty, and the breach penalty is constrained efficient.

Appendix

Derivation of equation (1)

By using integration by parts we find that

$$
\begin{aligned}
\pi(c_i) &= \int_{c_i}^{c^*-B} (c - c_i) p^{N-1}(c) dc + (1 - P^{N-1}(c^* - B))(c^* - B - c_i) \\
&= -|_{c_i}^{c^*-B} (c - c_i)(1 - P^{N-1}(c)) \\
&\quad + \int_{c_i}^{c^*-B} (1 - P^{N-1}(c)) dc + (1 - P^{N-1}(c^* - B))(c^* - B - c_i) \\
&= \int_{c_i}^{c^*-B} (1 - P^{N-1}(c)) dc
\end{aligned}
$$

Note that $\pi'(c_i) = -(1 - P^{N-1}(c_i))$ The expected profit of an entrant is thus

$$
\begin{aligned}
E\pi &= \int_0^{c^*-B} \pi(c) f(c) dc \\
&= -\int_0^{c^*-B} \pi'(c) F(c) dc \\
&= \int_0^{c^*-B} (1 - P^{N-1}(c)) F(c) dc
\end{aligned}
$$

where we again have used integration by parts.

Proof of Lemma 1

Integration by parts yields

$$
\begin{aligned}
W_\lambda(0,\lambda) &= \int_0^{c^*} (c^* - c)[(1 - qF(c))^{N-1}f(c) - (N-1)(1 - qF(c))^{N-2}F(c)f(c)q]dc \\
&= |_0^{c^*} (c^* - c)(1 - qF(c))^{N-1}F(c) + \int_0^{c^*} (1 - qF(c))^{N-1}F(c)dc \\
&= \int_0^{c^*} (1 - P^{N-1}(c))F(c)dc = \Pi
\end{aligned}
$$

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