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ESSAYS ON ENTRY, EXCLUSION, AND LITIGATION FINANCE

Presentata da: Baris Sevuk

Coordinatore Dottorato

Matteo Barigozzi

Supervisore

Luigi Alberto Franzoni

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Abstract

This thesis comprises two parts. Part I examines third-party litigation funding (TPLF). A critical review and a formal model with costly pre-trial investigation reveal a core trade-off: by relaxing claimants' financing and insurance constraints, funding can expand access to justice, but contract design and information frictions can also raise the incidence of weak claims. The model characterizes when each force dominates and derives implications for funding terms and policy.

Part II studies exclusionary conduct. A comment on Fumagalli–Motta (2008) revisits buyers' miscoordination and downstream competition, identifying a mechanism through which an incumbent can sustain exclusion as a unique equilibrium. The paper *Peer Raising Rivals' Costs and the Limits of Contracts for Entry Accommodation* develops a framework in which scale-driven network effects among buyers activate the same mechanism even without buyer pre-commitment; simple pricing schemes can therefore sustain exclusion despite standard "Chicago" remedies.

The final paper, *Exclusion Without Commitment: Financial Fragility and Entry Deterrence*, shows how conditional rebates can foreclose an entrant that must reach scale when capital markets are imperfect. Because buyers risk unmet demand or costly top-ups if others do not switch, each buyer's best response is to stay, sustaining exclusion. With downstream competition, exclusion can also arise via "strategic chilling" that softens competition. The results yield testable predictions and inform the assessment of rebate schemes when financial frictions limit entrants' ability to commit.
Keywords: Antitrust; Exclusion; Conditional rebates; Network effects; Litigation funding; Access to justice.
JEL: C7, C72, D4; L13; L41; K19; K21.

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Introduction

Litigation is a costly and risky investment project. A claimant who has suffered a loss must decide whether to transform that loss into a formal claim and then into a recovery through a process that requires up-front spending, tolerating delay, and bearing substantial uncertainty. These frictions matter because civil justice is not used by an abstract "representative litigant." It is used by parties with heterogeneous liquidity, time preferences, risk-bearing capacity, and procedural competence. In practice, the ability to enforce rights depends on whether the claimant can finance and manage the dispute long enough for the legal system to convert a claim into a payout (Cappelletti et al., 1976).

Third-party litigation funding (TPLF) changes this environment by inserting a specialized repeat player into the dispute through contract. The industry's core economic function is to reallocate some litigation activity away from one-shot plaintiffs—who are relatively inefficient litigators and often financially constrained—toward parties who are better positioned to value, finance, and manage claims. In that sense, litigation finance is not merely an additional "credit source." It is a form of intermediation and delegated litigation management: claims (or claim-like payoffs) become partially tradable assets, and contractual design becomes the mechanism through which investment, governance, and incentives are organized around those assets (Molot, 2011, 2014).

The industry operates through distinct business models, but the mechanism is shared. In commercial litigation funding, the funder often finances legal costs and may also supply project-management, monitoring, and expertise in exchange for a share of future proceeds. In consumer litigation lending, non-recourse advances provide liquidity to individual plaintiffs, shifting some downside risk to the lender while repayment is tied to recovery. These models differ in how intensively the funder intervenes and how portfolios are formed, yet both are based on the same comparative advantage story: the intermediary is a repeat player, can diversify across cases, can access capital at different terms than the claimant, and is typically better at selecting counsel, anticipating procedure, and pricing risk (Molot, 2011; Avraham and Sebok, 2018).

Once funding is available, it changes not only which claims can be brought but also how disputes evolve (Steinitz, 2013; Solas, 2019). A funded plaintiff's outside option improves: financial pressure is relaxed, the cost of delay is reduced, and the threat to proceed becomes more credible. Mechanically, this can raise the plaintiff's reservation value and alter settlement dynamics. Some cases that would have settled early under plaintiff-side financial strain may take longer or proceed further into litigation (Solas, 2019; Xiao, 2017). This is not automatically a pathology; it may reflect that previously suppressed meritorious claims are now prosecuted more diligently (Solas, 2019). But it does imply that "access to justice" and "more litigation" are linked through incentives rather than through a purely moral narrative. If the financing and risk-bearing structure change, so do the bargaining and filing behavior.

TPLF also introduces a governance problem that is inherently contractual and multi-party (Deffains and Desrieux, 2014). Funders bear costs and depend on litigation outcomes, but formal control rights typically remain with plaintiffs and their counsel. This wedge generates conflicts of interest (Sebok, 2014): funders may prefer earlier settlement to protect their investment, while plaintiffs may prefer holding out. In some consumer lending environments, repayment obligations can distort plaintiffs' incentives in either direction depending on how net payoffs evolve over time (Shukaitis, 1987; Daughety and Reinganum, 2013). Industry practice responds with contractual safeguards—termination provisions, staged funding, "reasonable cost" clauses, and dispute-resolution clauses—that allocate influence without fully transferring formal control (Steinitz, 2011; Duffy, 2016; Shamir and Shamir, 2021). These terms are not ancillary. They are the channel through which a repeat-player intermediary attempts to govern opportunism, manage agency problems, and protect asset-specific investments inside a tripartite relationship.

This thesis focuses on a mechanism that is often blurred in the debate on whether TPLF improves justice or fuels abuse: the interaction between funding and information production. Screening and case quality depend on costly plaintiff-side investigation and case development. By investigating, a claimant refines her beliefs about the claim and learns whether litigation is worth pursuing; investigation can therefore filter out meritless cases and, conversely, unlock claims that are initially unattractive but become viable once merit is confirmed. In this sense, information acquisition has productive value.

Crucially, investigation also generates informational rents even when the information is, in principle, verifiable. The point is not only that revelation may be costly; rather, learning more about the case changes the plaintiff's own valuation of her claim. An informed plaintiff knows when she holds a genuinely valuable case and is therefore less willing to accept unfavorable funding terms. Information acquisition thus improves the plaintiff's outside option in the funding negotiation and raises her reservation price for selling a share of the proceeds. From the funder's perspective, plaintiff-side investigation can therefore be "expensive" because it strengthens the plaintiff's bargaining position and compresses the surplus the funder can extract through contracting.

A key insight developed formally in the next chapter is that bringing a more efficient intermediary into litigation can reduce the intermediary's marginal willingness to rely on plaintiff-generated information. A sophisticated funder faces lower effective litigation costs and bears risk more cheaply, so financing may be privately attractive even under coarse priors. When that is the case, the funder may prefer contractual designs that economize on informational rents by discouraging pre-contract investigation, even if investigation is socially valuable. Efficiency is thus a double-edged sword: it expands access to justice by making more claims financeable, yet it can weaken screening by reducing the private demand for plaintiff-side information production.

The next chapter isolates this trade-off in a model where plaintiffs begin with priors about merit and differ in investigation costs. Investigation reveals merit at a cost. The funder—modeled as a more efficient litigant—can offer alternative contractual forms: one class conditions support on investigation and verified merit, while another is structured to proceed under the initial information set and thereby discourages investigation. The equilibrium choice of contract form depends on whether the claim is prima facie worth financing under priors and on where investigation costs lie in the population.

This framework yields a precise implication: litigation funding can simultaneously alleviate access-to-justice problems and exacerbate frivolous litigation—even when one abstracts from procedural pathologies or bad-faith actors. When priors make a claim not worth pursuing, funding can increase access by making investigation and subsequent filing privately viable; mutually beneficial trade then requires information production. But when priors already make filing attractive, the funder's relative efficiency can make it optimal to deter investigation for a subset of plaintiffs who would otherwise investigate under self-financing. In that region, funding can increase wasteful litigation spending by increasing uninformed filing and thereby the incidence of meritless claims that would have been screened out through investigation.

The goal of this part is to identify the mechanism that drives the ambiguous welfare effects: funding reallocates litigation to repeat players, and contractual design reshapes information acquisition and screening. This perspective also clarifies what regulation should be "about." If the core distortion runs through information and incentives, then the relevant levers are those that change the informational environment and the contractible allocation of influence—such as disclosure regimes, limits on contractual interference, and constraints on returns insofar as they alter screening and information rents—rather than treating litigation finance as a generic lending market.

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Chapter 1

Third-Party Litigation Funding's Impact on Access to Justice and Frivolous Litigation

1.1 Introduction

The ultimate goal of the civil justice system is to correct wrongs committed by entities, such as citizens and firms, and to provide wrongdoers with the proper incentives to reduce harms to others. However, possessing the mere right to litigate or defend a claim does not guarantee that citizens can effectively access justice (Cappelletti et al., 1976). The civil justice system is costly, risky, and complex, and it often involves parties with uneven social status. Therefore, no matter how well-crafted a civil justice system might be from a legal perspective, the civil procedure may still deny unsophisticated, budget-constrained, and risk-averse plaintiffs proper compensation for their losses. Consequently, plaintiffs' access to justice and supply of litigation remain at a socially undesirable level (Cappelletti et al., 1976).

Third-party litigation funding (TPLF) involves a sophisticated and well-structured third-party involvement in others' litigation claims by providing funds, project (litigation) management, or both. TPLF encompasses various practices, yet for plaintiffs, it primarily bifurcates into commercial litigation funding and consumer litigation funding. Commercial litigation funders invest money and time into litigation claims for a share in settlement proceedings or court awards. Their client base usually comprises industrial players, class-action initiators, and commercial cases (Chen, 2015; Molot, 2014; Stroble and Welikson, 2020). Typically, these funders are sophisticated, repeat players adept at bearing litigation risk and litigation management activities for their clients. By contrast, consumer litigation funders extend non-recourse loans to plaintiffs with small claims where there is little uncertainty about award distribution, costs, or procedures. Typically, plaintiffs in need of immediate cash receive non-recourse loans and use them for daily expenses.

TPLF can address the access-to-justice problem in several ways. To begin with, by monetizing litigation claims and hedging litigation risk, plaintiffs can mitigate their budget constraints and aversion to risk that prevent them from pursuing their claims diligently (Molot, 2011; Solas, 2019). Also, litigation funders, who are more capable of identifying litigation risk than financial intermediaries (Solas, 2019), can remove plaintiffs' credit constraints and reduce the rate at which plaintiffs discount the future, which increases their willingness to initiate litigation. Skiba and Xiao (2017) found that non-recourse loans provide better terms than other lending practices available to cash-strapped individuals, such as payday lending. Moreover, commercial litigation funders offer project management, consultancy, and high-quality legal services. Thus, they may alleviate the biases arising from the lack of sophistication on the plaintiff's side (Duffy, 2016; Molot, 2014; Solas, 2019). Besides, litigation funding aligns the sophisticated repeat players (funders) with the disempowered, risk-averse, and unsophisticated plaintiffs, thereby increasing their contribution to party rule-making, willingness to initiate a claim, and awareness of legal issues (Molot, 2011, 2014; Steinitz, 2011). All these aspects position the industry as a promising solution to the problem of access to justice.

The industry's promising aspects have attracted substantial public and scholarly interest, but so too have its more dubious features. Thus, the pertinent questions remain: can the industry address the procedural imperfections that plague the delivery of justice to weak parties, and if so, at what cost do these benefits come? Indeed, to the extent that the filed claims are meritorious from a legal and factual perspective, any material cost that the industry might place upon the courts or adversaries is an internalization of the social costs that barriers to justice place upon society (Solas, 2019). As a result, the increased volume of litigation is more likely to be problematic if litigation funders support meritless claims, thereby inflating unreasonable shifts of wealth or wasteful litigation spending. At first glance, it may seem counter-intuitive for profit-seeking parties to support such claims, as this would yield negative returns. Funders and plaintiffs may nevertheless initiate such claims.

Only a handful of formal economic studies on that possibility exist. The frivolous litigation arguments (in general and specifically against TPLF) are based on the possible adverse selection problem due to informational asymmetries between funders and their clients (Abramowicz, 2005); the possibility that the industry allows for extra-legal motives to materialize, which underpinned the patent-troll analogy[1]; the notorious reputation that repeat players might build (Farmer and Pecorino, 1998); the peculiarities of the funding contracts when the defendants are uninformed (Deffains and Desrieux, 2014);and the fact that more capable parties can better exploit procedural imperfections.[2] However, the frivolous litigation problem may also arise from plaintiffs' willing ignorance about the merits of their cases. Similarly, the lack of knowledge about their claims, which might result from prohibitive costs of evidence gathering, might also deter plaintiffs from pursuing their claims. As shown, introducing this aspect yields various implications for the industry.

In this paper, I present a simple model of litigation incorporating costly pretrial investigation and discuss how the litigation funder's involvement can alter the information-gathering patterns exhibited by claimholders.[3] The model is somewhat

[1]See the *Carhart* () case.

[2]For an extensive review of the literature on friovolous litigation, see Bone (1997).

[3]Compte and Jehiel (2008); Crémer et al. (1998b,a); Crémer and Khalil (1992) are useful anal-

similar to Chen's (2015) adaptation of Crémer & Khalil's (1992) strategic information acquisition model to litigation funding. According to Chen (2015), the funder writes contracts that deter information acquisition because it only yields information rents to the client. In contrast, my model predicts no unilateral change in plaintiffs' investigation choices. Instead, it demonstrates that litigation funding may simultaneously encourage and deter information acquisition, suggesting that access to justice and frivolous litigation increase concurrently.

Chen (2015) assumes that pre-trial investigation only has strategic value; that is, it only grants plaintiffs information rents. For this to hold true, the value of litigious activity should be observed at no cost after the project (i.e., the litigation claim) is initiated, a condition rarely met in actual litigation where the prospects of a case remain uncertain throughout the process. Thus, information gathering by plaintiffs has value-creating effects. Generally, for an investigation by one party of a contract to benefit the other, one of the parties should be more distant from information, or her information set should be restricted to that of the other party. This scenario is typical in litigation funding: although funders conduct due diligence on their potential clients' assertions, their assessment of a case's prospects usually occurs in the initial stages, and their interest in cases is typically held confidential. Therefore, they are neither better positioned to identify which sources of information might be relevant, nor can they accumulate more information than the original claimholders without breaching confidentiality.

In the model presented below, investigation into case prospects has a value-enhancing effect because it yields information about whether the case is meritorious or meritless. When a plaintiff suffers a loss, the nature of this loss and the socio-economic context in which it occurred do not usually indicate whether it constitutes a meritorious claim. Nevertheless, these aspects provide preliminary information, shaping the plaintiff's initial expectations (sometimes referred to as "priors" in the remainder of the text) about the claim's category and its potential value. Investigation, though costly, allows plaintiffs to refine their expectations regarding the claim type and value. Thus, the value of investigation stems from its ability to mitigate the risk of pursuing unmeritorious claims and consequently prevent wasteful litigation spending. Therefore, plaintiffs facing sufficiently low investigation costs will choose to investigate. By contrast, plaintiffs may opt for rational ignorance when investigation costs are prohibitively high. These uninformed plaintiffs may still want to file their claims since their priors may suggest that the claim is worth pursuing,

yses of the endogenous informational environments under contractual relationships.

resulting in the filing of meritless claims. In cases where initial expectations suggest that a claim is not worth pursuing, uninformed plaintiffs refrain from filing, causing the access-to-justice problem in the system.

The introduction of a more efficient litigation funder into the system, through contractual arrangements, alters plaintiffs' filing and investigation behaviors. As shall be shown, if the claim is not worth pursuing under the priors, where investigation is critical to the decision to file, the mutually beneficial trade between the funder and the plaintiff requires the latter to investigate. Thus, litigation funding will incentivize information gathering and filing to the point that investigation costs exhaust the mutually beneficial trade, increasing access to justice as a result. In contrast, if the claim is worthwhile without further investigation, whether the funding contract requires or deters information acquisition depends on investigation costs. In particular, because funders are more efficient players and, hence, perceive lower gains from investigation, they deter investigation by some plaintiffs who would investigate if they self-financed.[4] Consequently, litigation funding may exacerbate the frivolous litigation problem in the form of wasteful litigation spending. My model shows that even if contractual and procedural imperfections are ruled out, funders may tolerate frivolous litigation precisely because they are more efficient players—the very reason litigation funding also alleviates the access-to-justice problem.

1.2 Model

Suppose a plaintiff experiences an initial loss that might be attributed to the defendant's actions, with probability p. Given two mutually exclusive scenarios, the prior probability that a claim is without merit is $1 - p$. The expected court award for meritorious claims is $R > c_P$, whereas it is zero for non-meritorious claims. Legal costs incurred by the parties are represented as c_i, where $i = P, F$ for the plaintiff and the funder, respectively. The funder's superior legal expertise is reflected in the lower legal costs; that is, $c_P > c_F$.

Suppose the plaintiff can conduct a pre-trial investigation, which might include contacting witnesses, soliciting expert opinions, and seeking arguments from previously solved disputes. For simplicity, assume this investigation fully reveals the case's merits. Denote the investigation cost by I, which, by assumption, ranges over the non-negative real numbers. This cost encompasses all factors influencing

[4]In other words, the increase in the reservation price of the plaintiffs due to investigation exceeds the benefits of investigation in the eyes of the funders.

the plaintiff's ability to gather information and evidence, such as the nature of the dispute, legal uncertainties, and the plaintiff's capabilities. The investigation cost might be zero, suggesting that the harm itself clearly indicates the case's merits. Alternatively, it could be indefinitely high if, for example, the case details are private information to the defendant.

I assume the following timeline:

t_0: Risk-neutral plaintiffs are assigned legal claims.

t_1: Litigation funders announce contracts $(s, A(i = 1, I))$, specifying their share of the court awards (s) and a payment scheme conditioned on the observable investigation costs (I) and whether the contract requires investigation ($i = 1, 0$, with $i = 1$ indicating a requirement for investigation). Funders are fully committed to contract terms, and their share is determined exogenously.

t_2: Plaintiffs decide whether to conduct an investigation.

t_3: Plaintiffs decide whether to ask for funding and whether to file the claim. If the plaintiffs do not file the claim, the game ends here.

t_4: The funder decides whether to accept the case, having access to the investigation status and its results at no cost. This mechanism precludes frivolous litigation due to adverse selection.

t_5: The court ascertains the true state of nature and decides whether and how much to award the plaintiffs.

It is beneficial to differentiate between two scenarios based on the expected value of the claim under the initial expectations. If $pR - c_P < 0$, the claim is not worth pursuing under the initial expectations; otherwise (that is, if $pR - c_P \geq 0$), it is. Clearly, information plays a crucial role in the first scenario, where the plaintiff would refrain from filing the claim without additional information. By contrast, in the second scenario the plaintiff still deems it profitable to pursue the claim without further investigation.

The funder may propose two types of contracts. One type mandates investigation; under such contracts, only those plaintiffs who have conducted an investigation and confirmed the merits of their claims receive funding. These contracts must encourage the acquisition of information and ensure incentive compatibility once a plaintiff verifies her claim's merit. Alternatively, the funder can write contracts that envisage a monetary payment to all plaintiffs with some certain I, conditional on them not investigating. These contracts should discourage acquisition of information and encourage filing claims without further exploration of their merits. The former type of contracts will be termed *investigation contracts*, and the latter type will be referred to as *no-investigation contracts*. The returns from both types of contracts depend on the plaintiff's behavior under self-financing—that is, the default action.

It is obvious that a plaintiff with a prima facie worthy claim will initiate the claim, while a plaintiff with a prima facie worthless claim will not, when there is no option to investigate. Consequently, plaintiffs whose claims do not hold positive value under the initial information may fail to bring their cases to court. This indicates that these plaintiffs will encounter an access-to-justice issue. If a plaintiff investigates and discovers that her claim has merit, she expects to gain $R - c_P$ from a trial. If not, she expects a loss of c_P from a trial and will not file. Likewise, the funder would never want to take on meritless claims. Let us begin by formalizing the default actions.

Self-Financing

Without a litigation funding industry, plaintiffs investigate if the gains from information outweigh the investigation cost. However, the gains from investigating are defined with respect to the value of the litigation claim under the initial expectations, since the initial value of a litigation claim cannot be negative as the plaintiff can choose not to initiate it. This prior dependence, a key factor in informational models, is captured by the distinction between the claims worthy and unworthy of pursuing under the priors.

When a claim is prima facie worth pursuing, the value of information is

$$p(R - c_P) - (pR - c_P) = (1 - p)c_P, \tag{1.1}$$

where the first term on the right-hand side is the expected value of the claim under investigation and the second term is the value of the litigation claim under the initial information set. The difference between these two terms is the value of information.

In cases where the claim is not worth pursuing under the initial information, it is

$$p(R - c_P) - 0. \tag{1.2}$$

Note that the second term is null because the plaintiff would not file if she did not have the option to investigate.

The decision to investigate depends on whether the value of information exceeds the investigation costs. Since I ranges over the non-negative real numbers, there exists a value of I such that the following holds with equality. Denote the plaintiff with this level of I as $I^m(p)$ and refer to that plaintiff as the marginal investigating plaintiff. Those plaintiffs with a higher investigation cost than $I^m(p)$ will not investigate, while those with lower levels will. When the claim is prima facie worthless, the marginal investigating plaintiff will also be the one who has the highest I among those who file. Note that $I^m(p)$ is defined as

$$I^m(p) = \begin{cases} (1-p)c_P & \text{if } pR - c_P \geq 0, \\ p(R - c_P) & \text{if } pR - c_P < 0. \end{cases} \tag{1.3}$$

These considerations lead to the following result.

Proposition 0: [Self-financing]. When the plaintiffs self-finance, the following results hold:

Case I: If $pR - c_P \geq 0$, then

- Plaintiffs with $I \leq I^m(p)$ will investigate and subsequently pursue their cases only if the investigation reveals their claims to be meritorious.
- Plaintiffs with $I > I^m(p)$ do not investigate but still file their claims. This may lead to the filing of meritless claims, resulting in wasteful litigation spending.

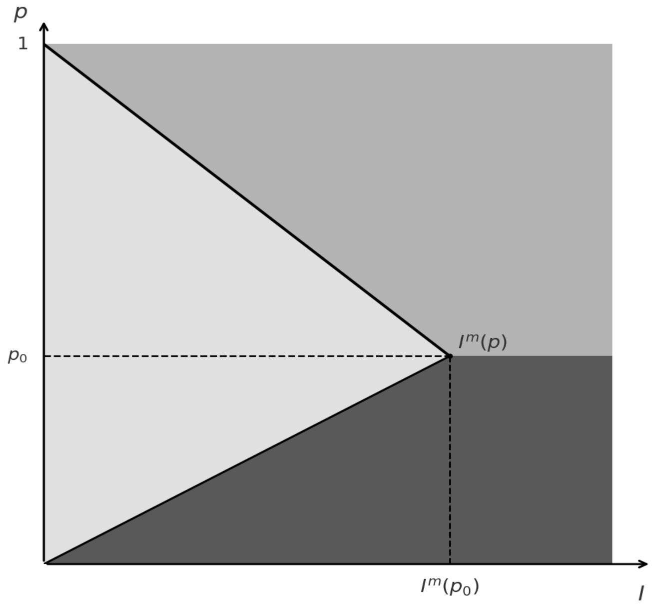
Case II: If $pR - c_P < 0$, then

- Plaintiffs with $I \leq I^m(p)$ investigate and subsequently pursue their cases only if the investigation reveals their claims to be meritorious.
- Plaintiffs with $I > I^m(p)$ neither investigate nor file their claims. Consequently, these plaintiffs will suffer from barriers to justice.

Proof. For either case, the investigation costs should be sufficiently low for the plaintiffs to investigate. By construction, only meritorious claims are brought to the court by investigating plaintiffs ($I \leq I^m(p)$), since meritless claims have a negative expected value. However, those plaintiffs for whom $I > I^m(p)$ do not investigate. In Case I, non-investigating plaintiffs find their claims worth pursuing under the priors. Thus, these plaintiffs will file, and some of them will make wasteful litigation spending on their meritless claims. By contrast, the non-investigating plaintiffs will not file their claims in Case II, since they expect to make losses in court. That is, non-investigating plaintiffs in Case I describe the frivolous litigation problem in our simple system, while those in Case II suffer from the access-to-justice problem. □

This proposition captures the informal idea that, depending on the priors, plaintiffs either risk wasteful filing (frivolous litigation) or face barriers to justice when investigation costs are too high.

Figure 1.1: The Marginal Plaintiff Schedule under Self-Financing



As illustrated in Figure 1.1, the schedule for the marginal plaintiff exhibits a kink at $p = p_0$, where p_0 is such that $p_0R - c_P = 0$. To the left of the kinked line $I_m(p)$ (the light gray area), plaintiffs choose to investigate and bring their meritorious cases to court. According to Proposition 0, those plaintiffs situated to the right of the $I_m(p)$ line will file their claims if $p \geq p_0$ —that is, in the medium gray area. Frivolous cases in this area constitute the frivolous litigation problem in the system. Conversely, if $I > I_m(p)$ and $p < p_0$, the plaintiffs do not file their claims and, hence, cannot access justice— the dark gray area. The following discussion will focus on how the introduction of a more efficient third-party funder alters the system in Figure 1.1.

Third-party Funding

Let us begin with the investigation contracts $(s, A(i{=}1, I))$. These contracts must incentivize investigation and be incentive-compatible after investigation. The t_3

incentive compatibility constraint, assuming a meritorious claim, is

$$(1-s)R + A(i{=}1, I) \ \geq \ R - c_P, \tag{1.4}$$

(IC_{t_3}).

The gains from investigating depend on the value of the claim under the default investigation decision. Thus, if $pR - c_P \geq 0$, the funder's contract should ex-ante offer

$$p\big[(1-s)R + A(i{=}1, I)\big] - I \ \geq \ \max\{\, pR - c_P,\ p(R - c_P) - I\,\}, \tag{1.5}$$

since plaintiffs who do not investigate ($I > I^m$) expect to make $pR - c_P$ from the court, while those who do investigate ($I \leq I^m$) expect $p(R - c_P) - I$.

Similarly, if $pR - c_P < 0$, the investigation constraint for the funder becomes

$$p\big[(1-s)R + A(i{=}1, I)\big] - I \ \geq \ \max\{\, 0,\ p(R - c_P) - I\,\}, \tag{1.6}$$

since non-investigating plaintiffs do not file and hence receive zero payoff.

Lemma 1. The investigation contracts $(s, A(i{=}1, I))$ have the following properties:

(a) When $I \leq I^m$, the maximum expected profit for the funder at t_1 is $p(c_P - c_F)$.

(b) When $I > I^m$, the maximum expected profit for the funder at t_1 is

$$c_P - pc_F - I \quad \text{if } pR - c_P \geq 0,$$

and

$$p(R - c_F) - I \quad \text{if } pR - c_P < 0.$$

Proof. Plaintiffs who investigate under self-financing do so if

$$p(R - c_P) - I \ \geq \ pR - c_P.$$

Contracts satisfying (IC_{t_3}) yield funder profit $sR - A(i{=}1, I) - c_F$. From (1.4) we obtain

$$0 \ \leq \ sR - A(i{=}1, I) - c_F \ \leq \ c_P - c_F.$$

Since only a fraction p of claims are meritorious, the funder's expected profit from offering $(s, A(i{=}1, I \leq I^m))$ is at most $p(c_P - c_F)$. This proves part (a).

For part (b), consider first $pR - c_P \geq 0$. Recall that $pR - c_P > p(R - c_P) - I$ when $I > I^m$. The t_3 contracts need not satisfy the investigation constraint.

Anticipating that only meritorious claims are funded, the plaintiff expects eligibility with likelihood p. Investigation then requires

$$p\big[(1-s)R + A(i{=}1, I)\big] - I \;\geq\; pR - c_P. \tag{1.7}$$

From this, the funder's maximum profit at t_1 is

$$p\big(sR - A(i{=}1, I) - c_F\big) \;\leq\; c_P - pc_F - I.$$

When $pR - c_P < 0$, note that $p(R - c_P) - I < 0$ for non-investigating plaintiffs. The investigation condition becomes

$$p\big[(1-s)R + A(i{=}1, I)\big] - I \;\geq\; 0. \tag{1.8}$$

Here, the funder's maximum profit is

$$p\big(sR - A(i{=}1, I) - c_F\big) \;\leq\; p(R - c_F) - I.$$

Thus, irrespective of whether the claim is initially worth pursuing, it suffices for an investigation contract to motivate investigation ex-ante, which ensures that (IC_{t_3}) is also met. $\square$

The funder may also announce contracts that require the plaintiff *not* to investigate. In this case, the funder offers a sure $A(i{=}0, I)$ and makes profit

$$psR - A(i{=}0, I) - c_F.$$

Such contracts are designed to deter investigation at t_2. They must satisfy

$$p(1-s)R + A(i{=}0, I) \;\geq\; \max\{\, pR - c_P,\; p(R - c_P) - I \,\},$$

if $pR - c_P \geq 0$; or

$$p(1-s)R + A(i{=}0, I) \;\geq\; \max\{\, 0,\; p(R - c_P) - I \,\},$$

if $pR - c_P < 0$.

These results set the stage for Lemma 2.

Lemma 2. The no-investigation contracts $(s, A(i{=}0, I))$ have the following properties:

(a) When $I \leq I^m(p)$, the maximum expected profit for the funder at t_1 is $pc_P - c_F + I$.

(b) When $I > I^m(p)$, the maximum expected profit for the funder at t_1 is

$$c_P - c_F \quad \text{if } pR - c_P \geq 0, \qquad pR - c_F \quad \text{if } pR - c_P < 0.$$

Proof. When $I \leq I^m(p)$, no-investigation contracts must satisfy

$$p(1-s)R + A(i{=}0, I) \;\geq\; p(R - c_P) - I. \tag{1.9}$$

This implies the funder's maximum profit is

$$psR - A(i{=}0, I) - c_F \;\leq\; pc_P - c_F + I.$$

These contracts offer rents to plaintiffs for forgoing the potential gains from investigating.

If $pR - c_P \geq 0$ and the plaintiff's default action is not to investigate ($I^m < I$), the plaintiff accepts the contract if

$$p(1-s)R + A(i{=}0, I) \;\geq\; pR - c_P. \tag{1.10}$$

This yields the funder an expected profit of $c_P - c_F$ at the contract announcement.

Conversely, if $pR - c_P < 0$, no-investigation contracts must incentivize litigation without investigation. Thus,

$$p(1-s)R + A(i{=}0, I) \;\geq\; 0 \tag{1.11}$$

must hold, and the funder's maximum profit is then

$$psR - A(i{=}0, I) - c_F \;=\; pR - c_F.$$

□

Our main result concerns the shift in the position of the marginal investigating plaintiff under self financing ($I^m(p)$) to that under litigation funding ($I^f(p)$).

Proposition 1. When plaintiffs can request third-party funding, the following results hold:

Case 1. If $pR - c_P \geq 0$, the marginal plaintiff has $I^f(p) < I^m(p)$ for any p.

- Plaintiffs with $I \leq I^f(p)$ investigate and file only if their claims are meritorious.
- Plaintiffs with $I > I^f(p)$ do not investigate but still file, possibly bringing meritless claims and incurring wasteful litigation spending.

Case 2. If $pR - c_P < 0$ but $pR - c_F \geq 0$, the impact on the marginal plaintiff's position is ambiguous.

- Plaintiffs with $I \leq I^f(p)$ investigate and file only if claims are meritorious.
- Plaintiffs with $I > I^f(p)$ do not investigate but file, risking wasteful litigation spending.

Case 3. If $pR - c_F < 0$, the marginal plaintiff has $I^f(p) > I^m(p)$ for any p.

- Plaintiffs with $I \leq I^f(p)$ investigate and file only if claims are meritorious.
- Plaintiffs with $I > I^f(p)$ neither investigate nor file.

Proof. **Case 1.** Consider plaintiffs with $I > I^m(p)$. Since

$$c_P - c_F > p\big((c_P - c_F) - I\big),$$

funders profit more from offering no-investigation contracts, which deter information acquisition. For the marginal plaintiff ($I = I^m(p)$), the investigation contract $(s, A(i{=}1, I{=}I^m(p)))$ yields profit $p(c_P - c_F)$, while the no-investigation contract yields

$$pc_P - c_F + I^m(p) \;=\; c_P - c_F,$$

since $I^m(p) = (1-p)c_P$. The funder's profit from deterring investigation decreases with I. At $I = 0$, the profit is $pc_P - c_F$, strictly less than what an investigation contract yields. Hence the marginal investigating plaintiff shifts to I^f, with $0 \leq I^f \leq I^m$, equality only if $p = 1$.

Case 2. Lemmas 1 and 2 imply that when $pR - c_P < 0$ and $pR - c_F \geq 0$, the funder can offer both contract types. The expected profit from an investigation contract to the marginal plaintiff is $p(c_P - c_F) > 0$, while that from a no-investigation contract is $pR - c_F$. If $pR - c_F$ is near zero but positive, then $pR - c_F < p(c_P - c_F)$. If $pR - c_P$ is just below zero, then $pR - c_F > p(c_P - c_F)$. Thus, the shift direction depends on p. Importantly, the funder cannot profitably offer investigation contracts to plaintiffs with excessively large I. Therefore, while litigation funding reduces barriers to justice, it also increases wasteful litigation spending when $pR - c_F \geq 0$.

Case 3. When $pR - c_F < 0$, no-investigation contracts are infeasible. The funder offers investigation contracts only. At $I = I^m$, expected profit is

$$p(R - c_F) - I^m \;=\; p(c_P - c_F),$$

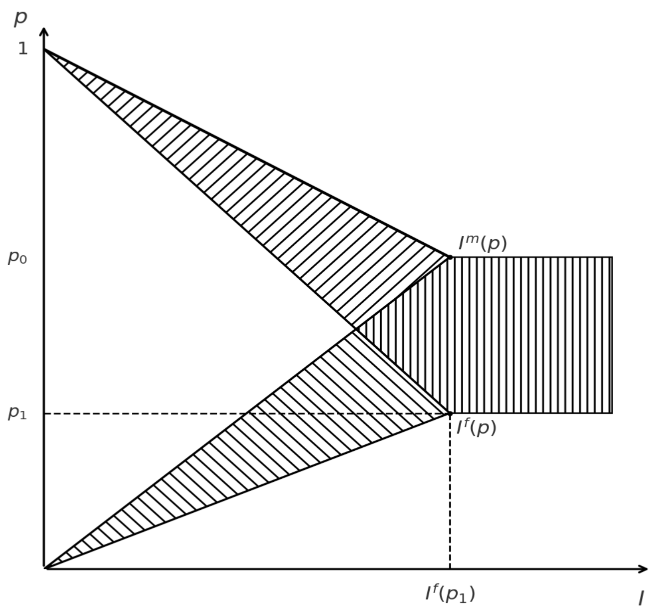
which declines with I. Hence, litigation funding fosters access to justice: $I^f \geq I^m$, with equality only if $p = 0$. □

The introduction of a litigation funder alters the position of the kinked line in Figure 1.1, illustrating how funding changes economic incentives. The threshold investigation cost under litigation finance is

$$I^f(p) = \begin{cases} (1-p)c_F, & \text{if } pR - c_F \geq 0, \\ p(R - c_F), & \text{if } pR - c_F < 0. \end{cases} \tag{1.12}$$

Thus, the simple system of Figure 1.1 becomes the system in Figure 1.2.

Figure 1.2: The Marginal Plaintiff Schedule under Third-Party Financing



The introduction of a litigation funder shifts the kink in the schedule for the marginal plaintiff downward to p_1. This generates three distinct regions in the figure:

1. **Pure access-to-justice benefits:** the triangular area bounded by the origin, the kink of $I^f(p)$ at p_1, and the intersection of $I^f(p)$ with $I^m(p)$. Plaintiffs in this region would not litigate under self-finance but do litigate with funding, and all such claims are meritorious.

2. **Combined access-to-justice benefits and frivolous litigation:** the pentagonal area to the right of the two schedules $I^f(p)$ and $I^m(p)$, bounded horizontally between p_0 and p_1. In this region, litigation funding brings in additional meritorious claims but also increases the share of frivolous claims.

3. **Pure frivolous litigation increase:** the triangular area, bounded by $p = 1$, the kink of $I^m(p)$, and the intersection of $I^f(p)$ and $I^m(p)$. Here, litigation funding introduces only frivolous claims without any access-to-justice benefits.

Thus, while third-party funding improves access to justice in some regions, it also expands the domain of frivolous litigation, and the balance depends on which area dominates.

The influence of a litigation funder on filing behavior depends critically on the nature of the claim and on the incentive structures shaped by costs and potential awards. If plaintiffs already find the claim worth pursuing without additional information, funders may exacerbate the problem of frivolous litigation without improving access to justice. This occurs because funders may find it too costly to work with informed plaintiffs who face high investigation costs—plaintiffs who, absent funders, might still have investigated. By contrast, if plaintiffs deem the claim not worth pursuing based on preliminary information, litigation funding always yields access-to-justice benefits. It may partially remedy the problem because funders can use their cost advantage to incentivize some plaintiffs to investigate the merits of the case. However, the ability of funders to incentivize investigation is constrained by investigation costs; thus, litigation funding cannot fully resolve the access-to-justice problem. The industry can eliminate this problem only if its cost advantage is large enough to make a claim worth pursuing even without investigation. Yet in such cases, the industry simultaneously creates a problem of frivolous litigation. Despite the apparent intricacy of these results, their regulatory implications are straightforward, as the next section will show.

1.3 Discussion

Several additional facets of the industry warrant closer examination. In practice, litigation funders may not be able to offer or commit to certain contracts, which could limit the applicability of the preceding analysis to specific cases. Likewise, funders have the discretion to choose the types of claims they endorse. From a purely profitability-driven perspective, the model suggests that funders' portfolios will be populated with claims that have positive expected value under uninformed plaintiffs' priors—precisely the context where wasteful litigation spending is most concerning. Alternatively, this means that funders are prone to endorse claims where information has little value.[5] This raises an important question: does this in fact occur, and if so, how can wasteful litigation spending be reduced in those procedures where funder involvement may create or amplify frivolous litigation? It is also vital to consider how the civil justice system is affected by the industry, which depends on how courts balance the welfare of adversaries, the enforceability of rights, and the costs of wasteful litigation. This section revisits some of the assumptions made in the second section and provides a perspective on how the civil justice system is affected by the litigation funding industry, as well as how it should respond to the challenges posed by the industry's influence.

1.3.1 Exogenously Determined Shares

The analysis hitherto has treated the funder's share in court awards as an exogenously determined parameter. With risk-neutral agents, any contract with a given share and monetary payment can be replicated by another combination of s and A. The introduction of risk aversion, however, alters these dynamics. With risk-averse plaintiffs, the funder's share functions as a device that transfers risk to the funder, which allows the funder to economize on the monetary payment A by increasing s. Despite such a well-established result, practical constraints such as formal and informal restrictions on the sale of claims—like champerty, maintenance, and other traditional legal barriers—limit the extent to which a funder can acquire claims.[6] These restrictions ensure that the funder cannot fully purchase the claim, thus maintaining the plaintiff's vested interest in the outcome of the litigation. Besides, funders usually want a stake of the plaintiffs in litigation in order to keep the original claimholder's interest in litigation (Molot, 2011).Spier and Prescott (2019) also show that whole claim sales (that is, $s = 1$) are not the optimal contracts when the plaintiffs have role-dependent expectations. Since the above model is not interested in these aspects of litigation funding, it was maintained that s was exogenously given.

[5] Either because the courts cannot weed out frivolous cases or the claim is worth pursuing under the initial information.

[6] See de Morpurgo (2011); Solas (2019).

1.3.2 Commitment

Note that the result—that litigation funder involvement mitigates the access-to-justice problem arising from investigation costs—depends on the funder's ability to commit to its announced contracts. When this assumption is dropped, no access-to-justice benefits may be observed in the above system. To see this, invoke the t_3 and t_2 incentive compatibility constraints. The latter is given by Inequality 7. Write the incentive-compatible contract at t_2 as $(s_{t=2}, A_{t=2})$, which satisfies

$$p[(1 - s_{t=2})R + A_{t=2}(i = 1, I)] - I \geq 0.$$

t_3 incentive compatibility suggests that the contract should satisfy

$$(1 - s_{t=3})R + A_{t=3}(i = 1, I) \geq R - c_P.$$

Thus, the profit-maximizing contract at t_3 is such that

$$(1 - s_{t=3})R + A_{t=3}(i = 1, I) = R - c_P.$$

A plaintiff knows the funder will want to switch to such a contract irrespective of her announcements. Therefore, instead of $(s_{t=2}, A_{t=2})$ she will incorporate $(s_{t=3}, A_{t=3})$. Thus, her expected gain from investigating and asking for funds becomes

$$p[(1 - s_{t=3})R + A_{t=3}(i = 1, I)] - I = p(R - c_P) - I.$$

Since $p(R - c_P) < I$, there cannot be access-to-justice benefits if funders cannot commit to a contract, whereas the results on frivolous litigation remain intact. Nevertheless, litigation funders are repeat players, routinely engaging in multiple funding relationships. The practice of announcing generic contracts tailored for different case types is also common.[7] Thus, the assumption of commitment to pre-announced contracts is not implausible.

1.3.3 Observability

It was maintained that the funder could observe whether the plaintiff has investigated as well as the characteristics of the dispute at no cost. The investigation process may produce verifiable evidence indicating that a plaintiff has indeed inves-

[7]For instance, see Omni Bridgeway's posted class action funding agreements and Woodsford' guide to its services.

tigated. However, whether the plaintiff has investigated cannot itself be verified. This asymmetry in the verifiability of the investigation decision creates scope for adverse selection and may deter the funder from offering no-investigation contracts. Moreover, even if more flexible information systems were allowed, informed plaintiffs could mimic less-informed plaintiffs. In practice, however, litigation funders typically conduct extensive due diligence to understand why a litigant seeks their services, which often helps mitigate adverse selection. Besides, the monetary payment envisaged by no-investigation contracts, $A(i = 0, I)$, is lower than $A(i = 1, I)$ and may be negative. Such negative payments, corresponding to cost-sharing agreements, are common in practice. Although they substantially limit adverse selection caused by asymmetric observability, they may fail to eliminate it entirely.

The funder can further address adverse selection in no-investigation contracts through case selection strategies. For instance, funders may choose to finance only plaintiffs facing budget constraints or those with compelling business reasons (Molot, 2009). They may also restrict no-investigation contracts to arrangements that require cost-sharing. Still, such contracts may be impractical in some scenarios. Accordingly, the frivolous litigation problem is more pressing where either the funder can directly influence the generation of claims or procedural design produces outcomes that diverge from the actual merits.

1.3.4 Productive Value of Information

The assumption that investigation yields benefits solely through improved predictions may be too narrow. Pre-filing investigation serves multiple purposes that extend well beyond prediction. First, thorough knowledge of the facts enables the initiator to choose more efficient legal procedures, potentially leading to better outcomes. Second, by investigating before filing, litigants can identify and select the most compelling evidence, thereby presenting a more credible narrative in court. Third, information gathered in the pre-filing phase can often be reused later in litigation, saving time and costs. All of these benefits can be interpreted as cost savings or as increases in expected court awards resulting from information gathering.

Although funders may be better positioned than plaintiffs to exploit such benefits, the trade-off between information rents and the productive value of information remains. Thus, the model remains relevant, even if it somewhat overstates the funder's willingness to deter information acquisition. This also underscores that the potentially adverse effects of litigation funding are especially pronounced when funders support plaintiffs even though additional information provides little incremental value.

1.3.5 Procedural Biases and Imperfections

The access-to-justice and frivolous-litigation problems may also be understood as procedural failures: failures to align the dispute's prospects with its legal and factual merits, or to provide adversaries with the right incentives to litigate and defend their claims. Such procedural imperfections explain why frivolous litigation persists, both in the forms of wasteful litigation spending and unreasonable wealth transfers. If some procedures are systematically favorable to plaintiffs, funders will naturally gravitate toward them. In such cases, information about merits is less valuable, and the situation parallels that of claims with positive expected value under prior beliefs—except that unreasonable wealth shifts may realize.

If a procedure yields returns greater than what actual merits would dictate (for instance, due to forced settlements or a high probability that the factfinder cannot reliably distinguish between meritorious and meritless claims), asymmetric observability is less important in contract design, since merits are effectively irrelevant. To the extent that funders' portfolios concentrate in such procedures, the resulting social costs—higher supply of litigation—do not simply internalize the externalities associated with access-to-justice failures.

The primary question, then, is not whether the industry should be excluded from certain procedures or subjected to blanket restrictions. Rather, litigation funding should be viewed as a potential corrective mechanism, filling gaps left by financial intermediaries, insurers, and project managers. The real question is how to redesign problematic procedures in the face of growing commodification and financialization of legal services and rights. Indeed, some legislatures have already approached TPLF from this angle.

A salient example is multidistrict litigation (MDL) in the United States,[8] which accounts for 73% of the federal caseload. Reports suggest that 20–50% of mass tort claims are meritless or based on sub-standard evidence (MDL-Subcommittee, 2018). In MDL, the absence of standardized pleading rules makes the sufficiency of evidence highly arbitrary. Procedural design permits numerous complaints to be

[8]Multidistrict litigation is a procedure designed to address the problems peculiar to mass tort litigation and diffuse-interest settings, such as the possible inconsistencies in how the case is dealt with across different districts and the rational apathy to follow the claim. In addition, the typical issues that fall into the category of mass torts are usually complex cases that require vigorous, time-consuming, and expensive procedures to determine whether a person is affected. Thus, these were the cases where the plaintiffs faced barriers to justice beyond the peculiarities of the diffuse-interest settings.

filed before defendants can conduct adequate discovery, effectively denying them a fair chance to understand the claims. Furthermore, plaintiffs strategically present their strongest cases as bellwethers, pressuring defendants into settlement.[9] Low marginal costs of filing[10] encourage mass recruitment of plaintiffs,[11] often financed by funders through law firms or non-recourse loans.

Thus, the current problems of MDL stem from poor procedural design interacting with financialization. Policymakers have debated MDL reform since 2017 with explicit attention to TPLF. Importantly, the core issue is not funding itself, but procedures vulnerable to extralegal motives and insufficient discovery safeguards. Recent Subcommittee proposals reflect this understanding: they do not seek to ban litigation funding but instead aim to improve discovery standards.[12] In my view, such procedure-based reforms are the most effective way to mitigate the industry's costs.

1.3.6 The Social Value of Litigation

Although procedural biases and imperfections have significant implications for regulatory efforts to address the costs of the industry, the model indeed suggests that the mere fact that litigation funders are more efficient litigators might increase social costs due to wasteful litigation spending. However, the extent to which this effect harms the courts depends on the relative weights they assign to justified wealth shifts and the costs incurred by the adversaries. Furthermore, the significance of these social costs varies based on the specific welfare function assumed, the distribution of cases across the (p, I) space, and the level of competition within the litigation market. These factors collectively influence how the potential drawbacks of litigation funding are experienced and perceived by the legal system. This sub-section analyzes how the industry affects the welfare of the legal system, which I will be referring to as the social value of litigation.

Some caveats are in order, though. To begin with, to concentrate on the most problematic case and show why a procedure-based approach is more pertinent, the following analysis will focus on the claims that are worth pursuing under the priors $(pR - c_P \geq 0)$, where litigation funding merely increases wasteful litigation spend-

[9] 97% of these cases are resolved through settlement (MDL-Subcommittee, 2018).

[10] Brickman (2007) reports that the cost of screening one potential asbestosis litigant was \$500-1000 while the potential value of each claim was \$30-50,000 in the US during the 90s.

[11] X Ante (a company that tracks multidistrict litigation advertisement) reports that \$ 220 million was spent on TV advertising to generate mass tort litigation in 2022 and 300 million \$ in 2019, almost tripling the amount spent in 2012. See https://www.x-ante.com.

[12] See proposed Rule 16.1 in sup (2024).

ing. It is because a major drawback of the model is that it does not account for the numerous mechanisms through which the access to justice benefits materialize, most importantly the insurance benefits and the elimination of financial constraints. Instead, the model posits that the access to justice benefits arise from that the information becomes more accessible with litigation funding. This jeopardizes the accuracy of any broad welfare analysis based on the model. However, by focusing on the most problematic case, one can show that the costs associated with frivolous litigation problem might be (partially or fully) offset by the cost efficiencies brought about by the industry if the industry is sufficiently competitive and, hence, the plaintiffs do enjoy these efficiencies. Thus, it is sufficient to focus on the case where $pR - c_P \geq 0$ to draw conclusions about the industry-wide regulations.

Another critical issue concerns the basis on which litigious activities should be evaluated, and how different categories of costs and benefits are incorporated into the social value function. This involves determining whether the analysis should focus on the justified shifts in wealth or the defendant's payments in the form of court awards and legal costs, which serve as a proxy for the defendant's incentives to take appropriate care. These two indicators are inherently linked, with wasteful litigation spending often reflecting the over-deterrence associated with frivolous cases being brought to court. Given this interconnection, I choose to base the welfare analysis on what plaintiffs receive. Concerning the integration of costs and benefits into the social value function, I assume that courts attribute equal importance to both the justified shifts in wealth and the legal costs, and that they utilize an additive social value function to assess these elements.

It is also unclear whether the funders' (outsiders) profits should be taken into account by the courts. Besides, although litigation funders replace plaintiffs and incur the legal costs, the original claimholders implicitly pay for their claims through the contracts. The effective legal costs incurred by the plaintiffs are determined by how much of the surplus created by the funding business is split between parties. In turn, this distribution of surplus is dictated by the degree of competition in the funding industry since the funders are first-movers, with monopoly corresponding to a situation where all the prospects go to the funder and perfect competition to a situation where the plaintiffs effectively pay c_F. To preserve flexibility, I assume that the court does not take the funder's profits into the account to identify a range of social values of litigation. Incidentally, even if the social value were based on the effective payments made by the defendants, the plaintiff's legal costs would be determined by the funding arrangements. Basing the welfare analysis on the plaintiffs' payoffs also features this aspect.

Suppose that for any p there is a unit mass of plaintiffs, and for each case initiated, the court and the defendant incur a cost of k. Assume that the investigation costs are distributed independently of p following a regular probability density function f_I. It is straightforward that for any p such that $pR - c_P \geq 0$, there is no access to justice problem as the justified wealth shifts take place with the natural costs of the adversaries and courts ($c_P, I,$ and k) factored in. However, some plaintiffs do not investigate but bring their litigation claims when $pR - c_P \geq 0$. Since the likelihood of a player having a meritless claim is $1 - p$ and only those plaintiffs with $I \geq I^m(p)$ might bring meritless claims, $(1-p)\int_{I^m(p)}^{\infty} f_I(x)\,dx$ of the unit mass of plaintiffs will bring meritless claims, thus unnecessarily burden the courts and the defendants. Therefore, the social value of litigation (SV) may be written as

$$\mathrm{SV}_0 = \underbrace{pR}_{1} - \underbrace{p(c_P + k)}_{2} - \underbrace{\int_0^{I^m(p)} x\, f_I(x)\,dx}_{3} - \underbrace{(1-p)(c_P + k)\int_{I^m(p)}^{\infty} f_I(x)\,dx}_{4} \quad (12)$$

where SV_0[13] is the social value of litigation under self-finance, Term-1 is the total justified shifts of wealth, Term-2 is the total spending on the justified shifts of wealth, Term-3 is the aggregate spending on investigation, and Term-4 is the total wasteful litigation spending due to a lack of investigation.

The court's utility under third-party funding may be written as

$$\begin{aligned}\mathrm{SV} = \Big(p[(1-s)R + A(i{=}1, I \leq I^f) - k]\int_0^{I^f} f_I(x)\,dx - \int_0^{I^f} x\, f_I(x)\,dx\Big) \\ + \Big([p(1-s)R + A(i{=}0, I > I^f) - k]\int_{I^f}^{\infty} f_I(x)\,dx\Big). \quad (13)\end{aligned}$$

when $pR - c_P \geq 0$.

As discussed, the effective price paid by the plaintiffs in bringing their claims is determined by the contracts. Contracts that yield the highest possible profit to the funder, as described in Lemmas-1 and -2, leave negligible portions of the surplus. Hence

$$p\big((1-s)R + A(i{=}1, I \leq I^f)\big) = p(R - c_P) \quad (14.1)$$

$$p(1-s)R + A(i{=}0, I^m > I > I^f) = p(R - c_P) - I \quad (14.2)$$

$$p(1-s)R + A(i{=}0, I > I^m) = pR - c_P. \quad (14.3)$$

[13]Notice that, if the funder's profits are taken equivalently to the payoffs of other parties, the resulting social value will be the same.

These expressions suggest that when there is virtually no competition between the funders, funding contracts do not pass on the cost efficiencies from the funders to the plaintiffs, while imposing extra costs to courts and defendants since plaintiffs with investigation costs in the range $I^m > I > I^f$ no longer investigate. Thus, the social value under non-competitive funding markets (SV_1) becomes

$$\mathrm{SV}_1 = pR - p(c_P + k) - \int_0^{I^f(p)} x\, f_I(x)\, dx - (1-p)(c_P + k) \int_{I^f(p)}^{\infty} f_I(x)\, dx.$$

Comparing SV_1 with SV_0 reveals that non-competitive funding markets will decrease the social value of litigation since

$$\mathrm{SV}_1 - \mathrm{SV}_0 = \int_{I^f(p)}^{I^m(p)} x\, f_I(x)\, dx - (1-p)(c_P + k) \int_{I^f(p)}^{I^m(p)} f_I(x)\, dx \tag{15}$$

and $(1-p)c_P > \int_{I^f(p)}^{I^m(p)} x\, f_I(x)\, dx$. Thus, even if k were assumed to be zero, non-competitive litigation markets decrease the welfare of the civil justice system.

The funding contracts must also ensure participation by the funder, which suggests that the best funding contracts could offer to the plaintiffs is given by

$$p\big((1-s)R + A(i{=}1, I \leq I^f)\big) = p(R - c_F) \tag{16.1}$$

$$p(1-s)R + A(i{=}0, I > I^f) = pR - c_F. \tag{16.2}$$

These contracts may be offered by funders if they operate in a perfectly competitive market so that they break-even in expectations. Consequently, the social value under perfectly competitive funding markets (SV_2) is given by

$$\mathrm{SV}_2 = pR - p(c_F + k) - \int_0^{I^f(p)} x\, f_I(x)\, dx - (1-p)(c_F + k) \int_{I^f(p)}^{\infty} f_I(x)\, dx. \tag{18}$$

Thus, the change in the social value of litigation when the market for litigation is competitive is given by

$$\begin{aligned}\mathrm{SV}_2 - \mathrm{SV}_0 = \Big(&p(c_P - c_F) + (1-p)(c_P - c_F) \int_{I^m(p)}^{\infty} f_I(x)\, dx \\ &+ \int_{I^f(p)}^{I^m(p)} x\, f_I(x)\, dx\Big) - \Big((1-p)(c_F + k) \int_{I^f(p)}^{I^m(p)} f_I(x)\, dx\Big).\end{aligned} \tag{19}$$

Expression-19 is higher than Expression-16, suggesting that the change in the social value is less likely to be negative. In particular, whether the change in social value when the funders break even is positive depends on how large k is with respect to the cost differentials between the funders and plaintiffs.

Recall that this measure of social value of litigation overlooks the many mechanisms through which access to justice benefits of the industry materialize. Obviously, these benefits are not enjoyed by the victims if the industry is not competitive, whereas they would inflate the maximum social value that could be reached under third-party funding. To the extent that the litigation funding industry is competitive and the access to justice problem is prevalent, the industry yields favorable outcomes for the civil justice system. For this reason, the general regulatory efforts should aim to foster competition in the funding industry, acknowledging that the litigation funding industry does not necessarily ensure that the negative externalities the access to justice problem places upon the civil justice system are internalized.

1.3.7 Client Protection and Lawyer Professionalism

The litigation funding business should raise significant concerns over client protection and lawyer professionalism. As discussed, the access to justice problem partly stems from plaintiffs being non-sophisticated, one-shot players. On the contrary, litigation funders are well-sophisticated, repeat players. This creates an informational asymmetry that favors the funders, potentially allowing them to cut prices or induce plaintiffs to opt for funding even when it is less advantageous than self-financing. One might argue that lawyers, as common agents of the courts and their clients, can prevent such abuses. However, lawyers are also repeat players and, hence, may establish long-lasting relationships with the funders. While such relationships are often seen as positive due to the market's disciplining effects (Molot, 2011), there is a risk that funders and lawyers might enter into tacit or explicit side contracts that could compromise the lawyers' fiduciary duties to their clients and the courts. Tautologically, funders might have law firms cherry-picking on behalf of them and prioritize claims that offer high rents to the funder at the expense of plaintiffs.

Because competition forces funders to offer more favorable terms, it limits their ability to abuse their position, suggesting that a competitive litigation market will yield additional benefits. Thus, competition does not only ensure that the plaintiffs enjoy the efficiencies that come with the funding business but also guards them against the possibly hazardous effects of the positional disparities between funders and plaintiffs.[14] □

[14] Similar considerations may also be found in the unmatured claim sales analysis of Cooter

1.3.8 Competition

The market for Third-Party Litigation Funding (TPLF) features low barriers to entry, primarily because the costs incurred by funders are predominantly variable (Solas, 2019). However, the litigation market necessitates asset-specific investments, such as due diligence and expert fees. The asset-specific nature of investments suggests that permitting competition at each stage of the funding arrangement could lead to inefficient outcomes due to premature termination (Duffy, 2016; Shamir and Shamir, 2021; Williamson, 1985). Thus, safeguard measures that lock in plaintiffs might be justified on efficiency grounds.

Nevertheless, these measures could enhance the funders' ability to capitalize on their advantages and seek self-interested control over the claim.[15] Furthermore, it is crucial to ensure that the funders remain solvent, possess the financial resources necessary to cover litigation costs, and have the capability to manage complex litigation. These requirements also serve to limit how aggressively funders might behave towards their locked-in clients. Thus, ex-ante competition per se may not be potent enough to limit the possible adverse effects of the industry. This indicates that additional regulatory measures that potentially increase entry barriers and limit competition may be necessary, such as court supervision, licensing schemes, or self-regulatory measures as discussed in some common law jurisdictions (Duffy, 2016; Greenberg et al., 2020; Mavrakis et al., 2014; Spender, 2008).

To sum up, this section revisited the assumptions that underpinned the results of the previous section, such as the commitment, observability, and exogenously determined shares of the funders. None of these assumptions seems to jeopardize the predictions of the model. For instance, the commitment assumption might well be plausible since the funders are repeat players, and dropping it would not negate the access to justice benefits of litigation funding, which addresses various barriers to justice. Likewise, case selection and contractual design may address possible adverse selection arising from asymmetric observability. More importantly, the value-creating effect of information gathering might be much higher than the model predicts, potentially inducing funders to offer investigation contracts. Nevertheless, the trade-off between the productive value of information and the information rents

(1989).

[15]Funder's control over litigation claims raise significant concerns in legal realm. Readers from legal background are advised to take a look at Daly and Pitt (2016); Steinitz (2011). The actual cases that are related to the issue of control include the Gbarabe v. Chevron Corp action, which revealed that funders do seek self-interested control over claims they support, and the White Lilly, LLC v. Balestriere PLLC action, a dispute between a litigation funder and its legal partner that unveiled the issues TPLF raises for the legal profession.

cannot be ruled out.

Funders may target procedures susceptible to their influence, which would impose negative costs on the civil justice system. These are also the cases where the funder would not find information valuable. These issues often arise not from the involvement of litigation funders per se, but from the procedural designs that allow for abuses by any efficient initiator—not exclusively funders, though their involvement does pose a more systematic threat due to increased financialization. Thus, I argued that if a procedure is fragile to the financialization and commodification of legal rights and services, a more effective approach to mitigate the costs that litigation funding introduces is to address these procedure-specific issues rather than targeting the industry as a whole.

The model in the second section, however, suggests that the litigation funding industry might impose social costs even if the procedures are perfectly accurate. Moreover, there might be further problematic aspects of the industry since, as a repeat-player, it may prevent lawyers from performing their duties to courts and their clients. The degree to which cost efficiencies and access to justice benefits are enjoyed by plaintiffs depends on how competitive the funding industry is. Similarly, the ability of the funders to take advantage of unsophisticated plaintiffs hinges on the competitiveness of the industry. For these reasons, I argued that the main task of the regulatory efforts should be to foster competition and ensure consumer protection, although some barriers to competition in the form of regulatory barriers might be justified on efficiency grounds.

1.4 Conclusion

Third-party litigation funding is a promising market solution to the problem of access to justice. However, a critical policy question remains: does the industry impose additional costs on the legal system beyond those related to the access to justice issue? I have partially answered this question by introducing pre-filing investigation and showing that litigation funders might indeed increase frivolous filings, even if courts and defendants can detect whether a claim is meritorious. It was also shown that the funders' involvement alters how informed the claimholders are and that the direction of the change depends on the peculiarities of the type of legal claims taken on by the funders. Contrary to previous arguments, my findings suggest that litigation funders do not necessarily incentivize or deter information acquisition and might indeed increase frivolous filings. This indicates that any social costs of the industry are largely determined by the types of claims that dominate the funders' portfolios. I also argue that litigation funding's possible adverse effects are soothed by competition in the funding industry and that weak procedural designs in the face of growing financialization of the legal sector should be a great matter of concern. Thus, future research on third-party litigation funding should focus on the portfolio formation strategies of funders, the actual industrial affairs within the funding business, and the challenges that litigation funding presents to certain procedures.

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Part II

Part II: Exclusionary Practices

Introduction to Part II

Introduction

A central controversy in the antitrust literature and in case law concerns whether practices that lack contractual exclusivity—such as rebates, loyalty discounts, or conditional pricing—can nevertheless produce exclusionary outcomes. The Chicago school argues that such contracts cannot be anticompetitive precisely because they lack pre-commitment: buyers remain free to switch after observing rivals' offers. This "commitment principle" has been highly influential in academic commentary.

The purpose of this part is to reassess that principle by shifting the focus from contractual form to economic mechanism. The guiding question is: which exclusionary mechanisms are at work in environments shaped by scale economies, and how do they operate under different institutional implementations—with or without pre-commitment? The scope of analysis spans both benchmark theoretical models and the practices at the center of major antitrust cases, including *Michelin II*, *British Airways*, and *Intel*.

The first chapter in this part, a Comment on Fumagalli and Motta (2008), sets the stage by returning to a novel exclusionary mechanism. There, downstream buyers sign exclusive contracts before entry, and the analysis shows that competition among them has an ambiguous effect: it can facilitate entry, but it can also sustain exclusion through a raising rivals' costs effect among buyers. This chapter is not merely a critique; its significance is to discover a novel mechanism that later reappears in settings without pre-commitment.

The following papers extend the analysis beyond buyer pre-commitment. *Peer Raising Rivals' Costs and the Limits of Contracts for Entry Accommodation* demonstrates that exclusion can arise even when buyers remain formally free, once scale disadvantages generate negative demand externalities that impose costs on other buyers, while proposing environments where such effects might occur and reading canonical antitrust cases through this lens. In such environments, one buyer's refusal to support a rival raises the risks faced by others, creating self-reinforcing foreclosure. It also treats the implications of the modeling choice of downstream competition. Under final-consumer coalitions or homogeneous-goods Bertrand, entry arises as the unique outcome. But once buyers compete in the final market, coalition-proofness need not imply entry—sub-coalitions can profitably deviate from entry to expose the other buyer(s) to higher effective costs. Finally, it discusses contractual richness arguments and whether richer contracts offered by the rival can defeat simple discount schemes of a dominant firm.

The next chapter, *Exclusion Without Commitment: Financial Fragility and En-*

try Deterrence, adds another layer by showing how conditional rebates interact with entrants' budget constraints. Here, exclusion emerges through a combination of financial fragility, lack of rival commitment, and incumbency advantages. It also finds a novel mechanism when entrants are budget constrained: *strategic chilling*, where buyers split their patronage to avoid head-to-head competition if the entrant makes an offer, causing losses to the entrant and, hence, driving it off the market.

The through-line of Part II is therefore mechanism-first. Across chapters, the analysis demonstrates that exclusionary outcomes do not hinge solely on buyer pre-commitment or availability of contracts. Instead, they are sustained by mechanisms—raising rivals' costs, negative demand externalities, and strategic chilling—that operate under different institutional forms. By tracing these mechanisms across both commitment and no-commitment environments, Part II contributes to understanding not only why exclusion arises in theory, but also how it has played out in some of the most contested antitrust cases.

Real-World Motivation

The controversy over exclusionary practices is not merely theoretical. Many of the most prominent abuse-of-dominance cases have centered on conditional rebates, retroactive discounts, and related schemes. These cases illustrate how the same underlying economic mechanisms—scale thresholds, future threats, liquidity constraints—can be implemented through different institutional forms. This section provides short vignettes of four landmark cases that motivate the analysis in Part II.

Intel (x86 CPUs; OEM rebates and retail exclusivity payments)

Intel maintained a dominant position in x86 CPUs during 1997–2007 and pursued what the European Commission characterized as a single foreclosure strategy. The firm offered conditional rebates to major OEMs (Dell, HP, NEC, Lenovo) that required near-total alignment with Intel, and made payments to the retailer Media-Saturn-Holding to stock only Intel-based PCs. Intel also provided "naked restrictions"—payments to HP, Acer, and Lenovo to delay or limit the launch of AMD-based products. The Commission found that these schemes leveraged OEMs' dependence on Intel's broad portfolio and created belief-driven risks of losing substantial rebates if they split purchases, thereby chilling support for AMD. The strategy combined conditional pricing and lump-sum payments with explicit contractual restraints, showing how a mixed implementation—rebates plus direct contractual restrictions—reinforced the same mechanism of foreclosure.

Post Danmark (bulk direct-mail; retroactive annual rebates)

Post Danmark offered a standardized, retroactive rebate scheme for direct advertising mail, calculated on an annual basis. As the incumbent with universal service obligations and near-complete coverage, Post Danmark was the unavoidable trading partner for large customers. A new entrant, Bring Citymail, operated only in Greater Copenhagen and exited the market after heavy losses. The Danish authority emphasized that the rebate structure amplified risks for customers: shifting part of their demand to the entrant would jeopardize accumulated rebates on all their remaining volume with Post Danmark. Here, exclusion was sustained not by contractual exclusivity but by a pricing-based design that made switching privately costly.

British Airways (travel agency commissions; performance rewards)

British Airways (BA) designed its travel agent remuneration around a basic commission plus retroactive "performance rewards." Once an agent met monthly growth targets for BA ticket sales, the higher commission applied retroactively to all BA sales in that period. This structure meant that diverting even a small portion of sales to a rival carrier risked the loss of increased commission on the entire remaining BA volume. In effect, the scheme raised rivals' costs at the distribution node by making partial switching privately costly for agents. Like Post Danmark, this was a pricing-based implementation without pre-commitment, where the market characteristics themselves generated adverse effects.

Summary

Across Intel, Post Danmark, and British Airways exclusionary outcomes were sustained not by formal exclusivity clauses alone, but by the interaction of economic mechanisms with different institutional implementations. Firms relied on scale thresholds, future threats (loss of accumulated rebates and the costs created by rival's fragilities), and in some cases liquidity constraints (as in Bring Citymail's inability to absorb losses) to foreclose rivals. These mechanisms were implemented through explicit contracts, through pricing structures that mimic commitment, or through combinations of both. This observation motivates the central argument of Part II: exclusion cannot be fully understood by classifying practices by form alone; instead, it requires tracing how mechanisms that magnify the costs from losing discounts reappear across institutional contexts.

Mechanisms and Their Implications

Form-based classifications—exclusive contracts, loyalty rebates, below-cost pricing—do not explain why efficient entrants may be foreclosed as the necessary condition for a practice to have exclusionary grip is that a failure of a rival to achieve sufficient scale harms its customers, which is not necessarily tied to pre-commitment or contractual exclusivity. The analysis in this part of the thesis shows that exclusion depends instead on three mechanisms tied to market structure, which can operate with or without formal exclusivity.

Coordination failures. When an entrant must achieve a scale threshold to be viable, each buyer's willingness to switch depends on whether others also do so. No buyer wants to be stranded with a sub-scale supplier, so everyone prefers the incumbent unless assured of collective movement. Even if entry would be efficient overall, the failure to coordinate leaves the rival excluded. Yet, as we shall see, allowing for communication as a means to coordinate buyers' actions do not necessarily result in entry and expansion even when the baseline game without communication exhibits multiple equilibria.

Raising rivals' costs. When pivotal buyers compete downstream, supporting a sub-scale rival may worsen a buyer's competitive position if one of its opponents stay with the incumbent. To avoid giving competitors an advantage, buyers rationally continue to support the incumbent. In this way, downstream rivalry itself sustains foreclosure.

Strategic chilling. Buyers may deliberately split their purchases in a way that keeps the entrant below scale when the entrant cannot commit to making sufficient losses below scale. Some buyers stay with the incumbent, while others source from both suppliers, including a limited discounted share from the entrant. This asymmetric allocation prevents the rival from ever reaching viability and simultaneously softens downstream competition. No exclusivity clause is required—the structure of incentives alone produces a stable, exclusionary outcome.

These mechanisms are shaped by structural conditions. Two are particularly important. The first is the incumbency advantages (or, equivalently, the rival's fragilities vis-à-vis the dominant firm): established firms enjoy scale economies, broad coverage, and reputational credibility, all of which magnify the risks buyers face when considering defection. The second is the entrant's fragility as transmitted to buyers—for example, the inability to finance losses (or to grant concessions needed to offset quality gaps) below scale, quality disadvantages linked to network effects, limited coverage, or other weaknesses that undermine the credibility of its offer. What matters, however, are the channels through which fragility affects buyers: exclusivity clauses that make any weakness more costly to test, financial constraints that prevent the rival from absorbing losses, or demand-side scale effects that reduce the value of the product at low adoption. These channels often coincide with the fragilities themselves. This interplay of fragility, incumbency advantage, and transmission channels is what shapes buyer incentives in exclusionary settings.

Recognizing these mechanisms carries several implications. Theoretically, it challenges the standing Chicago view that exclusion requires binding exclusivity or contractual pre-commitment. Once incumbency advantages and rival fragility are taken into account, exclusion can arise in settings where buyers remain formally free. As we shall see, classic Chicago remedies do not generically ensure entry and expansion as well.

In legal analysis, the mechanism-based approach reframes how to interpret several important cases. Instead of asking whether rebates were loyalty-inducing in form or whether prices fell below cost, the relevant question is whether the practice activated an exclusionary mechanism. Contracts and rebates are simply the implementations through which such mechanisms operate.

For enforcement, the contrast with form-based approaches and predatory pricing paradigm is especially sharp. Classifying practices by label (exclusivity, loyalty rebates, fidelity discounts) or relying solely on price–cost screens risks missing the economic reality of foreclosure. A mechanism-based assessment instead asks: does the practice create interdependent risks that deter switching? Does it allow downstream buyers to raise one another's costs? Does it exploit fragilities that undermine the credibility of entrants and allow incumbent to economize on concessions it has to make to exclude? By shifting attention from the form of practices to the mechanisms they activate, authorities can avoid both false positives and false negatives, aligning assessment with the structural forces that drive exclusion.

Literature Review

Although later chapters return to the literature as needed, it is useful to set the stage at the outset. Modern analysis of exclusionary practices is typically divided into two strands. The "Chicago school" view maintains that inefficient exclusion is rarely rational, absent some efficiency rationale. The post-Chicago literature, by contrast, identifies conditions under which exclusion can be profitable even against efficient rivals.

The first wave of modern post-Chicago work showed how contractual commitments could sustain exclusion. Aghion and Bolton (1987) demonstrated that exclusivity contracts can act as a rent-shifting device, effectively imposing an implicit entry fee on potential rivals. Rasmusen et al. (1991) and Segal and Whinston (2000) developed the "naked exclusion" framework, in which an incumbent coordinates through contracts with multiple buyers to deprive the entrant of the scale necessary to compete. Fumagalli and Motta (2006, 2008) extended this analysis to downstream competition, arguing that when buyers compete aggressively against one another, coordination on exclusion is harder to sustain and exclusivity contracts lose much of their force.

A common element in this body of work is the role of *contractual pre-commitment*. Buyers bind themselves ex ante to terms that alter their ex post incentives, and the incumbent uses these commitments to organize foreclosure.

The first paper in this part of the thesis—the *Comment* on Fumagalli and Motta (2008)—takes this pre-commitment tradition as a starting point but makes a distinctive correction. Fumagalli and Motta argued that downstream competition undermines exclusion, since buyers competing against each other have stronger incentives to defect from exclusivity. The *Comment* shows that this conclusion is incomplete. Using their framework, it demonstrates that downstream competition can also eliminate equilibria with entry. A single buyer may prefer to remain with the incumbent, even at a higher input price, if that prevents the entrant from reaching minimum scale. Once the entrant is kept out, rival buyers must return to the incumbent on worse terms, raising their costs and benefiting the deviator. Note that this mechanism is distinct from the classic raising-rivals'-costs approach to exclusion, where upstream firms engage in practices that directly affect their weaker rivals' costs (**?**). The raising-rivals'-costs mechanism identified in this thesis refers instead to a form of buyer opportunism arising from the upstream firm's ability to design downstream incentives through pricing. The contribution is therefore not to repeat that exclusivity can exclude, but to identify how downstream rivalry itself can sustain foreclosure.

This matters because the same mechanism is also observed under practices that do not entail contractual pre-commitment, and the impact of downstream rivalry is a central question in antitrust analysis, as most practices involve such environments.

A second question taken up in the literature is whether exclusion can arise when buyers remain formally free and richer contracutal or bargaining environments are considered. Ide et al. (2016) argue that it cannot. Analyzing rebate schemes of the type at issue in *Post Danmark* and *British Airways*, they show that such schemes lack the commitment power of exclusivity clauses. Because buyers make decisions ex post, incumbents cannot prevent them from switching to a more efficient entrant unless the offers involve unconditional transfers. Their conclusion is that foreclosure requires commitment or ad hoc restrictions on bargaining: without binding clauses, efficient entry should prevail, and the lessons of the exclusivity literature cannot be extended to rebates.

The analyses in this thesis depart sharply from that conclusion. They show that exclusion can persist without binding contracts when entrants face scale disadvantages or commitment problem, and when downstream rivalry alters buyers' incentives. In such settings, even formally non-binding arrangements can deprive entrants of the scale required to survive and defeat richer contractual arrangements by the rival. The underlying force is not the legal form of commitment but the structure of incentives created by coordination problems and competitive interactions.

Related insights come from the literature on predation. The Chicago view, following McGee (1958) and Posner (1976), was skeptical that predation could ever be rational.[1] A more general version of this Chicago school idea is that sufficiently rich contracts, buyer communication, and the presence of all relevant parties are sufficient to prevent inefficient exclusion. Although this idea rests on the Coasean principle that externalities are bargained away, such bargaining can ensure efficiency only if the system is a closed one, where all parties can attend the bargaining, the costs associated with bargaining are low, and parties can commit to contracts. In many important antitrust cases where buyers compete, however, the system is open, as the final consumers—a usually disorganized group—cannot be made a party to the bargaining between sellers and buyers, although their interests are taken into account by the bargaining parties. This is, in my opinion, one of the most interesting aspects of exclusionary practices.

[1] Of course, more contemporary literature shows that it can be the case, also through financial predation, reputation, incomplete information, and other imperfections that we are not going to discuss in this thesis (Milgrom and Roberts, 1982; Bolton and Scharfstein, 1990; Rasmusen et al., 1991).

The rival's ability to commit to certain practices is another interesting, but often overlooked, aspect of exclusion. In typical cases, the incumbent has a proven track record of performance in a market, whereas the rival lacks such visibility. Moreover, expanding—or promising to expand—its activities over a market entails large interim costs for an entrant. Given the fragilities and weaknesses it faces, the contracts and projects that an entrant can credibly offer are presumably limited. As we shall see, this credibility or commitment issue might result in a novel exclusionary mechanism whereby a more efficient rival is forced to make less favorable contracts than it otherwise could, or no offer at all.

Taken together, Part II shows that in open systems where downstream competition exists, the rival faces built-in commitment problems, and the incumbent's practices take the form of simple pricing decisions without buyer pre-commitment, these elements can operate as structural factors leading to exclusion. Thus, it also demonstrates the boundaries of the Chicago approach. The case law reflects similar points: in many recent antitrust cases, formal exclusivity clauses were absent, yet foreclosure concerns arose. In those cases, as the following analysis shows, what mattered was whether the practice interacted with rival fragility and competitive dynamics in ways that undermined entry. This broader lesson motivates the analyses that follow: the mechanisms are decisive, while neither legal labels nor counterfactual contracting situations can be fully informative.

Roadmap of Part II

Chapter 2 — *A Comment on Buyers' Miscoordination, Entry, and Downstream Competition.* The first chapter of Part II revisits the classic naked exclusion setting under exclusivity contracts. It challenges the claim that downstream competition undermines exclusion by showing that competition among buyers can itself sustain foreclosure. A buyer may prefer to remain with the incumbent—even at higher prices—if doing so prevents a rival from reaching minimum scale, thereby raising competitors' costs once they must return to the incumbent. The contribution is to isolate the mechanism of **downstream rivalry interacting with scale thresholds**, which not only reshapes the interpretation of exclusivity contracts but also foreshadows dynamics that persist even without contractual pre-commitment.

Chapter 3 — *Peer Raising Rivals' Costs and the Limits of Contracts for Entry Accommodation* This chapter abstracts from contractual form to show that the same exclusionary mechanism operates both when buyers sign binding commitments and when they remain formally free but face future threats realized through network effects. The central insight is that exclusionary force derives from how scale disadvantages shape buyer incentives, not from legal form. Using insights from the baseline model, the analysis confronts four presumptions in the literature: (i) that "negative externalities" alone cannot sustain exclusion without buyer pre-commitment; (ii) that communication selects accommodation, whereas coalitions can instead raise rivals' costs and sustain exclusion; (iii) that sufficiently rich bilateral contracts generically neutralize exclusion, despite feasibility is restrained by raising-rivals'-costs mechanism unless the rival has full commitment power; and (iv) that tweaks to supposedly bring "all parties" to bargaining cures exclusion indeed entails much stronger requirements such as centralized demand or full rival commitment. The chapter illustrates these points with major EU cases—*Michelin II*, *British Airways*, *Intel*, and *Post Danmark*.

Chapter 4 — *Exclusion Without Commitment: Financial Fragility and the Built-in Commitment Problem.* This chapter incorporates financial fragility and the commitment problem the weak entrants face into the mechanism-first framework. It shows how liquidity limits, together with scale disadvantages, generate capacity shortfalls that create risks and costs for buyers if they shift to the entrant. Conditional rebates exploit these vulnerabilities by forcing buyers to internalize the danger of being stranded with a sub-scale supplier. A distinctive mechanism of strategic chilling arises when buyers compete downstream: rather than coordinating to support the entrant, they deliberately split their purchases, ensuring the rival never reaches viability while simultaneously softening their own competition, thereby pushing rival off the market. The analysis demonstrates how incumbency advantages interact with entrants' built-in commitment to sustain foreclosure.

Part II develops a cumulative argument. Chapter 3 establishes the baseline mechanism under pre-commitment. Chapter 4 generalizes it, showing that the same forces operate under future threats and that richer contracts by rival does not necessarily defeat simple pricing practices pursued by the dominant firm. Chapter 5 extends the analysis to environments with liquidity constraints and commitment issues on the rival's side, introducing strategic chilling. Readers may follow each chapter independently, but taken together they trace how exclusionary mechanisms operate across institutional forms and how theory translates into diagnostic standards for competition law.

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Chapter 2

A Comment on Buyers' Miscoordination, Entry, and Downstream Competition

A Comment on Fumagalli and Motta (2008)[*] [†]

[*]This paper was published in the Economic Journal.

[†]I am deeply grateful to Vincenzo Denicolò for his invaluable guidance and support.

Abstract

Fumagalli and Motta (*The Economic Journal*, 2008) argue that competition among downstream buyers limits the ability of a dominant upstream firm to deter entry by a more efficient competitor. This comment demonstrates that the impact of downstream competition is, in fact, more complex. In particular, competition can motivate buyers to favor the incumbent due to a "raising rivals' costs" effect.

2.1 Introduction

A common concern in competition policy is that incumbents may use long-term contracts with buyers to lock in demand, thereby preventing the entry and expansion of more efficient potential competitors. This issue frequently arises in markets where the buyers are firms competing in a downstream market rather than final consumers. Thus, it is crucial to understand how downstream competition influences these entry deterrence mechanisms.

In an influential paper, Fumagalli and Motta (2008) (hereafter FM) argue that downstream competition unambiguously facilitates entry. In their model, both entry and no-entry equilibria exist when buyers do not compete with one another. The no-entry equilibria arise from a coordination failure among buyers. However, as downstream competition intensifies, this coordination failure becomes less likely. Consequently, when buyers compete, the no-entry equilibria may disappear. FM thus conclude that competition hinders entry deterrence.

In this comment, I argue that FM's analysis is incomplete. While they correctly identify the impact of downstream competition on no-entry equilibria, they overlook how such competition can also undermine entry equilibria. This occurs through a *raising rivals' costs* effect, which I will discuss in more detail below. I will show that this effect can eliminate entry equilibria across a wide range of parameter values, leaving only the no-entry equilibria. This suggests that, contrary to FM's conclusion, the impact of downstream competition on entry is, in fact, ambiguous.

2.2 Analysis

2.2.1 Assumptions

FM analyze an industry with two upstream firms — an incumbent (I) and an entrant (E) — and n symmetric downstream firms, denoted as $i = 1, 2, ..., n$. The products of the upstream firms are perfect substitutes and are used by downstream firms in production with a fixed, one-to-one input-output ratio. The downstream firms' products are substitutes for the final consumers, with the degree of substitutability being a key parameter in the model. The intensity of downstream competition depends both on the number of firms and the degree of product substitutability.

The entrant is more efficient than the incumbent, as it has a lower marginal cost (the entrant's cost is normalized to 0, while the incumbent's cost is denoted as $c_I > 0$). However, the entrant must pay a fixed entry cost $F > 0$, which the incumbent has already incurred. The downstream firms' marginal costs consist solely of the price they pay for the input, denoted as w_I or w_E, depending on whether they purchase from the incumbent or the entrant.

The game proceeds as follows (see FM's Figure 1). First, the upstream firms simultaneously submit uniform price bids, committing to supply the good at these prices to any buyer that approaches them. Buyers then choose which seller to approach, committing to procure the input only from that seller if it will be active. Next, the entrant decides whether to pay the entry cost F or not. If the entrant chooses not to enter, the buyers who initially approached the entrant solicit another uniform price bid from the incumbent. Finally, the downstream firms compete in quantities, and profits are realized.

While the FM analysis is more general, for simplicity, we focus on the case of two downstream firms ($n = 2$) and contrast the extreme cases where the final products are either independent — making each downstream firm a local monopoly — or perfect substitutes.

Finally, following FM, we focus on the following set of parameter values:

$$\frac{1}{4}\left(2-\sqrt{2}\right) < c_I < \frac{1}{3}, \tag{2.1}$$

and:

$$\frac{1}{16} < F < \frac{c_I(1-c_I)}{2}. \tag{2.2}$$

These conditions ensure that, if the downstream firms operated in independent markets, entry would be viable but could not be sustained by a single buyer.

2.2.2 Non-competing buyers

When downstream firms supply independent products, the demand for each product is given by $q_i = \frac{1}{2}(1-p_i)$. In this scenario, there is no competition among buyers, similar to the situation if the buyers were final consumers.

As demonstrated by FM, the game allows for both entry and no-entry equilibria. No-entry equilibria arise due to a coordination failure among buyers: if one buyer chooses to purchase from the incumbent — even if the incumbent's price is higher than what the entrant would charge — the remaining buyer's demand alone would not be sufficient for the entrant to cover its fixed costs (as implied by conditions (1) and (2)). Consequently, this buyer has no incentive to switch to the entrant.

As FM show, there is a multiplicity of equilibria of both types. To better understand what the entry and no-entry equilibria look like, it is useful to focus on the entry equilibrium where $w_E = w_I = c_I$ and both buyers purchase from the entrant, and on the no-entry equilibrium where the incumbent charges the monopoly price, while the entrant sets a lower price. That is,

$$w_E < w_I = \frac{1+c}{2}(= w_I^M). \tag{2.3}$$

Despite $w_E < w_I$, both buyers still patronize the incumbent due to the coordination failure mentioned earlier. Nevertheless, the perfectly coalition-proof Nash equilibrium always entails entry with non-competing buyers (see Remark 1 in FM).

2.2.3 Downstream competition

Against this benchmark, consider now the case where the products supplied by the downstream firms are perfect substitutes. In this case, the inverse demand for the final product is $p = 1 - q_1 - q_2$.[1] In the Cournot equilibrium, each downstream firm supplies $q_i = \frac{1-2w_i+w_j}{3}$ units of the product, where w_i denotes the price paid by firm i to its supplier.

No-entry equilibria

As FM correctly observe, downstream competition undermines certain no-entry equilibria. To understand why, consider that the incumbent will do everything possible to sustain a no-entry equilibrium, even if that requires pricing at cost ($w_I = c_I$), as it would earn no profit in an entry equilibrium regardless. On the other hand, to disrupt a no-entry equilibrium, the entrant will set a price that maximizes its profit when a buyer deviates and chooses to purchase from it, thereby maximizing its chances of covering its fixed costs. This optimal price is:[2]

$$\arg\max_{w_E \leq c_I} \left[w_E \frac{1 - 2w_E + c_I}{3} \right] = c_I. \tag{2.4}$$

If the resulting profit, $\frac{c_I(1-c_I)}{3}$, exceeds F, then no-entry equilibria cannot exist. This scenario occurs below the curve:

$$F = \frac{c_I(1 - c_I)}{3}. \tag{2.5}$$

The intuitive reason for the disappearance of no-entry equilibria is that with downstream competition, a single downstream firm that secures its input at a lower cost

[1]The demand functions are derived from the more general functions with continuously variable degree of product substitutability used in FM.

[2]The constraint $w_E \leq c_I$ is always binding since the unconstrained solution, $w_E = \frac{1+c_I}{4}$, would exceed c_I when $c_I \leq \frac{1}{3}$.

than its rival can capture enough final demand to make entry profitable. Because no buyer faces a re-contracting threat from choosing the entrant in this case, and lower input prices translate into higher profits, each buyer opts for the entrant.[3]

For the same reason, even when no-entry equilibria persist, the incumbent may be forced to reduce its price compared to a scenario without competition. Specifically, the incumbent can no longer charge the monopoly price w_I^M, as shown by FM. Thus, when buyers compete, either no-entry equilibria disappear entirely, or they become less profitable for the incumbent than when buyers are local monopolies.

Entry equilibria

FM claim that entry equilibria persist even with competition, concluding from this and their findings on no-entry equilibria that downstream competition unequivocally facilitates entry. However, competition among buyers may, in fact, undermine also entry equilibria.

To see why, consider a candidate entry equilibrium where $w_E \leq w_I = c_I$, with both buyers choosing to patronize the entrant. In this candidate equilibrium, each buyer earns a profit of $\frac{(1-w_E)^2}{9}$. For this to truly be an equilibrium, however, neither buyer should have an incentive to deviate and purchase from the incumbent instead.

Why might such a deviation — one that involves the deviating buyer paying a higher price — ever be profitable? The answer lies in the possibility that this deviation could deter the entrant from entering the market, leaving the rival buyer dependent on the incumbent for its input. If this happens, the incumbent would charge the rival buyer a price higher than c_I due to its captive position. As a result, the rival's costs would rise, potentially making the strategy profitable for the deviating buyer.[4] Note that this mechanism functions only when buyers compete,

[3] This implies that under Bertrand competition with homogeneous goods, entry is the only equilibrium, as the downstream firm with the lower input price captures the entire market.

[4] Re-contracting allows buyers to raise each other's costs and is the only source of risk for buyers considering patronizing the entrant. Without it—say, if the incumbent commits to its initial price

as otherwise, a buyer's profit would be unaffected by its rivals' costs.

From this reasoning, it appears that two conditions must be met for such a deviation to be profitable. First, the deviation must deter entry; otherwise, the strategy of raising the rival's costs would not work. Second, the deviating buyer's profit, when it pays $w_I = c_I > w_E$ and the rival pays the even higher price set by the incumbent during re-contracting, must exceed $\frac{(1-w_E)^2}{9}$.

Since the entrant's profit when a buyer deviates is $w_E \frac{1-2w_E+c_I}{3}$, the condition for the deviation to render entry unprofitable is:

$$w_E \frac{1 - 2w_E + c_I}{3} \leq F. \tag{2.6}$$

On the other hand, the price the incumbent would charge the non-deviating buyer during re-contracting is:

$$\arg\max_{w_I} \left[(w_I - c_I) \frac{1 - 2w_I + c_I}{3} \right] = \frac{1 + 3c_I}{4}, \tag{2.7}$$

which results in a profit of $\frac{25(1-c_I)^2}{144}$ for the deviating buyer. Therefore, for the deviation to be profitable, the following condition must also hold:

$$\frac{25(1 - c_I)^2}{144} \geq \frac{(1 - w_E)^2}{9}. \tag{2.8}$$

Thus, an entry equilibrium exists if and only if the entrant can set a price that ensures at least one of these conditions, (6) or (8), does not hold.

Condition (6) is most restrictive when $w_E = c_I$, implying that an entry equilibrium exists below the $F = \frac{c_I(1-c_I)}{3}$ curve (where no-entry equilibria do not exist). Condition (8) is most restrictive when $w_E = \frac{1-\sqrt{1-6F}}{2}$, which represents the lowest price for which entry is viable. Plugging this expression into (8), one sees that an

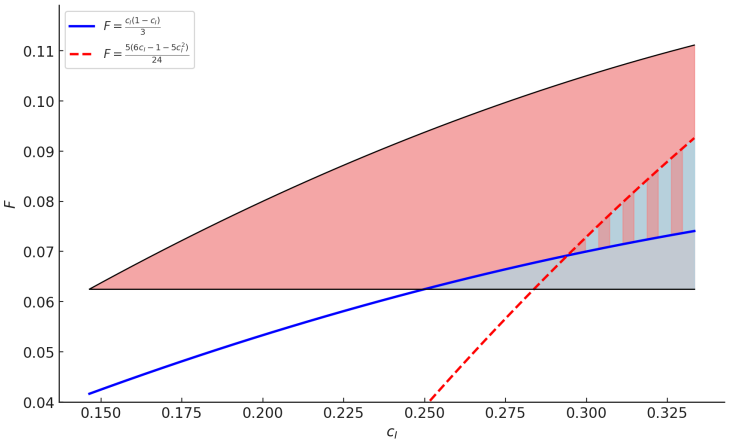
offer—choosing the entrant becomes the dominant strategy, as buyers face no risk of paying more than the incumbent's initial price.

entry equilibrium also exists below the curve:

$$F = \frac{5(6c_I - 1 - 5c_I^2)}{24}. \tag{2.9}$$

Above both curves, however, only no-entry equilibria exist.

Figure 2.1: The colored area represents the set of admissible parameter values defined by conditions (1) and (2). With non-competing buyers, both entry and no-entry equilibria exist throughout this entire region. Under downstream competition, however, only entry equilibria are present in the blue region, while only no-entry equilibria persist in the pink region. In the shaded area between the blue (solid) and red (dashed) curves, both entry and no-entry equilibria coexist even with competition.



In summary, only entry equilibria exist when $F < \frac{c_I(1-c_I)}{3}$; only no-entry equilibria exist if $F \geq \max\left[\frac{c_I(1-c_I)}{3}, \frac{5(6c_I-1-5c_I^2)}{24}\right]$; and both entry and no-entry equilibria exist if $\frac{c_I(1-c_I)}{3} \leq F \leq \frac{5(6c_I-1-5c_I^2)}{24}$. These conditions are illustrated in Figure 1, which shows a sizeable range of parameter values where entry equilibria disappear under competition. Note that, while in the pink region entry is precluded due to the described effect, the emergence of no-entry equilibria in the striped region is attributable only to miscoordination. Specifically, no-entry (entry) equilibria in the striped region arise because each buyer has an incentive to align its decision with the other and may expect the other to patronize the incumbent (entrant). In contrast, in the pink region, a buyer expecting the other to endorse the incumbent will do the same, but each buyer has an incentive to deter entry if they expect the other to endorse the entrant, in order to raise their rival's costs—a mechanism that rules out entry as a viable collective choice.

2.3 Conclusion

The analysis above suggests that downstream competition does not necessarily facilitate entry but has more nuanced effects. With non-competing buyers, exclusion can arise only from miscoordination, which could be mitigated through communication and non-binding commitments, since entry constitutes the perfectly coalition-proof equilibrium.[5] When competition is sufficiently intense, however, a pivotal buyer can profitably raise a rival's costs by switching to the incumbent, thereby deterring entry. This raising rivals' costs effect eliminates the entry equilibrium, making no-entry the unique equilibrium prediction of the game, regardless of underlying communication or belief systems.

In this comment, I have illustrated how this mechanism works in the case of two buyers, contrasting the extremes where the two downstream products are either independent or perfect substitutes. In the online appendix, I demonstrate that this effect is more general and applies to scenarios with more than two firms and intermediate levels of product differentiation.

Although the setting analyzed here does not involve upstream firms using exclusive contracts, FM's assumption that buyers must engage with a single seller makes the scenario reminiscent of those in the exclusive dealing literature. The mechanism identified by FM, whereby downstream competition undermines no-entry equilibria, is indeed similar to that of the naked exclusion and two-part tariff models of Fumagalli and Motta (2006). Even in these contexts, further research has shown that downstream competition may facilitate exclusion rather than prevent it. This is be-

[5]The coalition-proof equilibrium does not always entail entry when the game admits both types of equilibria. In fact, with many buyers, sub-coalitions may find it profitable to disrupt an entry equilibrium without any subset having the incentive to restore it.

cause the competition among the buyers reduces buyers' profits and, consequently, the compensation required for buyers to sign exclusive contracts (see, e.g., Simpson and Wickelgren (2007), Abito and Wright (2008), and Wright (2009)). However, the effect highlighted in this comment is distinct, relying instead on a raising rivals' costs mechanism that breaks the entry equilibrium when buyers compete.

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Appendix

Introduction

I prove the following claim:

Claim: No-entry can be the unique equilibrium prediction in any game with finite n.

To prove this claim, I will begin with FM's analysis and then show why their Proposition 2 is incomplete. I conclude the annex with an addendum to Fumagalli and Motta's (2008) main proposition.

Fumagalli and Motta's Analysis

Fumagalli and Motta (2008), henceforth FM, analyze an industry with two upstream firms—an incumbent (I) and an entrant (E)—and $n \geq 2$ symmetric downstream firms competing in final markets. The upstream firms' product enters the downstream firms' production with a fixed input-output ratio. The entrant must pay a fixed cost of entry F, while the incumbent has already incurred this cost.

The upstream firms have constant marginal costs, c_I and c_E. FM assume $c_E = 0$ and $\frac{1}{2}\left(1 - \sqrt{1 - \frac{1}{n}}\right) < c_I < \frac{1}{3}$. They also focus on a case where, if the downstream firms were independent monopolies, serving all buyers at the incumbent's marginal cost would justify entry, but a single buyer alone could not trigger entry. These conditions are satisfied by assuming that:

$$F_{\min} \equiv \frac{1}{8n} \leq F < \frac{c_I(1 - c_I)}{2} \equiv F_{\max}. \tag{A1}$$

Final consumers have the following utility function:

where q_i is the quantity produced by the i-th firm, $\mathbf{q}$ is the quantity vector, and $\mu \in [0, \infty)$ is the substitutability parameter. Notice that $\mu = 0$ corresponds to the case where the downstream firms operate as independent monopolies, whereas $\mu \to \infty$ describes Cournot competition with homogeneous goods. From Expression (1), it follows that the market inverse demand function is:

$$p_i = 1 - \frac{1}{1+\mu}\left(nq_i + \mu \sum_{j=1}^{n} q_j\right). \tag{2.10}$$

The timeline is given below:

- At time t_1, the upstream firms simultaneously submit uniform price bids, committing to provide the good at their bid prices to the buyers who addressed them.

- At t_2, buyers choose which seller to approach, binding them to buy the good from the upstream firm they address if the firm is present at t_4.

- At t_3, the entrant decides whether to enter, with entry being profitable only if a sufficient number of buyers have approached the entrant.

- At t_4, if entry does not occur, those who initially addressed the entrant solicit another uniform price bid from the incumbent.

- At t_5, the downstream firms compete in the final markets.

Let us solve the game backwards. Equation (2) implies that the total quantity produced Q^* in the final markets is given by

$$Q^*(\mathbf{w}, n, \mu) = \frac{n - \sum_{i=1}^{n} w_i}{2\beta + \gamma(n-1)}, \tag{2.11}$$

where $\mathbf{w}$ is the input price vector, $\beta = \frac{n+\mu}{1+\mu}$, and $\gamma = \frac{\mu}{1+\mu}$. One can find the demand for an individual firm's product as follows:

$$q_i^*(\mathbf{w}, n, \mu) = \frac{1 - \gamma Q^* - w_i}{2\beta - \gamma}. \tag{2.12}$$

Finally, each downstream firm makes $\pi_i(w_i, \mathbf{w}_{-i}, \mu) = \beta \left(q_i^*\right)^2$ in profits. Note that $\pi_i(w_i, \mathbf{w}_{-i}, \mu)$ monotonically decreases in w_i and monotonically increases in others' input prices if $\mu > 0$.

Suppose that entry did not take place. At t_4, the incumbent will charge the price w_F on disloyal buyers' purchases, which solves the incumbent's profit maximization problem given w_I and the number of players that addressed it at t_1 (denoted k). This yields

$$w_F(\mathbf{w}, n, k, \mu) = \frac{(2\beta - \gamma)(1 + c_I) + 2\gamma k w_I}{2(2\beta + \gamma(k-1))}. \tag{2.13}$$

Note that w_F is necessarily higher than w_I if the latter is lower than the incumbent's monopoly price, and hence, free buyers will always want to deviate to the incumbent since their payoffs decrease in their own input prices.

At t_3, the entrant observes how many buyers have addressed it. By construction, there exists a positive integer n^* such that whenever the number of players that endorsed the entrant $(n-k)$ is greater than n^*, entry is justified.

At t_2, the buyers decide whether to choose the incumbent or the entrant. Their decision problem in a 2-buyer game can be represented with respect to their choice of input provider as follows:

A Generic Payoff Matrix for the 2-Buyer Game

	Incumbent	Rival
Incumbent	A, A	B, C
Rival	C, B	D, D

In the table above:

- $A = \pi_i(w_i = w_I, w_{-i} = w_I, \mu)$,
- $B = \pi_i(w_i = w_I, w_{-i} = w_A, \mu)$,
- $C = \pi_i(w_i = w_A, w_{-i} = w_I, \mu)$,
- $D = \pi_i(w_i = w_E, w_{-i} = w_E, \mu)$,

where $w_A = w_E$ if a single player is enough to trigger entry ($n^* = 1$), and $w_A = w_F$ if both players must endorse the entrant to trigger entry ($n^* = 2$).

The above table suggests that entry is possible only if $w_E \leq w_I$, and, hence, the entrant will undercut the incumbent in any equilibrium, implying $D \leq A$ in any possible game. It also implies that the incumbent would never want to price below its marginal cost; that is, $w_I \geq c_I$.

Recall that when $\mu = 0$, a single player is not enough to trigger entry due to the restrictions on F; that is, $C = \pi_i(w_i = w_F, w_{-i} = w_I, \mu = 0) < A$. Also, $A = B$ when the buyers are independent monopolies because the input prices of other buyers do not affect a buyer's payoff. Consequently, exclusion arises only from miscoordination when $\mu = 0$, as in any game where $D > B \geq A \geq C$.

FM focus on the entrant's profits from a single deviant buyer to examine the limits of the incumbent's reliance on coordination failures. The entrant's "maximum" profit from serving a single deviant buyer is a function of the form

$$\pi_E^{*d}\left(\underbrace{w_I}_{+}, \underbrace{\mu}_{+}, \underbrace{n}_{-}\right). \tag{2.14}$$

Since π_E^{*d} increases in the incumbent's offer (which can go as low as c_I) and the degree of competition, if the efficiency gap is sufficiently large, as proxied by higher levels of c_I, and entry costs are not excessively high, intense competition eventually eliminates coordination failures. FM refer to this as Case I. Case I arises if $\lim_{\mu\to\infty} \pi_E^{*d}(w_I = c_I, \mu, n) \geq F$, meaning a single player can trigger entry as $\mu \to \infty$. Otherwise, Case II arises.

Proposition 2, Case I: If $\lim_{\mu\to\infty} \pi_E^{*d}(w_I = c_I, \mu, n) \geq F$, then:

- **Weak downstream competition** ($\mu \leq \mu^*$): Both no-entry and entry equilibria can occur. The incumbent can maintain no-entry equilibria by offering up to its monopoly price w_I^m.

- **Moderate downstream competition** ($\mu^* < \mu < \mu^{**}$): Coordination failures persist. However, the maximum price to support no-entry equilibria becomes $w_I^{ex} < w_I^m$.

- **Sufficiently intense downstream competition** ($\mu^{**} < \mu$): Even a single buyer can make entry profitable for the entrant at the incumbent's marginal cost. Thus, entry is the only equilibrium.

Proposition 2, Case II: If $\lim_{\mu\to\infty} \pi_E^{*d}(w_I = c_I, \mu, n) < F$, then:

- **Weak downstream competition** ($\mu \leq \mu^*$): The incumbent can sustain no-entry equilibria at its monopoly price w_I^m.

- **Sufficiently intense downstream competition** ($\mu > \mu^*$): Coordination failures persist, and the incumbent can price up to $w_I^{ex}(\mu)$.

Thus, FM conclude that more intense competition either eliminates coordination failures or decreases the price that can be sustained at a no-entry equilibrium. Additionally, according to Expression (6), concentrated downstream markets increase the likelihood of entry, as larger buyers offer greater potential profits for the entrant when they choose to deviate.

Discussion

The problem is that FM do not take into account that entry might be ruled out as a possibility as competition intensifies. However, the two conditions below suffice to eliminate entry as an equilibrium:

1. **Existence of a Pivotal Buyer**: Unilateral deviation from everyone addressing the entrant can prevent entry.

2. **Competitive Advantages from Deviation**: The deviant buyer makes higher profits by deviating when every other player addresses the entrant, even if the entrant bids the lowest price it can bid to cover entry costs.

Begin with the first condition and assume that every buyer believes the others will address the entrant, with $n \geq 3$. We are interested in cases where $n-1$ players cannot make entry profitable for the entrant. Assume that $w_I = c_I$ to determine the conditions under which the incumbent can exclude by bidding a uniform price without incurring losses. Since the quantity produced by each firm at any given set of prices increases with the degree of competition, this condition reduces to $n-1$ players being unable to attract entry at a negligibly lower input price than the incumbent's marginal cost when $\mu = 0$. Formally,

$$c_I Q^* \frac{n-1}{n} = \frac{(1-c_I)c_I(n-1)}{2n} < F. \tag{2.15}$$

The next step is to find the lowest level of μ that allows $(n-1)$ players to attract entry, as above that degree of competition the game will become a coordination game. Nevertheless, below this level of competition, the game might become one in which the only Nash equilibrium is achieved when all players address the incumbent. With $\mu > 0$, the entrant's profit from serving $(n-1)$ players is

$$c_I Q^* \frac{n-1}{n} = c_I \frac{n-1}{n} \frac{n(1-c_I)}{2\beta + \gamma(n-1)} = \frac{(1-c_I)c_I(n-1)(1+\mu)}{2n + (n+1)\mu}.$$

By solving $c_I Q^* \frac{n-1}{n} \geq F$ for μ, one obtains the upper bound for the set of μ values that allow a single player to deter entry:

$$\mu^0 = \frac{(1-c_I)c_I(n-1) - 2nF}{(n+1)F - (1-c_I)c_I(n-1)} > \mu. \tag{2.16}$$

A single player's decision to address the incumbent can prevent efficient entry when Inequality (2.16) holds. Note that this inequality implies a positive relationship between market concentration and μ^0.

The next thing to consider is whether it is profitable for a single player to deviate from the entry equilibrium. In this case,

$$w_F = \frac{2\beta - \gamma + (2\beta + \gamma)c_I}{4\beta}. \tag{2.17}$$

Although a single player might find it more profitable to choose the incumbent when every other player chooses the entrant, the entrant can offer higher profits to all players by reducing its bid, thereby making deviation to the incumbent less appealing. Denote by $w_{E,\min}$ the lowest price the entrant can bid, which solves

$$w_{E,\min}Q^* = w_{E,\min}\frac{n(1-w_{E,\min})}{2\beta+\gamma(n-1)} \equiv F.$$

Simple algebra yields

$$w_{E,\min} = \frac{1}{2} - \sqrt{\frac{1}{4} - \frac{(2\beta+\gamma(n-1))F}{n}}. \tag{2.18}$$

Since the comparison should be based on that price, the decision of any single buyer to stay with the incumbent when it believes the others will switch to the entrant depends on whether

$$\pi_i(w_i = w_{E,\min}, w_{-i} = w_{E,\min}, \mu) < \pi_i(w_i = w_I, w_{-i} = w_F, \mu) \tag{2.19}$$

holds. Inequality (2.19) reduces to whether

$$\frac{\gamma(n-1)}{4\beta}(1-c_I) - (c_I - w_{E,\min}) > 0. \tag{2.20}$$

The question is, then, of finding a critical value for μ above which Inequality (2.20) holds. Notice that $w_{E,\min}$ is always positive, and higher values of it increase the likelihood that Inequality (2.20) holds. Thus, by letting $w_{E,\min} = 0$, one may find a sufficient criterion for μ, which is

$$\mu^{00} = \frac{4nc_I}{(n-1)(1-c_I)-4c_I}. \tag{2.21}$$

If $\mu^{00} < \mu^0$, Conditions (8) and (12) are satisfied simultaneously, meaning that there exists a set of values for μ that renders the game one with a single Nash equilibrium in which a more efficient entrant is excluded. However, there is nothing to ensure that $\mu^{00} < \mu^0$, and solving for those conditions under which it holds does not yield any straightforward expression. Nevertheless, it can be established that a proper subset of values for c_I, given F, simultaneously satisfies

$$F < \frac{(1-c_I)c_I}{2} < \frac{nF}{n-1}$$

or, alternatively,

$$\frac{1}{2}-\sqrt{\frac{1}{4}-2F}<c_I<\frac{1}{2}-\sqrt{\frac{1}{4}-\frac{n}{n-1}2F}, \tag{2.22}$$

and $\mu^{00}<\mu^0$ exists.

Lemma 1: There exists a subset $c_I \in S_0 \subseteq S = \left(\frac{1}{2}-\sqrt{\frac{1}{4}-2F}, \frac{1}{2}-\sqrt{\frac{1}{4}-\frac{n}{n-1}2F}\right)$ that satisfies $\mu^{00}<\mu^0$.

Proof: Notice that $\frac{\partial}{\partial c_I}\mu^{00}=\frac{4n(n-1)}{((n-1)(1-c_I)-4c_I)^2}>0$, while $\frac{\partial}{\partial c_I}\mu^0=\frac{(n-1)(1-2c_I)((n+1)-2n)F}{((n+1)F-(1-c_I)c_I(n-1))^2}<0$. If $\mu^{00}<\mu^0$, then

$$4(1-c_I)c_I^2(n-1)^2+(1-c_I)^2c_I(n-1)^2<4n(n-1)Fc_I+(n-1)(1-c_I)2nF. \tag{2.23}$$

By letting $c_I=\frac{1}{2}-\sqrt{\frac{1}{4}-2F}+\epsilon$, where $\epsilon\to 0^+$, we find $2F\approx(1-c_I)c_I(n-1)$. Therefore, the above inequality becomes

$$(n-1)8Fc_I+(n-1)2F(1-c_I)<4n(n-1)Fc_I+(n-1)(1-c_I)2nF.$$

Clearly, $(n-1)(1-c_I)2nF>(n-1)2F(1-c_I)$ and $4n(n-1)Fc_I\geq(n-1)8Fc_I$. Therefore, for values of c_I near its infimum, the subgame at t_2 is not a coordination game but one in which the only Nash equilibrium is to address the incumbent.

On the contrary, for values of c_I close to $\frac{1}{2}-\sqrt{\frac{1}{4}-\frac{n}{n-1}2F}$, the supremum of S, $2nF\approx(1-c_I)c_I(n-1)$. In this case, Inequality (2.23) becomes

$$8n(n-1)Fc_I+(n-1)2nF(1-c_I)<4n(n-1)Fc_I+(n-1)(1-c_I)2nF.$$

This implies $4n(n-1)Fc_I<0$, which cannot be the case. Because S is connected and the functions that describe the market mechanism are continuous in c_I, there exists a non-empty subset $S_0\subset S$ such that, whenever $c_I\in S_0$, $\mu^{00}<\mu^0$, and, hence, sufficiently intense competition may allow the incumbent to exclude the entrant without relying on coordination failure.

Additionally, because $w_{E,\min}$ is assumed to be zero in finding the sufficient conditions for $\mu^{00}<\mu^0$, there exists another threshold level μ^1 and another subset of S (denoted S_1) such that $\mu^1<\mu^{00}$ and $S_0\subset S_1$. Note that $S_1\subseteq S$ because $c_I>\frac{1}{2}-\sqrt{\frac{1}{4}-2F}$ by assumption, and if $c_I>\frac{1}{2}-\sqrt{\frac{1}{4}-\frac{n}{n-1}2F}$, then fewer than n players can trigger entry. Thus, whenever $\mu\in(\mu^1,\mu^0)$, $c_I\in S_1$, and the incumbent bids in a neighborhood to the right of c_I, the only Nash equilibrium is the no-entry equilibrium. Note that $\mu^1>0$ since the input price of others does not matter for any single buyer when $\mu = 0$ and is finite. ■

Lemma 1 established that for any F and any finite n, there exists a range of values of c_I that allows the incumbent to make offers such that the only Nash equilibrium involves no entry for certain levels of μ, regardless of the entrant's offer.

Another relevant question is how market fragmentation affects the ability of the incumbent to exclude the rival without relying on coordination failures. It turns out that market fragmentation may make entry possible. The intuition underlying this reasoning is that, just as bigger players can trigger entry through deviating, they can deter efficient entry by remaining. In turn, this implies that they may stick with the incumbent if it is profitable when the others choose the entrant, which, as shown, is possible for any finite number of buyers.

Lemma 2: Buyer fragmentation may limit the ability of the incumbent to exclude without relying on coordination failures.

Proof: Begin by noting that a lower bound for μ_1 is zero if we let $w_{E,\min} = c_I$ and that μ^0 and μ^{00} are decreasing in n. Also, note that μ_1 always lies between zero and μ^{00}. The difference between μ^0 and zero decreases with n. Suppose that $c_I \in S_1$ so that $F < \frac{(1-c_I)c_I}{2} < \frac{nF}{(n-1)}$ and $\mu^0 - \mu^{00} > 0$. The difference between μ^0 and μ^{00} is

$$\mu^0 - \mu^{00} = \frac{[(n-1)(1-c_I) - 4c_I]\,[(1-c_I)c_I(n-1) - 2nF]}{[(n+1)F - (1-c_I)c_I(n-1)][(n-1)(1-c_I) - 4c_I]} - \frac{4nc_I[(n+1)F - (1-c_I)c_I(n-1)]}{[(n+1)F - (1-c_I)c_I(n-1)][(n-1)(1-c_I) - 4c_I]}. \quad (2.24)$$

Because $[(n+1)F - (1-c_I)c_I(n-1)]$ is negative, $n \geq 3$, and $c_I < \frac{1}{3}$, the denominator is negative. It is also straightforward that the denominator decreases with n. The numerator of this expression is

$$(1-c_I)^2c_I(n-1)^2 - 2n(n-1)(1-c_I)F - 4(1-c_I)c_I^2(n-1) + 8nFc_I - 4n(n+1)Fc_I + 4n(1-c_I)c_I^2(n-1) < 0.$$

Let $F_{\text{sup}} = \frac{(1-c_I)c_I}{2}$ and $F_{\text{inf}} = \frac{(1-c_I)c_I(n-1)}{2n}$; thus, $F_{\text{inf}} < F < F_{\text{sup}}$. The terms $4(1-c_I)c_I^2(n-1)$ and $8nFc_I$ have degree one in n. Thus, they cannot be the dominant terms. Let $8nFc_I - 4(1-c_I)c_I^2(n-1) = A$. Notice that $4(1-c_I)c_I^2 > A > 0$ because $F_{\text{sup}} > F > F_{\text{inf}}$.

The remaining terms have degree two in n. Let $(1-c_I)^2c_I(n-1)^2 - 2n(n-1)(1-c_I)F = B$. It must be that $0 > B > -(1-c_I)^2c_I(n-1)$, so B cannot be a dominant term. The remaining two terms are $4n(n+1)Fc_I$ and $4n(1-c_I)c_I^2(n-1)$. When

$F = F_{\text{sup}}$, $4n(n+1)Fc_I = 2n(n+1)(1-c_I)c_I^2$. Because $n \geq 3$, $2n(n+1)(1-c_I)c_I^2 \leq 4n(1-c_I)c_I^2(n-1)$, which implies $4n(1-c_I)c_I^2(n-1) > 4n(n+1)Fc_I$. The difference between the two terms increases with n, implying that $4n(1-c_I)c_I^2(n-1)$ is the dominant term. Since it is dominant, the numerator must be positive at some finite n. Thus, the difference $\mu^0 - \mu^{00}$ has to decrease after some finite n. Because the difference between μ^0 and the upper (μ^{00}) and lower (0) bounds of μ_1 decreases, the difference $\mu^0 - \mu_1$ also has to decrease.

Therefore, the range of μ where the result in Lemma 1 is observed must shrink, implying that market fragmentation makes it more likely that an entry equilibrium is observed. Note also that the set $S = \left(\frac{1}{2} - \sqrt{\frac{1}{4} - 2F}, \frac{1}{2} - \sqrt{\frac{1}{4} - \frac{n}{n-1}2F}\right)$ shrinks and eventually becomes empty as $n \to \infty$, which also implies that no-entry equilibrium cannot be the only equilibrium with atomized buyers. ■

Lemma 2 establishes that entry may be possible in more fragmented markets, whereas in concentrated markets a single buyer may more easily deter efficient entry.

The 2-player case should be addressed for completeness; the following lemma accomplishes that.

Lemma 3: When $n = 2$, (1) the implications of Lemma 1 are valid and (2) no-entry equilibrium can be the only Nash equilibrium even as $\mu \to \infty$.

Proof: As $\mu \to \infty$, the condition for unilateral deviation to deter entry becomes

$$c_I Q^* \frac{n-1}{n} = c_I(1-c_I)\frac{n-1}{n+1} < F. \tag{2.25}$$

Recall that $F < \frac{c_I(1-c_I)}{2}$. This means that $\frac{n-1}{n+1}$ has to be lower than $\frac{1}{2}$, which can be the case only if $n = 2$, corresponding to Case II in FM with two downstream players. However, μ^1 may be undefined for $n = 2$. Therefore, if μ^1 is finite and a single player cannot trigger entry as $\mu \to \infty$—that is, in Case II of FM's analysis—exclusion is the unique equilibrium prediction for $\mu > \mu^1$.

Case I involves parameters such that entry is the only equilibrium as $\mu \to \infty$. A necessary condition for the no-entry equilibrium to be the only Nash equilibrium is $F > \frac{(1-c_I)c_I(n-1)}{2n}$ by Condition 7. Thus, since $n = 2$ and, hence,

$$\lim_{\mu \to \infty} \pi_E^{*d}(w_I = c_I, \mu, n = 2) = \frac{c_I(1-c_I)}{3} > \frac{c_I(1-c_I)}{4},$$

the intersection of S_1 with Case I is non-empty. For instance, with $c_I = 0.26$ and $F = 0.0625$, no-entry is the only Nash equilibrium at $\mu = 11$, although entry is the only Nash equilibrium as $\mu \to \infty$. ■

Finally, because $\pi_i(w, \mu)$ is smooth, and w_F is smooth in w_I, there exists a non-empty set of prices neighboring c_I that also eliminate entry. The least upper bound of this set is $w^T = \min\{w^{(T,1)}, w^{(T,2)}\}$, where $w^{(T,1)}$ (referring to Condition 1) is such that

$$(n-1)\pi_E^{*d}(w_I = w^{(T,2)}, \mu, n) = F,$$

while $w^{(T,2)}$ (Condition 2) is such that

$$\pi_i(w_i = w^{(T,1)}, w_{-i} = w_F, \mu) = \pi_i(w_i = w_{E,\min}, w_{-i} = w_{E,\min}, \mu).$$

Thus, if $c_I \in S_1$ and $\mu \in (\mu^1, \mu^0)$, the incumbent can rule out entry by offering $w_I \in [c_I, w^T)$. Since w_F, $w_{E,\min}$, the extent to which w_F matters for a buyer's payoff, and the equilibrium values are functions of μ, w_I^T is also a function of μ.

The following addendum may be made to FM's Proposition 2.

Addendum to FM's Proposition 2: The following arguments may be made about Proposition 2.

1. If $c_I \notin S_1$, Proposition 2 is valid.
2. If $c_I \in S_1$, then FM's Proposition 2 is valid for the values of $\mu \notin (\mu^1, \mu^0)$.
3. If $c_I \in S_1$, $\mu \in (\mu^1, \mu^0)$, and $w_I \in [c_I, w^T)$, the only Nash equilibrium is no-entry.
4. If $c_I \in S_1$, $\mu \in (\mu^1, \mu^0)$, and $w_I \in [w_I^{\text{ex}}, w_I^T]$, both no-entry and entry may be Nash equilibria of the t_2 subgame.

Proof: For any number of players who deviated from choosing the entrant, free buyers will have an incentive to deviate to get the input at w_I since $w_I < w_F$. Thus, every buyer will choose the incumbent at t_2 if $w_I \in [c_I, w_I^T]$, and the realized profits for all downstream players will be lower compared to the case where every player chose the entrant, since their marginal cost will be higher.

Note that w_I^T is lower than the maximum price bid that can support coordination failures, w_I^{ex}. This implies that there is a w_E that can support entry when $w_I^{\text{ex}}(\mu) \geq w_I > w_I^T(\mu)$, since either Inequality 11 is irrelevant or reversed. The rest of the proof follows from Lemmas 1 through 3 and FM's analysis. ■

Summary of Findings

The issue with FM's analysis presented in the comment is valid for the general case of $n \geq 2$. Additionally, the appendix proves that downstream market concentration might reinforce the exclusionary capabilities of the incumbent, in contrast to the assertions made in FM.

References

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Chapter 3

Peer Raising Rivals' Costs and the Limits of Contracts for Entry Accommodation

Abstract

I study exclusion when downstream buyers compete and a rival's product value rises with overall adoption. With uniform upstream prices and observed offers, a pivotal buyer may switch to the incumbent, push the rival below scale, and worsen the rival's terms for remaining buyers. This peer raising rivals' costs effect can make exclusion the unique Nash prediction and robust to buyer communication. I then ask whether richer contracts restore entry accommodation when the incumbent continues to post a uniform price. I show that implementing accommodation generically requires contracts that condition on aggregate sourcing and that commit the rival to compensate buyers, even at a loss, when adoption is low.

3.1 Introduction

Can a dominant upstream firm deter adoption of a more efficient rival by merely announcing price? A benchmark answer is "typically no." If buyers remain free to switch after observing all offers and the rival is present, an efficient rival should be able to win business by undercutting the incumbent, and exclusion—when it appears in related models—reflects a coordination problem (e.g., buyers are effectively locked-in ex ante so that the rival is absent in a punishment phase for its would-be customers) rather than a privately profitable choice for any individual buyer.

This paper identifies an environment in which that conclusion can fail. An incumbent and a more efficient rival supply downstream firms that compete in the final market. The rival's offer is scale sensitive: below a threshold adoption level, its customers face a disadvantage because key attributes improve with overall adoption. Depending on the application, this can capture service coverage, reliability, logistical challenges, support availability, interoperability, learning, perceived quality, or demand-side network effects. The crucial feature is that the disadvantage applies contemporaneously. The rival can be active and offering terms, yet the realized terms faced by its customers worsen when adoption is low.

Downstream competition then turns a scale disadvantage into a non-negligible strategic incentive. When one buyer switches from the rival to the incumbent, the rival may fall below scale; the rival's effective price to the remaining rival customers rises; and the switching buyer benefits because its competitors become less efficient.[1] I refer to this channel as *peer raising rivals' costs* (peer-RRC): a buyer may defect even if the incumbent offers worse terms because defection worsens competitors' real terms through lower adoption.[2] This, in turn, can make exclusion the unique equilibrium outcome without pricing below cost.

The first set of results characterizes equilibrium outcomes where both upstream firms quote uniform prices. I derive conditions under which exclusion is the *unique* Nash equilibrium despite the rival's efficiency advantage. Then, I show that communication among buyers does not generically select accommodation: even when the baseline game has multiple equilibria, communication can facilitate self-enforcing coalitions that exploit peer-RRC against outsiders, so accommodation need not be

[1] Ide et al. (2016) emphasize that if a more efficient rival is present during a would-be penalty phase, the rival can counter an incumbent's punishment scheme and simple pricing cannot profitably exclude. In the present environment, the disadvantage is embedded in the rival's *effective* terms and varies with realized adoption, so a buyer's switch can trigger a cost/quality deterioration for other buyers even when the rival is present.

[2] Sevük (2025) shows that downstream competition can generate a peer-RRC incentive in a more classic framework with buyer pre-commitment.

coalition-proof.

Coasean logic motivates the intuition that contracting externalities can be internalized when all relevant interests are represented and sufficient instruments are available (Coase, 1960). In the presence of downstream competition, however, final consumers' interests—those of an affected party—are not contractible, and exclusion may persist even when the contractual space is rich. Motivated by this tension, I ask whether expanding the rival's contracting instruments can restore accommodation when the incumbent posts uniform prices.[3]

I compare three families of instruments: (i) standard bilateral menus, (ii) share-contingent designs that condition terms on aggregate contracting behavior, and (iii) price/performance-assurance schemes in which the rival commits to absorb losses to compensate for lower adoption. Which instruments succeed is governed by a feasibility constraint—how much surplus the rival can credibly pledge against that needed to implement accommodation. I show that familiar bilateral instruments (price discrimination, two-part tariffs, and the like) primarily reallocate surplus across buyers and states; hence, cannot generically deter pivotal defections. Conditioning prices on contracting decisions helps through breach penalties if contracting with the rival can be made a dominant strategy, but it is not a universal remedy when buyers are sufficiently concentrated. Robustly restoring accommodation instead requires a stronger commitment technology—such as credible compensation when adoption falls short.

The paper is organized as follows. Section 2 presents the model and studies uniform upstream pricing. It characterizes when the peer raising rivals' costs (peer-RRC) mechanism makes exclusion the unique Nash equilibrium despite the rival's efficiency advantage. Section 2.2 shows that buyer communication does not generically select accommodation due to buyer opportunism when the game admits multiple equilibrium predictions. Section 2.3 asks whether contractual richness for the rival restores accommodation when the incumbent posts a uniform price. It shows bilateral instruments primarily reallocate surplus and therefore cannot generically deter pivotal defections under peer-RRC; share-contingent (all-or-none) designs can help via breach penalties but may fail when buyers are sufficiently concentrated and below-scale deterioration is steep; robust implementation instead requires a structure that keeps the rival's effective terms attractive below scale. Section 3 discusses what modeling moves that supposedly restore "all-parties-present" entail in this class of environments and relates the analysis to prominent antitrust cases.

[3] I also discuss the modeling moves employed to bring all parties into upstream–downstream bargaining.

Section 4 concludes.

3.2 Analysis

Consider a market with two upstream input providers, an incumbent (I) and a rival (R), who compete to supply $n \geq 2$ downstream Cournot competitors.[4] Downstream firms (buyers) use the input supplied by upstream firms in fixed proportion to output, normalized to a one-to-one ratio.

The representative final consumer's utility is

$$U(\boldsymbol{q}) = \alpha \sum_{i=1}^{n} q_i - \frac{1}{2}\left(\beta \sum_{i=1}^{n} q_i^2 + \gamma \sum_{i=1}^{n} \sum_{j \neq i} q_i q_j\right), \tag{3.1}$$

where $\boldsymbol{q}$ denotes the vector of quantities, $\beta > 0$, and $\beta \geq \gamma \geq 0$.

Upstream firms have constant marginal costs c_I, c_R, with $w_R^m > c_I > c_R$, where w_R^m is the rival's monopoly price and $c_I - c_R$ is referred to as the efficiency gap. The incumbent operates at efficient scale, benefiting from an established logistics network, cumulative buyer relationships, and a broad service infrastructure that provide it with a significant competitive advantage when the rival is at low scale. The rival lacks such scale economies and faces inefficiencies in production and distribution below its minimum efficient scale.[5]

To capture this, let the rival's *effective* price offer differ from its nominal price by a function $f(Q_R^{-i})$, where Q_R^{-i} denotes the total quantity purchased from the rival excluding buyer i's order.[6] There exists a threshold quantity $\bar{Q}$ such that $f(Q_R^{-i}) = 0$ for $Q_R^{-i} \geq \bar{Q}$, and f is decreasing on $Q_R^{-i} \in [0, \bar{Q})$. The rival's effective price under the maintained scale penalty specification is

$$w_R^{ef} = w_R + f(Q_R^{-i}). \tag{3.2}$$

[4]The main comparative-static differences between Cournot and Bertrand competition, for a given γ/β, n, and $\boldsymbol{w}$, concern the number of active firms—except when $\gamma = \beta$ (Ledvina and Sircar, 2011, 2012).

[5]Explicitly incorporating these inefficiencies into the rival's cost function would not alter the results; what matters is whether such efficiencies are passed on to buyers.

[6]We maintain a regularity condition:

$$2\beta + \gamma(k-1) - (k-1)\tau > \frac{\gamma^2 k(n-k)}{2\beta + \gamma(n-k-1)},$$

where $\tau := \sup_{Q \geq 0} |f'(Q)|$, ensuring uniqueness of the equilibrium. Also, assume $f \in C^2[0, \bar{Q}]$ with $f' \leq 0$ and $f'' \geq 0$.

Expression (3.2) captures cost-side network externalities such as logistics inefficiencies, plant utilization, or service networks.[7]

A parallel demand-side interpretation arises when product value (or choke price) increases with aggregate utilization of the rival's input—typical in sectors such as freight carriage, airlines, postal services, or online networks. In that case, the representative utility can be written as

$$U(\boldsymbol{q}) = \alpha_I \sum_{i\in I} q_i + \sum_{i\in R} \alpha_{R,i}(Q_R^{-i}) q_i - \frac{1}{2}\left(\beta \sum_{i=1}^{n} q_i^2 + \gamma \sum_{i=1}^{n} \sum_{j\neq i} q_i q_j\right), ^8 \qquad (3.3)$$

where $\boldsymbol{q}$ is the vector of quantities, the subscripts $\{I, R\}$ denote the supplier chosen by downstream firm i, and $\alpha_R(Q_R^{-i}) = \alpha - f(Q_R^{-i})$ is weakly increasing in aggregate utilization.

To ensure that entry is viable and the market remains contestable, impose the following condition:

$$0 \leq \bar{Q} < Q^{*,-i}(\boldsymbol{w} = \boldsymbol{c}_I),$$

where $\boldsymbol{c}_I$ is the price vector with all elements equal to c_I, and $Q^{*,-i}$ is the equilibrium aggregate quantity purchased from R, excluding buyer i. This ensures that, under full participation, the rival can reach efficient scale.[9]

The game unfolds according to the following timeline: At t_1, the incumbent announces its price w_I. Observing this offer, the rival announces a counter-offer at t_2. At t_3, after observing all offers and under complete information about the market environment, downstream firms decide from which upstream firm they will purchase the input. Each downstream firm's type is given by its choice $a_i \in \{I, R\}$. Finally, at t_4, downstream firms compete in the final market.

3.2.1 Peer Raising-Rivals'-Costs Mechanism

Suppose that the rival offers a uniform price w_R and that each buyer believes that others will endorse the rival.

Begin with the t_4 subgame. Fix two symmetric price offers (w_I, w_R), assume $w_I < w_R^m$, and let k denote the number of buyers purchasing from the rival. For any

[7] Appendix C derives f from a primitive coverage/reliability problem and shows that allowing the penalty to depend on total adoption, $f(Q_R)$, preserves the same economics while reducing tractability.

[8] See Appendix A for the formal equivalence result.

[9] In the 2-buyers case, if $k = 1$, the rival's customer will face the intercept of the penalty function. In the relevant pricing region, if $k = 2$, then the penalty collapses. This corresponds to a case where f is a piecewise constant function. See Appendix C.

such pair of offers and number of rival-endorsing buyers, the induced equilibrium outcomes are unique. They can be expressed as a function of k and the group chosen at t_3. When analyzing individual and group outcomes, I use the input price vectors of the respective superscript's dimension $(\boldsymbol{w_I^{n-k}}, \boldsymbol{w_R^{k}})$ with generic elements (w_I, w_R).

In particular, the downstream subgame has a unique within-type symmetric equilibrium in which all buyers choosing the upstream firm a produce $q_a^*(k)$ and make profits $\pi_a^*(k) = \beta\big(q_a^*(k)\big)^2$. To analyze the impact of a price shock, let $\boldsymbol{v}$ be a positive vector of dimension k (or $n-k$) with all elements equal to $v > 0$. A (semi-)symmetric price shock to w_R prices reduces profits and quantities for the R-group:

$$\pi_R^*\big(w_R, (\boldsymbol{w_I^{n-k}}, \boldsymbol{w_R^{k}})\big) \geq \pi_R^*\big(w_R + v, (\boldsymbol{w_I^{n-k}}, \boldsymbol{w_R^{k}} + \boldsymbol{v})\big). \tag{3.4}$$

and increases those for the I-group:

$$\pi_I^*\big(w_I, (\boldsymbol{w_I^{n-k}}, \boldsymbol{w_R^{k}})\big) \leq \pi_I^*\big(w_I, (\boldsymbol{w_I^{n-k}}, \boldsymbol{w_R^{k}} + \boldsymbol{v})\big). \tag{3.5}$$

Equality obtains if the R-group is inactive.[10] The induced change in $f(Q_R^{-i})$ does not overturn these effects and, with $f' < 0$, typically reinforces them. Relations (3.4) and (3.5) are the key monotonicity conditions used in analyzing unilateral deviations and price shocks.

A unilateral deviation (to or from the rival) also affects the penalty function f. We have

$$Q_R^{*,-i}(\boldsymbol{w_R^{k}}, \boldsymbol{w_I^{n-k}}) \leq Q_R^{*,-i}(\boldsymbol{w_R^{k+1}}, \boldsymbol{w_I^{n-k-1}}), \tag{3.6}$$

with strict inequality when R-types are active. Moreover,

$$\frac{\partial Q_R^{*,-i}}{\partial w_I} \geq 0, \quad \frac{\partial Q_R^{*,-i}}{\partial w_R} \leq 0. \tag{3.7}$$

Inequality (3.6) implies that the rival's effective price is a weakly decreasing function of k:

$$\frac{\Delta w_R^{ef}}{\Delta k} \leq 0. \tag{3.8}$$

These relations are sufficient to characterize the subgame-perfect equilibria.[11]

In the t_3 subgame, buyers choose their types under optimistic beliefs (each expects others to endorse the rival). Any buyer strictly prefers the incumbent if

[10] The same comparative statics applies also to the I-group and to individual shocks of v.
[11] See also Appendix A.

$w_R > w_I$, so the equilibrium is $k^* = 0$. Hence, in t_2, the rival will undercut the incumbent.

Define

$$S(w_I, w_R) := \min\{k \in \{0, \dots, n\} : w_R^{ef}(k) \leq w_I\},$$

with the convention that $S = n + 1$ if the set is empty. Thus, $w_R^{ef}(k < S) > w_I$ and $w_R^{ef}(k \geq S) \leq w_I$. When the set is not empty, as I maintain below, $S(w_I, w_R)$ is non-increasing in w_I and non-decreasing in w_R.

Suppose $c_I \leq w_I < w_R^m$ throughout the remainder of the analysis. If $S(w_I, w_R = w_I - \varepsilon) < n$ (with $\varepsilon \to 0$), every buyer endorses the rival, yielding accommodation ($k^* = n$) since

$$\pi_I^*(k = n-1) < \pi_R^*(k = n)$$

by the individual-shock version of (3.4). Thus, the rival can profitably post $w_R^* = w_I - \varepsilon$ with $\varepsilon \to 0$, which is optimal in t_2 given $w_I < w_R^m$. For ease of notation, I drop ε in the remainder of the analysis.

The exception to the accommodation result arises when $S(w_I, w_I) = n$.[12] A unilateral defection may then raise $w_R^{ef}(n-1) > w_I$; the loss from switching to the incumbent can be offset by the induced increase in other buyers' effective prices. If, for a given (w_I, w_R),

$$\pi_I^*(k = n-1) > \pi_R^*(k = n),$$

each buyer has an incentive to deviate to the incumbent when $k = n$. Suppose $S(w_I, w_R) = n$, i.e. $w_R^{ef}(n) \leq w_I < w_R^{ef}(n-1)$. Since $w_R^{ef}(k)$ is weakly decreasing in k, we have $w_R^{ef}(k) > w_I$ for all $k \leq n-1$. Therefore no profile with $1 \leq k \leq n-1$ can be a Nash equilibrium, and the resulting equilibrium is $k^* = 0$. The condition for this peer raising-rivals'-costs effect is

$$w_I - w_R \; < \; \frac{\gamma(n-1)\, f\big(Q_R^{*,-i}(k = n-1)\big)}{2\beta + \gamma(n-2)}. \tag{3.9}$$

Otherwise, no buyer can gain by unilaterally deviating from an accommodation equilibrium. Thus, if $\gamma = 0$, the right-hand side of (3.9) is zero, so no buyer can profitably deviate from accommodation. Likewise, if $S(w_I, w_R) \leq n-1$ so that $f\big(Q_R^{*,-i}(k = n-1)\big) \leq w_I - w_R$, (3.9) cannot hold since $\beta \geq \gamma$. Conversely, when $S(w_I, w_R) = n$ (so $w_R^{ef}(n) \leq w_I < w_R^{ef}(n-1)$) and $\gamma > 0$, Condition (3.9) is exactly the requirement for a profitable deviation from the candidate accommodation profile

[12] $S(w_I, w_R)$ might be equal to $n+1$ if w_I is sufficiently high even if $w_R < w_I$. But, when w_R is in a neighborhood of c_R, S cannot be higher than n due to the contestability condition.

$k = n$. Since no profile with $1 \leq k \leq n-1$ can be a Nash equilibrium, it follows that if the rival cannot choose a feasible uniform price $w_R \geq c_R$ such that Condition (3.9) fails, exclusion ($k^* = 0$) is the unique equilibrium prediction.

If $S(w_I, w_R{=}w_I) \geq n$, then Condition (3.9) implies $k^*(w_I, w_R) = 0$ for all w_R in a neighborhood of w_I. When this is the case, the highest price the rival can charge and make accommodation an equilibrium is

$$\bar{w}_R(w_I) := \sup\{\, w_R \in [c_R, w_R^m] : \text{Condition (3.9) fails at } (w_I, w_R)\,\},$$

with $\sup \varnothing = -\infty$. Note that, $\bar{w}_R < w_I$ since, otherwise, Condition (3.9) always holds. Profitability then requires the rival to choose

$$w_R^* \;=\; \max\{\bar{w}_R,\, c_R\}.$$

Thus, the rival cannot profitably defeat the raising-rivals'-costs mechanism unless $\bar{w}_R \geq c_R$. Otherwise, the rival is assumed, without any loss of generality, to set $w_R^* = c_R$.

Lemma 1-1. The rival's optimal counter-offer is as follows:

- If $S(w_I, w_I) < n$, then $w_R^* = w_I$ and $k^* = n$.
- If $S(w_I, w_I) \geq n$ and $\bar{w}_R \geq c_R$, then $w_R^* = \bar{w}_R$ and $k^* = n$.
- If $S(w_I, w_I) \geq n$ and $\bar{w}_R < c_R$, then $w_R^* = c_R$ and $k^* = 0$.

Proof. If $S(w_I, w_I) < n$, then the rival can slightly undercut the incumbent and still receives endorsement. If $S(w_I, w_I) \geq n$, the rival must post a sufficiently low price to endorse entry. The highest such price is $\bar{w}_R$. If there does not exist any price $\bar{w}_R$ such that (3.9) fails in the relevant range, then the rival charges its marginal cost and exclusion equilibrium arises. Otherwise, the rival charges $\bar{w}_R$ and receive endorsement under optimistic beliefs. □

In turn, the incumbent knows that the only way to defeat the rival is to rely on a peer RRC mechanism. Lower price offers (i) decrease the left-hand side of Condition (3.9) and (ii) reduce $Q_R^{*,-i}$ for any $k < n$—possibly increasing S and the penalty $f(Q_R^{*,-i})$. Thus, the incumbent begins by considering marginal-cost pricing ($w_I = c_I$).

If $S(c_I, c_R) < n$ or $S(c_I, c_I) = n$ but $\bar{w}_R(c_I) > c_R$, the rival can always profitably induce accommodation ($k^* = n$). In this case, the incumbent's optimal price is $w_I^* =$

c_I.[13] In contrast, the incumbent can exclude profitably if $S(w_I{=}c_I, w_R{=}c_R) = n$ and Condition (3.9) holds when evaluated at the marginal costs. Then, there exists a nonempty set of prices for which the RRC mechanism operates. The incumbent will charge the highest of such prices; that is,

$$w_I^* = \bar{w}_I := \sup\{\, w_I \in [c_I, w_R^m] : \text{Condition (3.9) holds given } w_R = c_R \,\}.$$

This leads us to a central result of the analysis.

Proposition 1. Under optimistic beliefs, one of the following three cases arises:

- If $S(c_I, c_I) < n$, an accommodation equilibrium ($k^*{=}n$) arises with price offers $(w_I^*, w_R^*) = (c_I, c_I)$.
- If $S(c_I, c_I) = n$ and $\bar{w}_R \geq c_R$, an accommodation equilibrium ($k^*{=}n$) arises with price offers $(w_I^*, w_R^*) = (c_I, \bar{w}_R)$.
- If $S(c_I, c_I) = n$ and $\bar{w}_R < c_R$, an exclusion equilibrium ($k^*{=}0$) arises with price offers $(w_I^*, w_R^*) = (\bar{w}_I, c_R)$.

Proof. The proof follows from the preceding arguments. Appendix B establishes a stronger peer-RRC result.

The three cases delineate when buyer-induced RRC, through the rival's lost scale, becomes binding. When $S(c_I, c_I) < n$, there is slack: a single defection cannot starve R enough to worsen others' terms. When $S(c_I, c_I) = n$ but $\bar{w}_R \geq c_R$, full participation with R remains feasible—the highest break-even $\bar{w}_R$ can hold all buyers, and accommodation survives. The peer-RRC mechanism prevails when $S(c_I, c_I) = n$ and $\bar{w}_R < c_R$: any buyer switching to I raises the others' effective costs by pushing R below scale when $w_I^* \in [c_I, \bar{w}_I]$. That peer-RRC makes the pivotal deviation profitable and unravels support for R without buyer pre-commitment, rival absence, or communication limits. Exclusion emerges as the unique equilibrium prediction resulting purely from contemporaneous scale–rivalry feedback and the incumbent's sufficient concessions in the form of low prices to deter buyers from endorsing the rival.

[13] A higher w_I cannot be part of a subgame-perfect equilibrium. This is because the best-response offer is either $w_R^*(w_I > c_I) > c_I$, so that the incumbent would profitably undercut, or because by continuity $\bar{w}_R(w_I > c_I) > \bar{w}_R(w_I = c_I)$, so that the peer-RRC mechanism would prevent entry if w_I was set lower, returning to $w_I^* = c_I$.

3.2.2 Persistence of Exclusion under Communication

Begin by removing optimistic expectations. An immediate implication is that exclusion is a Nash equilibrium whenever $1 < S(c_I, c_R) < n$. Define the highest price that keeps $S(w_I, w_R)$ below n:

$$w_R^n := \sup\{\, w_R \in [c_R, w_R^m] : S(w_I, w_R) \leq n - 1 \,\}$$

If $1 < S(c_I, c_R) < n$ and $w_I \geq c_I$, w_R^n is always defined with $w_R^n \leq w_I$. Denote the maximum of these prices by $\tilde{w}_R := \max\{\, w_R^n,\, \bar{w}_R\}$. For each w_I, set the cutoffs

$$\begin{aligned} w_R^o(w_I) \ &:= \ \min\{\tilde{w}_R, w_R^m\}, \\ w_I^o \ &:= \ \sup\{\, w \in [c_I,\, w_I^m] : \ S(w, c_R) > 1\}. \end{aligned}$$

This allows us to briefly explain the multiplicity result.

Lemma 2-1. If $1 < S(c_I, c_R) < n$, then for every $w_I \in \big[c_I,\, w_I^o\big)$ and every $w_R \in \big[c_R,\, w_R^o(w_I)\big)$, both $k^* = 0$ and $k^* = n$ are equilibria.

Proof. By the definitions of w_R^n and $\bar{w}_R$ and the monotonicity of S and (3.9) in w_R, for all $w_R < w_R^o(w_I)$ (with $w_R \leq w_I$) we either have $S(w_I, w_R) < n$ or $S(w_I, w_R) = n$ but (3.9) fails. No buyer wants to unilaterally deviate from $k = 0$ because $S(w_I, w_R) > 1$ and, hence, the deviator faces a higher effective input price. Also, $k = n$ is an equilibrium because $S(w_I, w_R) < n$ or Condition 9 fails. When $k < S$, the rival's customers strictly prefer to deviate to the incumbent to decrease their effective input price, whereas when $n > k \geq S$ the incumbent's customers have an incentive to switch. By the definitions of w_I^o and $w_R^o(w_I)$, both conditions hold throughout those intervals.[14] □

Now, suppose buyers can reach non-binding agreements through communication and $n > S(c_I, c_R) > 1$. Suppose also that initially all buyers agree to endorse the rival—i.e., $k = n$—and both upstream sellers follow marginal-cost pricing.

Define a first-order coalition of deviators $l_1 \leq n$. A first-order coalition is never profitable if $l_1 < n - S$, because then $w_R^{ef} < w_I$, or if $l_1 = n$ since $w_R < w_I$. Define

$$l_1^* \in \operatorname{argmax}_{l_1 \in \{1,\ldots,n\}} \ \pi_I^*(k = n - l_1).$$

If $\pi_I^*(k = n - l_1^*) \leq \pi_R^*(k = n)$, no strictly profitable first-order deviation exists and $k^* = n$ is a coalition-proof and strong Nash equilibrium (Aumann, 1959; Bernheim

[14]As usual, if $S(c_I, c_R) = 1$ there exists a set of prices that makes entry the unique equilibrium prediction.

et al., 1987).

If any l_1^* deviation is profitable, there must exist a sub-coalition of size $l_2 \leq l_1$ that can profitably revert to the rival for $k^* = n$ to be coalition-proof. Let

$$k^c \in \operatorname{argmax}_{k\in\{S,\dots,n\}} \pi_R^*(k)$$

denote the number of rival buyers that maximizes a rival customer's payoff. Thus, the self-enforceability check reduces to whether the deviation of size $l_2^* := k^c-(n-l_1^*)$ is profitable since $\pi_R^*(k^c) \geq \pi_R^*(k=n)$. This yields the modified condition for peer-RRC

$$c_I - c_R \; < \; \frac{\gamma(n-l_1^*)\, f\big(Q_R^{*,-i}(n-l_1^*)\big) \; + \; \big(2\beta+\gamma(n-k^c)\big)\, f\big(Q_R^{*,-i}(k^c)\big)}{2\beta+\gamma(2n-l_1^*-k^c-1)}, \quad (3.10)$$

which is obtained by comparing $\pi_I^*(k = n - l_1^*)$ with $\pi_R^*(k^c)$. If a self-enforcing first-order coalition exists, then $k^* = n$ cannot be a CPNE. [15]

Notice that Condition (3.10) holds under standard primitives: a small efficiency gap with intense downstream rivalry (small $c_I - c_R$, $\gamma > 0$); a steep effective-price penalty at low adoption; and a setting in which almost everyone is pivotal (S and hence k^c close to n), which lowers the denominator and raise the numerator of the right-hand side of (3.10).

Proposition 2: There exists an admissible game such that Condition (3.10) holds. Moreover, for that game, there exists $\varepsilon > 0$ such that for all $w_I \in [c_I, c_I+\varepsilon)$ (given $w_R = c_R$), the outcome $k^* = 0$ is a CPNE.

Proof. Consider an admissible game in which Condition (3.10) holds with a strict inequality at $(w_I, w_R) = (c_I, c_R)$; such a configuration is feasible because only a sign restriction is imposed on $c_I - c_R$. By local continuity of equilibrium identities in (w_I, w_R), Condition (3.10) continues to hold for all w_I in some neighborhood of c_I (given $w_R = c_R$). □

Thus, allowing coalition talk does not necessarily select accommodation. Coalitions can profitably peel off and raise outsiders' costs via the peer–RRC channel. This result shows why further remedies such as richer contracts and commitment assumptions are needed to revive accommodation generically: without richer instruments that mobilize the rival's rents and blunt buyer opportunism, the efficient outcome may be blocked. Even when such fixes are admitted, however, they may fail to induce entry and expansion.

[15] At $\gamma = 0$ (no downstream rivalry), (3.10) reduces to $2\beta\,(c_I - c_R) \; < \; 2\beta\, f\big(Q_R^{*,-i}(k^c)\big)$, but by the definition of S, we have $c_R + f(Q_R^{*,-i}(k^c)) \leq c_I$; thus, competition ($\gamma > 0$) is necessary.

3.2.3 How Rich Are "Sufficiently Rich" Contracts?

A standard Coasean/Chicago intuition is that exclusion should vanish once parties can write sufficiently rich contracts: either the entrant converts its rents into compensating transfers, or it designs incentives so that unilateral defection is not attractive.

In environments where exclusion reflects mere miscoordination, bilateral "top-up" schemes can indeed restore accommodation. With peer-RRC, however, the contractual question is sharper: contracts must relax a *feasibility* constraint by expanding *pledgeable* surplus, or else directly blunt the opportunistic deviation motive. Because final consumers are missing, contracts that would generically implement entry accommodation in standard settings can fail unless the rival can credibly commit to terms that remain attractive even at low realized adoption—that is, unless it can sustain effective prices (or performance) below efficient scale.

Maintain the uniform-price benchmark for the incumbent to evaluate whether richer contracts can beat the weakest practice. At t_3, each buyer i makes contracting ($a_i^1 \in \{I, R\}$) and sourcing ($a_i^2 \in \{I, R\}$) decisions. The rival announces a contract C_R.

Fix the candidate accommodation profile where every buyer contracts with and sources from the rival. Define $B_i(\boldsymbol{w_R})$ as buyer i's gain from a unilateral deviation (at either the contracting or sourcing stage) that reduces realized adoption from $k = n$ to $k = n - 1$, evaluated under the baseline pricing environment:

$$B_i(\boldsymbol{w_R}) \;=\; \pi_I^*(k = n - 1) \;-\; \pi_R^*(k = n),$$

and $B := \sum_i B_i$ is the minimum aggregate "insurance" required to deter pivotal peel-offs. The rival's *on-path profit* at accommodation is Π_R, equal to its mark-up $(w_R - c_R)$ times equilibrium quantity $Q_R^*(k = n)$. Define the feasibility bound

$$F(\boldsymbol{w_R}) \;:=\; \Pi_R(\boldsymbol{w_R}) \;-\; B(\boldsymbol{w_R}). \tag{3.11}$$

When prices are uniform, we write $F(w_R)$ with $w_{R,i} \equiv w_R$ for all i. Let $\Delta_F(C_R)$ denote the change in this feasibility bound induced by a contract C_R, evaluated relative to the baseline pricing strategy that coincides with the same on-path prices at $k = n$. If $F(\boldsymbol{w}_R) < 0$, the rival cannot finance the minimum on-path incentives required to deter pivotal deviations while remaining weakly profitable.

To focus on implementation of accommodation, we assume that whenever $F + \Delta_F(C_R) \geq 0$ and the rival's net profits are non-negative on-equilibrium path, the rival can *fully commit* to the entire state-contingent contract schedule under C_R, including any off-equilibrium losses required to persuade buyers to sign and switch. This assumption will be referred to as *full commitment* in what follows.[16]

The rival's contract may involve signing transfers $\boldsymbol{P^1(a^1)}$ and corrective payments $\boldsymbol{P^2(a)}$ with $P > 0$ denoting a payment from the rival to the buyers (and vice versa for $P < 0$). Payments and penalties to the incumbent's customers are void (ab initio): $P_i^2 = P_i^1 = 0$ if $a_i^2 = a_i^1 = I$. Also, penalties cannot be set arbitrarily high:[17] We assume that net breach payments are bounded by the damages suffered by the rival and loyal buyers. Under these restrictions, an aggregate damages cap can be written as

$$\sum_{i \in D} \Big(P_i^1(R) + P_i^2\big(I \mid a_i^1 = R\big) \Big) \geq \big[\Pi_R(k - |D|) - \Pi_R(k)\big] + \sum_{j \in S_R \setminus D} \big[\pi_j^R(k - |D|) - \pi_j^R(k)\big], \tag{3.12}$$

if the contract is symmetric where D is the set of R-signers who breach and S_R is the set of buyers who signed with R. Condition (3.12) makes explicit what "enforcement" can achieve on its own: it can shift losses from loyal parties to deviators up to the level of expected harm, but it cannot generate arbitrary additional pledgeable resources.

Now, consider the class of "bilateral menus"

$$\boldsymbol{C^1} = \Big\{ \big(\boldsymbol{w_R},\ \boldsymbol{P^1(a^1)},\ \boldsymbol{P^2(a)} \big) \ :\ \boldsymbol{w_R} \in [\boldsymbol{c_R}, \boldsymbol{\bar{w}_R}]^{\boldsymbol{n}} \Big\}.$$

where $\boldsymbol{w_R}$ is a (possibly asymmetric) price vector. This menu nests standard instruments: price discrimination, two-part tariffs, exclusives with damages, MFN/MFC and rebates, and threshold/participation bonuses indexed to realized adoption.

When exclusion is driven by negligible contracting externalities (e.g., $S(c_I, c_R) < n$ or $S(c_I, c_R) = n$ but Condition (3.9) fails), the feasibility bound does not bind at accommodation as $F \geq 0$: the rival can finance the needed insurance from on-path profits. Thus, as in Spector (2011), introducing bilateral menus expands the feasible set of compensating transfers and limits exclusion under these conditions.

By contrast, under peer-RRC the obstruction is not a lack of enforceability; it is

[16] Full commitment requires extraordinary structure on the rival and financial markets: (a) deep financing to absorb off-equilibrium losses; (b) renegotiation-proofing or reputational bonds that make deviation costly; and (c) verifiability of the promised schedule.

[17] Under civil law, parties may agree on fixed penalties for breach and courts normally enforce them, but courts may reduce penalties deemed disproportionate. Under common law, remedies focus on compensating the innocent party rather than stipulated penalties; "liquidated damages" are enforced only when they reasonably approximate expected harm. See Hermalin et al. (2007).

a lack of pledgeable surplus ($F < 0$). Appendix B shows that bilateral menus cannot relax the feasibility bound under peer-RRC: C^1 contracts may reshuffle deviation incentives but cannot restore $F \geq 0$ and entry accommodation. It is worth noting that with C^1, breach penalties provide *enforcement*, not *surplus*: they can compensate for deviation losses, but they do not generate the ex-ante resources needed to ensure contracting in the first place.

The next class conditions prices (and quantities) on the realized signing and sourcing profile $\boldsymbol{a} = \{\boldsymbol{a}^1, \boldsymbol{a}^2\}$ and may be referred to as the "aggregate-contingent" designs:

$$\boldsymbol{C^2} = \big\{\boldsymbol{w_R(a)},\ \boldsymbol{P^1(a^1)},\ \boldsymbol{P^2(a)}\big\}.$$

Two subclasses that are defined with respect to whether the prices can be conditioned on sourcing or merely on adoption are of particular interest.

The first is allowed to condition prices only on the aggregate contracting behavior ($\boldsymbol{a^1}$). These contracts can be designed as all-or-none or share-contingent contracts $\boldsymbol{C^2_{SC}}$, whereby the rival refuses to sell if a target signing behavior is not achieved and quotes a price only if the target is met. Thus, they may remove the risk in signing with the rival to a great extent through breach penalties.

Let the scale target be $\boldsymbol{A^T} \subseteq \boldsymbol{A^1} := \times_{i\in N} A^1_i$. The class $\boldsymbol{C^2_{SC}}$ is restricted as follows:

$$\begin{aligned} w_{R,i} > w_I, &\quad P^1_i(a^1_i{=}R){+}P^2_i(a^2_i{=}I \mid a^1_i{=}R) \geq 0 \quad \forall\, \boldsymbol{a}^1 \notin \boldsymbol{A}^T \\ w_{R,i} \leq w_I, &\quad P^1_i(a^1_i{=}R){+}P^2_i(a^2_i{=}I \mid a^1_i{=}R) < 0 \quad \forall \boldsymbol{a}^1 \in \boldsymbol{A}^T \end{aligned}$$

That is, they specify a target signing set $A^T \subseteq A^1$ and make terms explicitly contingent on whether the target is achieved. Off target, the contract makes signing with the rival riskless: it sets $w_{R,i} > w_I$ and imposes no penalty for sourcing from the incumbent, so buyers optimally source from I. For this reason, these contracts do not require full commitment, as signers face no downside risk off target, making the rival's ability to commit irrelevant.[18] On target, the rival undercuts and imposes compensatory breach penalties on deviators. Because buyers face no risk in signing and anticipate that aggregate-contingent pricing activates only when the target is met, signing becomes the dominant strategy whenever the rival undercuts the incumbent at the target scale.

In this case, buyer opportunism entails "signing ($a^1_i = R$) to pay the penalty

[18] The implementation of share-contingent contracts requires (a) an observable and contractible aggregate (share or quantity); (b) enforceable liquidated damages that pass penalty-doctrine screens; (c) a clear allocation rule for corrective payments across loyal buyers and breachers; (d) information and competition compliance; and, most importantly, a central audit/screening device that is typically associated with substantial costs.

($a_i^2 = I$).” Thus, enforcement relaxes the feasibility bound ($\Delta_F > 0$) because participation is secured and “scale insurance” becomes state-contingent. The condition under which peer-RRC still blocks accommodation ($k = n$) under C_{SC}^2 is the modified test

$$\pi_I(n-1) + (n-1)\pi_R(n-1) > n\pi_R(n), \tag{3.13}$$

which gives rise to the sufficient condition

$$\frac{\gamma\,(n-1)\,f\big(Q_R^{*,-i}(n-1)\big)\ -\ A}{2\beta+\gamma(n-2)}\ >\ (c_I - c_R), \qquad A := (\sqrt{n}-1)(2\beta-\gamma)(\alpha-c_R) > 0, \tag{3.14}$$

derived in Appendix B. A necessary condition for (3.13) to hold is that the downstream market is sufficiently concentrated. In particular, there exists a threshold level $N^0(\alpha, \beta, \gamma, c_I, c_R)$ such that, whenever $n > N^0$, share-contingent designs implement accommodation. Otherwise, (3.13) may hold so that C_{SC}^2 designs fail in a set of admissible games.[19]

The second subclass can condition prices on the actual sourcing decision. Thus, it requires a perfect monitoring technology that simultaneously detects a deviation and negligible menu costs. An example of particular interest is price/performance-assurance contracts C_{PA}^2 that promise a target effective price that either undercuts the incumbent at any sourcing profile or involves below-cost pricing financed through participation fees on customers. Price/performance-assurance requires extraordinary commitment technology and perfect enforcement since we allow the rival to commit to making losses through lower prices and to refuse to renegotiate when adoption falls short. Formally, the rival either offers

$$w_R(\boldsymbol{a}) \text{ such that } w_R^{ef} < w_I - \varepsilon,$$

or designs a contract that involves below-cost pricing on-path, that is, $w_R(\boldsymbol{a^2} = \boldsymbol{R}) < c_R$, and

$$\pi_R^*\big(n; w_R(\boldsymbol{a^2} = \boldsymbol{R})\big) - t_i \geq \pi_I^*(n-1) \quad \forall i,$$

$$\Pi_R(\boldsymbol{a^2} = \boldsymbol{R}) = \big(w_R(\boldsymbol{a^2} = \boldsymbol{R}) - c_R\big)\, Q_R^*\big(n; w_R(\boldsymbol{a^2} = \boldsymbol{R})\big) + \sum_{i=1}^{n} t_i \geq 0$$

where $t_i := -\Big(P_i^1(\boldsymbol{a^1}) + P_i^2(\boldsymbol{a^2} = \boldsymbol{R})\Big) \geq 0$. Thus, “source from R” is a dominant strategy in every relevant choice profile. Such contracts can implement accommoda-

[19] At best they can sustain an active-but-below-scale outcome, which I do not discuss since it relies on the maintained contracting asymmetry and on *net* breach revenues exceeding any contracting and administration costs.

tion generically because they blunt buyer opportunism by removing the incentives to deviate from an accommodation equilibrium if the prices that implement such contracts are not indefinitely low.

Now that we have defined the classes of contracts of interest, we can articulate the central result of the paper.

Proposition 3. Suppose the incumbent is restricted to uniform prices. Recall that under full commitment, accommodation $k = n$ is implemented whenever $F + \Delta_F(C_R) \geq 0$.

1. $\boldsymbol{C^1}$ cannot implement accommodation generically because $\sup_{C_R \in C^1}\big(F+\Delta_F(C_R)\big) = F(c_R)$. Hence, whenever $F < 0$, we have $F + \Delta_F(C_R) < 0$ for all $C_R \in C^1$.

2. $\boldsymbol{C^2_{SC}}$ cannot implement accommodation generically because, when $n < N^0$ and Condition (3.13) holds, we have $F + \Delta_F(C_R) < 0$ for all $C_R \in C^2_{SC}$.

3. Provided the assured-price schedule is well-defined for the primitives under consideration, there exists $C_R \in \boldsymbol{C^2_{PA}}$ such that $\Delta_F(C_R) = B$, and hence $F + \Delta_F(C_R) \geq 0$.

Proof. As a benchmark, Lemma B.1 shows that when the feasibility constraint is not binding ($F \geq 0$), even relatively poor contracts can implement accommodation. We therefore focus on the peer-RRC region in which $S(c_I, c_R) = n$ and Condition (3.9) holds, so that $F < 0$.

The first step is to show that within the class without breach penalties (C^0), the maximal feasibility gain is zero. Lemma B.3 decomposes the rival's equilibrium profit into a term that depends only on the mean effective price plus a strictly negative dispersion term. Lemmas B.4–B.5 then show that asymmetric per-unit prices around a fixed mean can neither increase the rival's equilibrium scale nor relax the feasibility bound for any adoption level k, implying $\sup_{C_R \in C^0}\big(F + \Delta_F(C_R)\big) = F(c_R)$, with the supremum attained at a uniform cost-based offer in the relevant domain.

The second step extends the argument to bilateral menus C^1. Lemma B.6 shows that introducing corrective payments does not increase the feasibility bound unless participation is ensured. Moreover, even when signing implies sourcing, $B(w_R) > \Pi_R(w_R)$ throughout the relevant range, so the rival cannot finance $B(w_R)$. Hence,

$$\sup_{C_R \in C^1}\big(F + \Delta_F(C_R)\big) = F(c_R),$$

and accommodation cannot be implemented generically. This establishes Item (1).

For share-contingent contracts C^2_{SC}, the key issue is whether a buyer can profitably deviate at the sourcing stage despite breach penalties. Lemma B.7 shows that for sufficiently large n the deviation cannot be profitable (so C^2_{SC} always succeeds), whereas Lemma B.8 shows that when $n < N^0$ there exists a set of admissible primitives in which buyers are sufficiently concentrated and the penalty function is sufficiently steep relative to the efficiency gap, so that Condition (3.13) holds. This establishes Item (2).

Finally, for C^2_{PA}, construct a price-assurance contract that guarantees the required insurance level B. Such a contract exists if the prices that are required are not indefinitely low, implying $F + \Delta_F(C_R) \geq 0$ and thus implementation of accommodation. This establishes Item (3). □

Proposition 3 delineates a limit of the "sufficiently complete contracts" view when final consumers are absent due to downstream competition. While the Chicago tradition emphasizes that sufficiently rich contracts internalize externalities and prevent inefficient exclusion, this logic depends critically on the contractibility of final consumers and the commitment technology at the rival's disposal. In particular, Proposition 3 shows that a large set of contracts cannot generically ensure entry and expansion of a more efficient rival.

Item (1) is the substantive limit: under peer-RRC, the binding obstacle is the pledgeability gap $B(w_R) > \Pi_R(w_R)$. Since no bilateral menu can raise F even if the rival can commit to loss-making below scale, bilateral menus cannot defeat the peer-RRC mechanism induced by unconditional uniform pricing from the incumbent. This result also nests the familiar "rich contracts cure miscoordination" result: when F is slack ($\Pi_R \geq B$), bilateral instruments can mobilize the rival's rents to insure buyers and coordinate on $k = n$ under a full commitment technology. If the rival's ability to make off-path losses were limited, then it would not be able to persuade buyers to sign its contract below some participation level through bonuses.

Items (2)–(3) identify which further instruments can defeat peer-RRC. Share-contingent (all-or-none) contracts can restore accommodation by making participation self-enforcing and turning breach penalties into enforceable, state-contingent scale insurance. Yet, they may fail when buyers are sufficiently concentrated and the below-scale disadvantage is sufficiently steep (captured by (3.13) and the threshold N^0). Price-assurance designs eliminate the opportunistic deviation motive directly, but only under unrealistic commitment and perfect enforcement technologies that allow the rival to commit to below-scale losses and rule out renegotiation.

3.3 Discussion

This section begins with a discussion of all-parties-present rationales and then discusses how the above analysis maps to a set of prominent antitrust cases.

3.3.1 Effective Presence of All Relevant Parties

In the benchmark normative view, sufficiently rich contracting internalizes externalities, so exclusion requires that some relevant interests are absent (or noncontractible) at the contracting stage. For instance, if the share-contingent contracts could involve final consumers (say, through a term that specifies how much they will source from the R-group buyers), the deviator would have to compensate final consumers as well. In the parameter region of interest—where deviation is privately profitable but inefficient—the aggregate losses imposed on all relevant parties exceed the deviator's private gain, so such compensation would eliminate the incentive to deviate. However, a distinctive feature of environments with downstream competition is this form of *openness*: final consumers are naturally not parties to contracting.[20]

Although consumer noncontractibility is simply a structural feature of markets in which buyers are competitors in final markets, it is useful to examine two standard modeling moves that are often read as making "all parties effectively present," and to clarify what each move actually entails in this environment.

A common argument is that very intense downstream competition effectively "brings consumers to the table," so that upstream contracting internalizes the relevant externalities (Ide et al., 2016). In such models, however, the key effect of homogeneous-goods Bertrand is not representation of consumer interests per se, but *centralization*: extreme downstream competition expands the potential scale of each downstream firm discontinuously, so derived demand becomes effectively aggregated and downstream firms behave like agents competing to serve a single large purchaser. In such centralized-demand environments, selecting the efficient rival is essentially riskless for each buyer as externalities are fully internalized by the central demander, so accommodation obtains (Rasmusen et al., 1991; Segal and Whinston, 2000; Fumagalli and Motta, 2006).

Formally, under homogeneous-goods Bertrand, the downstream game induces a lowest-wins allocation rule that is equivalent to a single-buyer environment; the existence of a downstream market becomes irrelevant except insofar as the incumbent

[20]See Spector (2011) for the flip side of the problem; that is, the role played by contractual restrictions when all relevant contracting parties are present.

can use transfers to create an agency problem.[21] Outside this boundary—e.g., with decentralized demand, product differentiation, or capacity constraints—the exclusionary potential of simple pricing policies (discounts, price announcements, rebates) can re-emerge.

A second "all-parties-present" move concerns timing. In many classic demand-externality models with scale disadvantages represented by a fixed entry cost and flat marginal cost, the entrant's decision typically occurs after buyers are approached by the incumbent. Exclusives can then generate a signing pattern that makes entry unprofitable, and buyers who initially choose the entrant is exposed to renegotiation threat—a phase where the entrant is absent (Segal and Whinston, 2000; Rasmusen et al., 1991; Fumagalli and Motta, 2008).

If the entry decision is made before buyers' sourcing decisions, the rival can undercut the incumbent and commit to serving buyers at its announced terms as sunk entry costs become irrelevant for pricing. In that case, even if low participation would ultimately prevent the entrant from recouping entry costs, buyers do not face any contracting risk. This timing change is therefore best understood as a *price-assurance benchmark* rather than a pure "all-parties-present" resolution, because it embeds an assumption about the entrant's ability to commit to serve even when adoption is low and to make losses ex post rather than renegotiate.

Together, these observations suggest that "all-parties-present" interpretations of homogeneous Bertrand or entry-before-buyers are better read as boundary cases: the former delivers demand centralization; the latter delivers entrant commitment to price-assurance. Both eliminate the specific contracting risk that drives exclusion.

3.3.2 A View on Prominent Antitrust Cases

The model above highlights two broad ways in which a practice can become exclusionary. First, a practice can *increase buyers' exposure* to the rival's below-scale disadvantage, perhaps tying the degree of exposure to aggregate adoption—in the model's language, by raising the rival's *effective* terms relative to its posted terms ($w_R^{ef} > w_R$) and/or by creating a perceived value gap ($\alpha_R < \alpha_I$). Second, a practice may involve sufficient concessions to buyers such that, given those disadvantages, they want to remain with the incumbent to avoid weakening their competitive position. Moreover, in this environment, accommodation may hinge on the rival's ability

[21] See Abito and Wright (2008) and Simpson and Wickelgren (2007) for how transfers can matter. A formal equivalence result between centralized demand and homogeneous Bertrand is stated in Appendix C.

to commit to compensating buyers when adoption falls short.

With that lens, this subsection identifies elements in the record that resonate with the model's channels: practices that widen effective-term or perceived-value asymmetries, that increase exposure to adoption risk, and that interact with commitment constraints in a way that can make entry accommodation hard to implement.

Table 3.1: Selected cases: practice and scale-sensitive disadvantage channels

Case	**Practice (label)**	**Scale-sensitive disadvantage channel (where it bites)**
Intel	Loyalty rebates / lump-sum transfers	Conditional payments undermining perceived rival reliability; restricted access to high-reputation OEMs.
British Airways	Loyalty/incremental-share targets	Hub/alliance network advantages make switching expose agencies' clients to thinner coverage and reliability when rival adoption is low; performance targets deepen exposure.
Post Danmark (II)	Retroactive rebates	Scale/density asymmetries; slower rival delivery; financial fragility and sustained losses limit compensating transfers.

In the Intel case, much of the record concerns lump-sum rebates.[22] However, the record also identifies a set of 'naked restrictions"—(a) launch/support-delay obligations, (b) channel/stock restrictions for AMD-based systems, and (c) retail exclusivity—that directly limit the visibility and availability of AMD-based products.[23] In the model's language, these restrictions plausibly operate through both primitives: launch delays and channel limits raise the rival's *effective* terms for OEMs, w_R^{ef}, while reduced support depress the perceived value of the rival input, lowering α_R. Together, they increase the commercial risk of dealing with the rival and are especially damaging when more customers subscribe to them; once OEMs coordinate on the incumbent's terms, those terms can become the baseline for access and support, making the rival's disadvantages more salient and persistent.

In *Post Danmark*, limited commitment arising from financial fragility, together with economies of density, may have reinforced the incumbent's exclusionary edge. The record suggests existing differences in coverage, density, and delivery times (quality).[24] Delivery times are closely linked to service frequency: denser networks can sustain more frequent rounds and shorten expected delays and determines the value of the network that is being utilized.[25] Retroactive rebates can interact with

[22]Reading *Intel v. European Commission* (COMP/C-3/37.990, 13.05.2009), paras. 193–216 and 455–500, suggests that rebates were performance-based for Dell and NEC but largely lump-sum for other OEMs.

[23]*Intel v. European Commission*, Decision C(2009) 3726 final, recitals (1641), (1677)–(1678); Art. 1(e)–(h) (p. 515).

[24]*Post Danmark A/S v. Konkurrencerådet*, 2015, paras. 3–10, 14.

[25]Mohring (1972) highlights the general mechanism whereby higher service frequency reduces

the existing density differences: when the rival's thinner network makes its service effectively more costly (or lower quality) at the margin, rebates can constitute the sufficient concessions needed to tilt demand toward the incumbent.

At the same time, the contracting results suggest a natural counterfactual: if the rival could credibly pledge enough surplus, a density-induced quality gap (e.g., delivery time) could in principle be offset in utility space via compensating discounts or transfers. Yet, Bring Citymail reported unsustainable financial losses and quit the market.[26] Read through the paper's lens, this points to an interaction between scale-induced costs on buyers and an entrant's limited ability to commit to the below-scale compensation needed to sustain accommodation.

The value of airline services is directly shaped by network geometry. Larger hub systems and alliance participation expand connectivity, raise frequency, tighten connection times, and enable through-ticketing and schedule coordination. These features naturally create a structural value gap, $\alpha_R < \alpha_I$, for thinner networks. *British Airways* combined marketing agreements with a sliding-scale "performance reward" featuring strong threshold effects and broader coverage of UK agents, making diversion away from the larger-network incumbent costly and pushing agencies to preserve British Airways share even when rival fares were potentially attractive—exactly the "sufficient concessions" logic during entry attempts.[27]

Across Intel, Post Danmark, and British Airways, exclusion does not turn on labels. It turns on whether a practice (i) widens underlying asymmetries (for example, by directly restricting the reach, visibility, or reliability of the rival's offering) and/or (ii) interacts with those asymmetries in a way that amplifies the private risk of dealing with the rival, especially when overall adoption matters. When either holds, buyers may rationally tilt away from the rival and exclusion can persist without below-cost pricing.

3.4 Conclusion

This paper develops a model in which scale-driven feedback and downstream rivalry sustain exclusion—without buyer pre-commitment or ad-hoc contractual restrictions. A pivotal buyer's defection imposes scale penalties on others, triggering a

expected waiting time in network services; NERA Economic Consulting (2004), documents strong economies of delivery density in EU postal operations, implying that end-to-end competition is toughest in delivery.

[26] *Post Danmark A/S v. Konkurrencerådet*, 2015, paras. 12, 34.

[27] Case T-219/99, *British Airways plc v. Commission* [2003] ECR II-5917, paras. 9, 259–261, 271–274, 308, 313–314.

peer-induced raising-rivals'-costs (RRC) effect. This mechanism renders entry accommodation privately unstable even under uniform pricing, making exclusion the unique equilibrium prediction. The result emerges from equilibrium incentives alone, not from miscoordination or communication frictions.

It also shows that standard "rich contract" remedies—bilateral menus, MFN clauses, two-part tariffs, exclusives with capped damages—cannot overcome the core feasibility constraint because of the rival's limited pledgeable surplus under decentralized demand and contemporaneous network effects. Only instruments that condition on aggregate participation or guarantee subscale viability (e.g., share-contingent or price-assurance contracts) can restore accommodation—and only under strong enforcement, observability, and commitment assumptions. Thus, contractual richness does not generically neutralize exclusion; its efficacy depends on frictions and market structure.

These results delineate a sharp boundary for Chicago logic: exclusion can arise and persist even when formal contracting appears neutral. The analysis provides a tractable benchmark for assessing exclusionary risk in settings characterized by decentralized buyers, scale, and competitive interdependence. Conceptually, the paper shows how downstream rivalry converts scale-sensitive disadvantages into a strategic force: individual buyers may rationally defect in order to worsen rivals' effective terms, so the "sufficiently rich contracts" logic can fail in decentralized-demand settings where final consumers are not contractible.

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Appendix

Appendix A

Let k be the number of $a_i = R$-firms and $n - k$ the number of $a_i = I$-firms. All types face the inverse demand function derived from Equation (1) in the main text:

$$p_i = \alpha - \beta q_i - \gamma \sum_{j \neq i} q_j.$$

Fix k and consider the downstream Cournot subgame with k buyers sourcing from R and $n-k$ sourcing from I. Let $q = (q_1, \ldots, q_n)$ and define the pseudogradient $g(q) = (g_i(q))_{i=1}^n$ where $g_i(q) := \partial \pi_i(q)/\partial q_i$. Define $\tau := \sup_{Q \geq 0} |f'(Q)|$. Because $w_{R,i} = w_R + f(Q_R^{-i})$ depends on competitors' quantities, the downstream game has extra cross-effects among R-firms; uniqueness is not implied by $\beta \geq \gamma$ alone. Clean, checkable sufficient conditions that restore uniqueness are $2\beta > \gamma + \tau$ and

$$2\beta + \gamma(k-1) - (k-1)\tau > \frac{\gamma^2 k(n-k)}{2\beta + \gamma(n-k-1)}. \tag{U}$$

The following lemma proves that claim.

Lemma A.1 (Uniqueness). Suppose $\tau := \sup_{Q \geq 0} |f'(Q)| < \infty$, f is weakly decreasing, and $2\beta > \gamma + \tau$. Assume moreover that

$$\big(2\beta + \gamma(k-1) - (k-1)\tau\big)\big(2\beta + \gamma(n-k-1)\big) > \gamma^2 k(n-k).$$

Then the downstream Cournot subgame has a unique Nash equilibrium that is within-type symmetric.

Proof. We show uniqueness by reducing to within-type symmetric profiles. Each π_i is strictly concave in q_i since $\partial g_i / \partial q_i = -2\beta < 0$, so best replies are single-valued.

We first show that an equilibrium must be within-type symmetric. Assume that the aggregate quantity remains the same, which means

$$g_i(q^*) - g_j(q^*) = (2\beta - \gamma)(q_j^* - q_i^*) + f(Q_R^{-j,*}) - f(Q_R^{-i,*}).$$

Let q^* be a Nash equilibrium and pick $i, j \in R$ with $q_i^*, q_j^* > 0$. Then $g_i(q^*) = g_j(q^*) = 0$.

$$(2\beta - \gamma)(q_i^* - q_j^*) = f(Q_R^* - q_j^*) - f(Q_R^* - q_i^*).$$

If $q_i^* > q_j^*$ then $Q_R^* - q_i^* < Q_R^* - q_j^*$ and, since f is weakly decreasing, the right-hand side is ≤ 0 while the left-hand side is > 0, a contradiction. Thus $q_i^* = q_j^*$. The same argument (with f absent) implies $q_i^* = q_j^*$ for all active $i, j \in I$. Therefore any Nash equilibrium is semi-symmetric: there exist (q_R^*, q_I^*) such that $q_i^* = q_R^*$ for $i \in R$ and $q_i^* = q_I^*$ for $i \in I$.

The next step is to show uniqueness of this equilibrium. For a semi-symmetric profile (q_R, q_I) the interior first-order conditions are

$$\alpha - w_I - \big(2\beta + \gamma(n-k-1)\big)q_I - \gamma k q_R = 0,$$

and

$$\alpha - w_R - \big(2\beta + \gamma(k-1)\big)q_R - \gamma(n-k)q_I - f\big((k-1)q_R\big) = 0.$$

Let $D_I := 2\beta + \gamma(n-k-1) > 0$. Thus,

$$q_I(q_R) = \frac{\alpha - w_I - \gamma k q_R}{D_I}.$$

Substituting this we define

$$\Phi(q_R) := \alpha - w_R - \big(2\beta + \gamma(k-1)\big)q_R - \gamma(n-k)\, q_I(q_R) - f\big((k-1)q_R\big).$$

Then any semi-symmetric equilibrium must satisfy $\Phi(q_R) = 0$. Moreover, using $|f'| \leq \tau$,

$$\Phi'(q_R) = -\big(2\beta+\gamma(k-1)\big) + \frac{\gamma^2 k(n-k)}{D_I} - (k-1)f'\big((k-1)q_R\big) \leq -\Big(2\beta+\gamma(k-1)-(k-1)\tau\Big) + \frac{\gamma^2 k(n-k)}{D_I}.$$

Assumption (U) is equivalent to

$$2\beta + \gamma(k-1) - (k-1)\tau > \frac{\gamma^2 k(n-k)}{D_I},$$

hence $\Phi'(q_R) < 0$ for all $q_R \geq 0$. Therefore Φ is strictly decreasing and has at most one root on $[0, \infty)$, implying at most one semi-symmetric equilibrium. Corner cases ($q_R = 0$ and/or $q_I = 0$) are also unique by strict concavity in own output. Thus, the Nash equilibrium is unique.[28] □

[28] At any Nash equilibrium q^* (with constraints $q_i \geq 0$), strict concavity of π_i in q_i implies the complementarity conditions: if $q_i^* > 0$ then $g_i(q^*) = 0$, while if $q_i^* = 0$ then $g_i(q^*) \leq 0$. Hence there cannot be "mixed" active/inactive firms within the same type. Indeed, suppose $i, j \in R$ with $q_i^* = 0$ and $q_j^* > 0$. Then $g_j(q^*) = 0$ and

$$g_i(q^*) - g_j(q^*) = (2\beta - \gamma)q_j^* + f(Q_R^{-j,*}) - f(Q_R^{-i,*}),$$

A fixed-point for this problem is achieved when

$$q_R^* = \frac{(2\beta-\gamma)\alpha - (2\beta+\gamma(n-k-1))w_R^{ef} + \gamma(n-k)w_I}{(2\beta-\gamma)(2\beta+\gamma(n-1))}$$

and

$$q_I^* = \frac{(2\beta-\gamma)\alpha - (2\beta+\gamma(k-1))w_I + \gamma k w_R^{ef}}{(2\beta-\gamma)(2\beta+\gamma(n-1))}.$$

The resulting profits are

$$\pi_{a_i}^*(k) = \beta\,[q_{a_i}^*(k)]^2.$$

Fix k and consider the (unique) downstream equilibrium induced by offers (w_I, w_R). Recall that the effective input price faced by an R–buyer is

$$w_R^{ef} = w_R + f(Q_R^{*,-i}),$$

where $f(\cdot)$ is weakly decreasing (with $f = 0$ above the scale threshold). Hence any change in $Q_R^{*,-i}$ feeds back into w_R^{ef} in the opposite direction (since f is weakly decreasing).

Holding w_R^{ef} fixed, the Cournot equilibrium quantities satisfy the usual comparative statics: an increase in w_I decreases each I–buyer's equilibrium quantity and increases each R–buyer's equilibrium quantity. In particular, q_R^* increases for every R–buyer, and therefore the aggregate quantity purchased from R excluding any given buyer, $Q_R^{*,-i}$, increases. Since f is weakly decreasing, this implies that $f(Q_R^{*,-i})$ weakly decreases and thus w_R^{ef} weakly decreases. This feedback reinforces the initial effect on quantities and hence on profits for the I–group. (Assumption (U) rules out sign reversals from the feedback through f.)

Now, suppose w_R increases by $v > 0$. Conditional on w_R^{ef}, each R–buyer's equilibrium quantity decreases. Consequently $Q_R^{*,-i}$ cannot increase, so $f(Q_R^{*,-i})$ weakly increases and the resulting increase in w_R^{ef} reinforces the reduction in R–buyers' quantities (and the corresponding increase in I–buyers' quantities). Since equilibrium profits are monotone in own equilibrium quantity, the claimed monotonicity relations (Relations (3.4) and (3.5)) follow.

Suppose one player switches to the rival. Consider $Q_R^* = kq_R^*$. If $w_R^{ef} \geq w_I$, q_R^* weakly increases for each member of the R-group, as can be seen from the numerator of the expression for q_R^*. An additional effect comes from the new buyer switching to

where $Q_R^{-i,*} = Q_R^*$ and $Q_R^{-j,*} = Q_R^* - q_j^* < Q_R^*$. Since f is weakly decreasing, $f(Q_R^{-j,*}) - f(Q_R^{-i,*}) \geq 0$, so $g_i(q^*) - g_j(q^*) \geq (2\beta-\gamma)q_j^* > 0$ (as $2\beta > \gamma$), contradicting $g_i(q^*) \leq 0$. Thus either all R-firms are active or all are inactive. The same argument applies to type I (where the f term is absent).

the R-group; thus, Q_R^* increases and f decreases, further increasing Q_R^*. If $w_R^{ef} < w_I$, the total change in R-group quantity, holding f fixed, is given by $D\Delta Q_R^{*,-i} = (2\beta + \gamma(n-k-2))(w_I - w_R^{ef}) \geq 0$, where $D = (2\beta - \gamma)(2\beta + \gamma(n-1))$.

To analyze the effect of an additional rival endorser, fix offers (w_I, w_R) and a semi-symmetric profile with k buyers sourcing from R (so $n-k$ source from I). Let $q_R^*(k)$ denote the equilibrium quantity of a representative R-buyer when the effective input price is

$$w_R^{ef} = w_R + f(Q_R^{*,-i}),$$

and write total rival-group quantity as $Q_R^*(k) = k\, q_R^*(k)$.

Consider a deviation in which one buyer switches from I to R, so the number of rival endorsers increases from k to $k+1$. First, *holding the scale term f fixed* (equivalently, holding w_R^{ef} fixed), the closed-form Cournot solution implies

$$D\big(q_R^*(k+1) - q_R^*(k)\big) = \gamma\,(w_R^{ef} - w_I),$$

where $D := (2\beta - \gamma)(2\beta + \gamma(n-1))$. Hence, if $w_R^{ef} \geq w_I$, then $q_R^*(k+1) \geq q_R^*(k)$: existing members of the R-group weakly expand. Moreover, the switching buyer now also produces as an R-type, so $Q_R^*(k)$ increases. Since f is (weakly) decreasing, the induced increase in $Q_R^{*,-i}$ lowers f, which further reinforces the increase in rival-group quantity.

If instead $w_R^{ef} < w_I$, then $q_R^*(k+1) < q_R^*(k)$ for the *existing* R-buyers, but the switching buyer's addition dominates in the aggregate. In particular, still holding f fixed, the net change in the rivals' aggregate quantity faced by any given buyer (i.e. excluding that buyer) satisfies

$$D\,\Delta Q_R^{*,-i} = \big(2\beta + \gamma(n-k-2)\big)\,(w_I - w_R^{ef}) \;\geq\; 0.$$

Thus, $Q_R^{*,-i}$ is weakly increasing in the number of rival endorsers, and by monotonicity of f, w_R^{ef} is weakly decreasing in k, reinforcing the effect.

Note that whenever a candidate equilibrium quantity for some buyer is negative, the Nash equilibrium is obtained by setting that buyer's quantity to zero and solving the induced Cournot game among the remaining active buyers (i.e., replacing n with the number of active buyers) (Ledvina and Sircar, 2011). In the present two-group environment, the active set shrinks either by k or by $n-k$. When one of the groups is inactive, the corresponding symmetric quantities (under uniform pricing) are

$$q_R^0 = \frac{\alpha - w_R^{ef}}{2\beta + \gamma(k-1)} \qquad \text{if the } I\text{-group is inactive,}$$

and

$$q_I^0 = \frac{\alpha - w_I}{2\beta + \gamma(n-k-1)} \qquad \text{if the } R\text{-group is inactive.}$$

Because the downstream game is concave, a buyer type's equilibrium profit is maximized when rivals' activity is minimized—that is, when the opposing group becomes inactive (whether due to a semi-symmetric price shock or an exogenous reduction in the number of players; see Corchón (1994) or Acemoglu and Jensen (2013)).

Finally, the case where α_{a_i} depends on Q_R^* while w_R is given is equivalent to the case where $w_R^{ef}(Q_R^{-i}) := w_R + f(Q_R^{-i})$. Recall from the main text that the utility function in this case is given by

$$U(q) = \alpha \sum_{i \in I} q_i + \sum_{i \in R} \big(\alpha - f(Q_R^{-i})\big) q_i - \frac{1}{2}\left(\beta \sum_{i=1}^{n} q_i^2 + \gamma \sum_{i=1}^{n} \sum_{j \neq i}^{n} q_i q_j\right).$$

The mark-up (i.e., $p_i - w_R$) for $i \in R$ is

$$p_i - w_R = \alpha - \beta q_i - \gamma \sum_{j \neq i} q_j - (w_R + f(Q_R^{-i})).$$

Appendix B

I begin with $\boldsymbol{C^1}$ contracts. Suppose first that we restrict R to offering contracts with no corrective payments—$\boldsymbol{C^0}$. Consider symmetric $\boldsymbol{C^0}$:

$$\boldsymbol{C^0 = \big\{w_R,\ P^1(k), P^2 = 0\big\}}.$$

Lemma B.1: Under full commitment on the rival's side, there exists a non-empty subset of symmetric $\boldsymbol{C^0}$ contracts that implements accommodation if $S(c_I, c_R) < n$ or if $S(c_I, c_R) = n$ but Condition (9) fails.

Proof. The proof is simple. Suppose $w_R < w_I$. R can commit to paying $P^1(k)$ such that

$$\pi_I(k-1) < \pi_R(k) + P^1(k)$$

for $k \leq n-1$. At $k = n-1$, even if $P^1(k = n) = 0$, the above condition holds. Hence, equilibrium profitability is recovered. □

The next result is the most important one.

Lemma B.2: Symmetric $\boldsymbol{C^0}$ contracts cannot implement accommodation when $S(c_I, c_R) = n$ and Condition (9) holds.

Proof. Let $q_R(n, w_R)$ denote the rival's equilibrium quantity when $k = n$, and $q_I(n-1, w_R^{ef})$ the incumbent's when $k = n-1$, with

$$q_R(n, w_R) = \frac{\alpha - w_R}{2\beta + \gamma(n-1)}, \qquad \frac{dq_R}{dw_R} = -\frac{1}{2\beta + \gamma(n-1)},$$

and

$$\frac{\partial q_I}{\partial w_R^{ef}} = \frac{\gamma(n-1)}{D}, \qquad D := (2\beta - \gamma)\big(2\beta + \gamma(n-1)\big) > 0.$$

Write the pass-through factor as

$$\Theta(w_R) := 1 + f'(Q_R^{*,-i})\frac{dQ_R^{*,-i}}{dw_R}, \qquad \Theta_{\min} := \inf_{w_R \in [c_R, w_R^m]} \Theta(w_R) \ \geq 1,$$

so $\frac{dq_I}{dw_R} \geq \frac{\gamma(n-1)}{D}\,\Theta_{\min}$ while the penalty is active.

Step 1: Starting gap at $w_R = c_R$. Case III implies the single-deviation condition binds at $k = n$, hence

$$\frac{B(c_R)}{n} = \beta\big(q_I^2(n{-}1, w_R^{ef}) - q_R^2(n, w_R)\big) \ > \ 0 = \frac{\Pi_R(c_R)}{n}.$$

Step 2: Pointwise slope gap on $[c_R, w_R^m]$. Using $B/n = \beta(q_I^2 - q_R^2)$,

$$\frac{d}{dw_R}\Big(\tfrac{B}{n}\Big) = 2\beta\Big(q_I\,\frac{dq_I}{dw_R} - q_R\,\frac{dq_R}{dw_R}\Big).$$

Lower–bound it by (i) replacing q_I with q_R (valid since Case III gives $q_I(n{-}1, w_R^{ef}) \geq q_R(n, w_R)$ on the interval) and (ii) inserting the derivative bounds above:

$$\frac{d}{dw_R}\Big(\tfrac{B}{n}\Big) \ \geq \ 2\beta\, q_R\left[\frac{\gamma(n-1)}{D}\,\Theta_{\min} \ + \ \frac{1}{2\beta + \gamma(n-1)}\right]. \tag{LB}$$

For the rival,

$$\frac{d}{dw_R}\Big(\tfrac{\Pi_R}{n}\Big) = q_R + (w_R - c_R)\frac{dq_R}{dw_R} \ \leq \ q_R. \tag{UB}$$

Divide (LB) by (UB) (valid because $q_R(n, w_R) > 0$) we get:

$$2\beta\left[\frac{\gamma(n-1)}{D}\,\Theta_{\min} + \frac{1}{2\beta + \gamma(n-1)}\right] \ > \ 1. \tag{$*$}$$

Step 3: Closed-form simplification. Substituting $D = (2\beta-\gamma)(2\beta+\gamma(n-1))$ into $(*)$ and clearing positives,

$$2\beta(\Theta_{\min} - 1) + \gamma \;>\; 0.$$

Equivalently,

$$(n-1)\gamma\,[\,2\beta(\Theta_{\min} - 1) + \gamma\,] \;>\; 0.$$

$\square$

Since $\gamma > 0$ and $\Theta_{\min} \geq 1$, the slope gap in $(*)$ holds pointwise on $[c_R, w_R^m]$. Combined with $B(c_R) > \Pi_R(c_R)$, it follows that $B(w_R) - \Pi_R(w_R)$ is strictly increasing and remains positive on the whole interval. Hence, no symmetric contract can implement $k = n$.

We can introduce asymmetric contracts by perturbing the price vector and checking whether any such perturbation relaxes the feasibility bound. Begin with a premise.

Invertibility: Let I_n be the $n \times n$ identity and $J := \mathbf{1}\mathbf{1}^\top$. Set

$$M := 2\beta I_n + \gamma(J - I_n) = (2\beta - \gamma)I_n + \gamma J, \qquad \mathcal{L} := M^{-1} = uI_n + vJ,$$

with

$$u := \frac{1}{2\beta - \gamma} > 0, \qquad v := -\frac{\gamma}{(2\beta - \gamma)\big(2\beta + \gamma(n-1)\big)} < 0, \qquad \lambda_1 := \frac{1}{2\beta + \gamma(n-1)}.$$

Equivalently,

$$\mathcal{L} = u\Big(I_n - \tfrac{1}{n}J\Big) + \lambda_1\,\tfrac{1}{n}J, \quad \text{so } u + nv = \lambda_1.$$

For an R-block of size k (after reordering indices),

$$\mathcal{L}_{RR} = uI_k + vJ_k, \qquad \mathcal{L}_{RI} = v\,\mathbf{1}_k\mathbf{1}_{n-k}^\top,$$

and we will use

$$A_k := u+vk = \frac{2\beta + \gamma(n-k-1)}{(2\beta - \gamma)\big(2\beta + \gamma(n-1)\big)} > 0, \qquad B_k := v(n-k) = -\frac{\gamma(n-k)}{(2\beta - \gamma)\big(2\beta + \gamma(n-1)\big)} \leq 0,$$

with the handy identity $A_k + B_k = \lambda_1$.

We are interested in two types of dispersion: (i) Effective-price dispersion at fixed mean: $w_R^{ef} = \bar{\mu}\,\mathbf{1}_k + \theta\,\xi,\ \mathbf{1}_k^\top\xi = 0,\ \theta \geq 0$. (ii) Posted-price dispersion along a ray: $w_R(t) = \bar{w}\,\mathbf{1}_k + t\,d,\ \mathbf{1}_k^\top d = 0,\ t \geq 0$; let $\bar{\mu}(t) := \frac{1}{k}\mathbf{1}_k^\top w_R^{ef}(t)$ and $\xi^{ef}(t)$ be the induced effective-price mean and dispersion.

Note that Assumption (U) implies

$$(k-1)A_k\tau < 1,$$

which makes the scalar fixed point for $\bar{\mu}(t)$ a contraction and ensures global monotonicity in t.

Lemma B.3 gives a profit decomposition for the rival and its customers under effective-price dispersion at a fixed mean.

Lemma B.3: Fix an R-block of size k. The Cournot solution on R satisfies

$$q_R = \underbrace{\big[A_k(\alpha-\bar{\mu}) + B_k(\alpha - w_I)\big]}_{=:m(\bar{\mu})}\,\mathbf{1}_k \;-\; u\,\xi, \qquad Q_R = \mathbf{1}_k^\top q_R = k\,m(\bar{\mu}).$$

Consequently, for any c_R,

$$\begin{aligned} \Pi_R &= (w_R^{ef} - c_R\mathbf{1}_k)^\top q_R = (\bar{\mu}-c_R)\,Q_R \;-\; u\,\|\xi\|^2, \\ \sum_{i=1}^{k} \beta q_{R,i}^2 &= \beta\left(\frac{Q_R^2}{k} + u^2\,\|\xi\|^2\right). \end{aligned} \tag{3.15}$$

Proof. Reorder indices so $R=\{1,\dots,k\}$. Then

$$q_R = \mathcal{L}_{RR}(\alpha\mathbf{1}_k - w_R^{ef}) + \mathcal{L}_{RI}(\alpha\mathbf{1}_{n-k} - w_I\mathbf{1}_{n-k}) = (uI_k + vJ_k)\big((\alpha-\bar{\mu})\mathbf{1}_k - \xi\big) + v\,(n-k)(\alpha-w_I)\mathbf{1}_k,$$

which simplifies (using $J_k\mathbf{1}_k = k\mathbf{1}_k$ and $J_k\xi = \mathbf{1}_k(\mathbf{1}_k^\top\xi) = 0$) to $q_R = m(\bar{\mu})\mathbf{1}_k - u\,\xi$ with $m(\bar{\mu}) = A_k(\alpha-\bar{\mu}) + B_k(\alpha-w_I)$. Summing over R yields $Q_R = k\,m(\bar{\mu})$. For profit,

$$\Pi_R = (\bar{\mu}\mathbf{1}_k + \xi - c_R\mathbf{1}_k)^\top\big(m(\bar{\mu})\mathbf{1}_k - u\,\xi\big) = (\bar{\mu}-c_R)\,k\,m(\bar{\mu}) - u\,\xi^\top\xi = (\bar{\mu}-c_R)Q_R - u\|\xi\|^2,$$

because $\mathbf{1}_k^\top\xi = 0$. Finally,

$$\sum_{i=1}^{k} q_{R,i}^2 = \|m(\bar{\mu})\mathbf{1}_k - u\xi\|^2 = k\,m(\bar{\mu})^2 + u^2\|\xi\|^2 = \frac{Q_R^2}{k} + u^2\|\xi\|^2,$$

and multiplying by β gives the quadratic identity. Since $\beta \geq \gamma$, we have $2\beta-\gamma \geq \beta$, hence

$$u = \frac{1}{2\beta-\gamma} \leq \frac{1}{\beta},$$

i.e. $u \geq \beta u^2$. $\square$

In particular, at fixed mean $\bar{\mu}$ the aggregate Q_R is independent of dispersion ξ, while dispersion strictly reduces the rival's profit by $u\|\xi\|^2$ and increases the customers' quadratic term by $\beta u^2\|\xi\|^2$. If $\beta \geq \gamma$ (equivalently $u \geq \beta u^2$), then for any $\xi \neq 0$ the dispersion penalty on Π_R weakly dominates the dispersion gain in $\sum_i \beta q_{R,i}^2$. Thus, the local maximum profit for the R-group and the rival is achieved under price symmetry, $\xi = 0$.

An alternative strategy to defeat the peer RRC mechanism is to increase quantity at a given posted price. The next lemma shows that introducing non-uniform prices weakly raises the mean effective price and therefore decreases the rival's total quantity, so asymmetric prices cannot ease the quantity constraint.

Lemma B.4: Consider the zero-mean posted-price ray $w_R(t) = \bar{w}\,\mathbf{1}_k + t\,d$ with $\mathbf{1}_k^\top d = 0$, $t \geq 0$. Then

$$\bar{\mu}(t) \text{ is nondecreasing in } t, \qquad Q_R(t) = k[A_k(\alpha - \bar{\mu}(t)) + B_k(\alpha - w_I)] \text{ is nonincreasing in } t.$$

Proof. (i) Scalar fixed point and contraction. For any mean μ and induced dispersion $\xi^{ef}(t)$, by invertibility $q_R(\mu, t) = m(\mu)\mathbf{1}_k - u\,\xi^{ef}(t)$ with $m(\mu) := A_k(\alpha-\mu)+B_k(\alpha-w_I)$, so $Q_R^{-i}(\mu, t) = (k-1)m(\mu) + u\,\xi_i^{ef}(t)$. Define

$$T_t(\mu) := \bar{w} + \frac{1}{k}\sum_{i=1}^{k} f\big((k-1)m(\mu) + u\,\xi_i^{ef}(t)\big).$$

Equilibrium satisfies $\bar{\mu}(t) = T_t(\bar{\mu}(t))$. Using $|f'| \leq \tau$ and $m'(\mu) = -A_k$,

$$|T_t(\mu) - T_t(\mu')| \leq (k-1)A_k\tau\,|\mu - \mu'| < |\mu - \mu'|,$$

so T_t is a contraction; a unique $\bar{\mu}(t)$ exists.

(ii) $T_t(\mu)$ is nondecreasing in t for each fixed μ. Write $c(\mu) := (k-1)m(\mu)$. Since $\frac{1}{k}\sum_i \xi_i^{ef}(t) = 0$ and $f'' \geq 0$, Jensen gives $\frac{1}{k}\sum_i f(c(\mu) + u\,\xi_i^{ef}(t)) \geq f(c(\mu))$, with equality at $t = 0$. Along $w_R(t)$, the induced $\xi^{ef}(t)$ has the same mean (zero) and weakly larger dispersion as t increases; thus $t \mapsto T_t(\mu)$ is nondecreasing.

(iii) Monotone comparative statics of the fixed point. If $T_{t_2}(\mu) \geq T_{t_1}(\mu)$ for all μ and both are contractions, then their fixed points satisfy $\bar{\mu}(t_2) \geq \bar{\mu}(t_1)$ (iterate T_{t_2} starting at $\bar{\mu}(t_1)$). Hence $t \mapsto \bar{\mu}(t)$ is nondecreasing.

(iv) Q_R and profits. Since $Q_R(t) = k[A_k(\alpha - \bar{\mu}(t)) + B_k(\alpha - w_I)]$ with $A_k > 0$, Q_R is nonincreasing in t. $\square$

Lemma B.4 states that Q_R^* cannot be increased via price dispersion, so asymmetric prices cannot decrease S. Moreover, since Q_R^* is nonincreasing in t,a deviating buyer of the incumbent faces (weakly) higher equilibrium quantity q_I^* on average, and dispersion further raises the deviator's payoff because profits are quadratic in quantity.

Lemma B.5: The maximum $\Delta F(C^0) = 0$.

Proof. The result follows from Lemmas B.3 and B.4. In words, dispersion reduces the rival's pledgeable profit (Lemma B.3) and (weakly) decreases total quantity (Lemma B.4), while the incumbent's profit never decreases. Hence, the maximal change in the feasibility bound within C^0 is 0. As Lemma B.2 shows, increasing w_R can raise the rival's profit but does not relax the feasibility bound. Therefore, $\Delta F(C^0) = 0$. □

Thus, no $\boldsymbol{C^0}$ contracts can trigger entry under RRC. Also, Lemmas B.2 and B.5 show that symmetric contracts with $w_R = c_R$ outperforms the asymmetric contracts or charging $w_R > c_R$. So, symmetric contracts that envisage c_R when $k = n$ will be the benchmark for our consideration in the rest of the analysis.

Now, consider the whole set of $\boldsymbol{C^1}$ contracts and for the sake of argument assume that the stipulated damages are enforceable[29] and set $P^2(a^2 = I|a^1 = R) \to \infty$.

Lemma B.6: The maximum $\Delta F(C^1) = 0$.

Proof. Because $P^2(a^2 = I \mid a^1 = R) \to \infty$, any buyer who signs R must source R. To induce all buyers to sign R, the minimal aggregate insurance required at the signing stage is

$$B(w_R) \;=\; \sum_{i=1}^{n} \big[\pi_I(n-1) - \pi_R(n)\big].$$

By Lemma B.2, $B(w_R) > \Pi_R(w_R)$ for all $w_R \in [c_R, w_R^m]$ (the gap is positive at $w_R = c_R$ and its slope keeps it positive throughout). Hence, the rival cannot finance the necessary $P^1(\cdot)$ transfers from on-path pledgeable profits under any C^1 instrument. Therefore, $F(w_R) = \Pi_R(w_R) - B(w_R) < 0$, and the maximal change in the feasibility bound within C^1 is 0.

Even if the rival signs $n-1$ buyers and funds the remaining insurance for one more, some other buyer would then be underfunded given the same shortfall; a profitable signing deviation (RRC/holdout) emerges, so full participation still fails. □

Lemmas B.2-B.6 prove Proposition 3-1.

[29]This assumption merely economizes on the analysis of signing and sourcing decisions and has no other implications. If one thing, stipulated damages ensures compliance.

Let us move on with $\boldsymbol{C^2_{SC}}$ contracts. The main text shows that the dominant strategy is to set $a_i^1 = R$. Suppose that the rival offers its best prices $w_R(k = n) = c_R$ and sets the highest legally enforceable breach penalty

$$P^1(k=n)+P^2(|D|=1) \le (n-1)\big[\pi_R(n)-\pi_R(n-1)\big] \quad \text{(allowing } P^2 < 0 \text{ subject to (12)).}$$

Then, a single buyer's deviation gain is $\pi_I(n-1)-\pi_R(n)-(P^1(k=n)+P^2(|D|=1))$, or, more accurately,

$$\pi_I(n-1) + (n-1)\pi_R(n-1) - n\pi_R(n). \tag{3.16}$$

No deviation if (3.16) ≤ 0. Since $\pi_R(n-1) \ge 0$, a sufficient condition for no deviation is $\pi_I(n-1) \le n\,\pi_R(n)$. Interpreting the test as the deviation condition, we obtain the modified version of Condition (9):

$$\frac{\gamma\,(n-1)\,f\big(Q_R^{*,-i}(n-1)\big)\;-\;A}{2\beta+\gamma(n-2)} \;>\; (c_I-c_R), \qquad A := (\sqrt{n}-1)(2\beta-\gamma)(\alpha-c_R) > 0. \tag{3.17}$$

Now, analyze the impact of a buyer's deviation to the incumbent. For $k \in \{n-1, n\}$ write

$$x_k := Q_R^{*,-i}(k) = (k-1)q_R^*(k), \qquad w_R^{ef}(k) = c_R+f(x_k), \qquad \Delta := f(x_{n-1})-f(x_n) \ge 0.$$

Recall that f is decreasing and convex with finite slope $\tau := \sup_{Q\ge 0}|f'(Q)| < \infty$, and $f(x_n) = 0$. Let the denominator of equilibrium quantities and the cross-price feedback on Q_R^* be

$$D := (2\beta-\gamma)\big(2\beta+\gamma(n-1)\big), \qquad b_k := \frac{(k-1)(2\beta-\gamma(n-k-1))}{D} = (k-1)A_k.$$

Suppose that $\Delta = 0$. A single player's deviation from n then gives rise to a change in total quantity bounded from below by

$$T(n) := \frac{(2\beta-\gamma)\alpha + \gamma\big((n-1)c_R - (n-2)c_I\big)}{D}.$$

This gives us the "one-step identity:"

One-Step Identity: For the step $k : n \to n-1$,

$$x_k - x_{k-1} \;-\; b_{k-1}\,\Delta \;=\; T(k).$$

Thus, Assumption (U) not only bounds the off-diagonal feedback from f but is also a necessary condition for R-group activity.[30] Note that Assumption (U) may be re-written as $\tau < 1/b_{n-1}$.

Lemma B.7: There exists an N^* such that whenever $n \geq N^*$, Condition (3.17) fails, which implies there exists another $N^0 \geq N^*$ such that Condition (3.16) fails.

Proof. The left-hand side of Condition (3.17) is

$$\gamma(n-1)\Delta - (\sqrt{n}-1)(2\beta-\gamma)(\alpha - c_R).$$

The one-step identity implies:

$$\frac{x_n - x_{n-1}}{b_{n-1}} = \frac{(2\beta-\gamma)\alpha + \gamma\big((n-1)c_R - (n-2)c_I\big)}{2\beta(n-2)} \geq \Delta$$

Because at $n = 2$, a buyer's deviation leads to the intercept of f, the above inequality is undefined for $n = 2$. In turn, the following condition implies that (3.17) fails for a given n if

$$\frac{(2\beta-\gamma)\alpha + \gamma\big((n-1)c_R - (n-2)c_I\big)}{2\beta(n-2)} \leq A = (\sqrt{n}-1)(2\beta-\gamma)(\alpha - c_R).$$

Rearranging gives:

$$(2\beta-\gamma)\alpha + \gamma\big(2c_I - c_R\big) \leq 2\beta(n-2)(\sqrt{n}-1)(2\beta-\gamma)(\alpha-c_R) + n(c_I - c_R)$$

where the right-hand side monotonically increases with n even if $\sqrt{n}-1$ were kept constant, meaning that there must exist N^* such that whenever $n \geq N^*$, (3.17) fails. This implies that a higher N^0 such that whenever $n \geq N^0$, (3.16) fails. Notice (3.16) may be written as

$$\frac{\gamma\,(n-1)\, f\big(Q_R^{*;-i}(n-1)\big) \;-\; A \;+ B}{2\beta + \gamma(n-2)} \;>\; (c_I - c_R)$$

where $B = \sqrt{n-1}\; q_R^*(n-1) < (2\beta-\gamma)(\alpha - c_R)$. Hence, the rate of change in A term arising from $\sqrt{n}-1$ term dominates that in B. Thus, monotonicity of the

[30] Necessity follows from the one-step identity and the contraction bound. Since $\Delta \leq \tau\,(x_n - x_{n-1})$, the one-step identity implies

$$T(n) = (x_n - x_{n-1}) - b_{n-1}\Delta \;\geq\; (1-\tau b_{n-1})(x_n - x_{n-1}).$$

If the rival remains active (interior), then $x_n - x_{n-1} > 0$, which requires $1 - \tau b_{n-1} > 0$, i.e. $\tau b_{n-1} = (k-1)A_k\tau < 1$.

left-hand side remains intact and there exists N^0 such that whenever $n \geq N^0$, (3.16) fails. $\square$

This takes us to our final lemma, which is a sufficiency condition based on Condition (3.17).

Lemma B.8: Fix any $N^0 > n \geq 2$. Then there exist primitives and a decreasing convex f satisfying (U) such that (3.17) holds strictly (deviation), and there exist (possibly other) primitives and f that violate (3.17) (no deviation).

Proof. In the RRC region we must have

$$x_n - x_{n-1} > T(n).$$

By the mean value theorem, we have $f(x_{n-1}) = s(x_n - x_{n-1})$ and, because there is no penalty when $k = n$, $f(x_n) = 0$. Thus, $\Delta = s(x_n - x_{n-1})$. Plugging into the one-step identity gives

$$x_n - x_{n-1} - b_{n-1}\, s(x_n - x_{n-1}) = T(n) \implies \Delta(s) = \frac{s\,T(n)}{1 - b_{n-1}s}, \qquad s \in \big[0,\, \min\{\tau, 1/b_{n-1}\}\big).$$

Hence $\Delta(s)$ is continuous and strictly increasing in s. The test's LHS is

$$\mathrm{LHS}(s) = \frac{\gamma(n-1)}{2\beta + \gamma(n-2)} \cdot \frac{s\,T(n)}{1 - b_{n-1}s} - \frac{A}{2\beta + \gamma(n-2)},$$

also continuous and strictly increasing in s whenever $T(n) > 0$. Because s is bounded below by zero and both Conditions (3.16) and (3.17) involve an extra negative term, there exists a set of parameters where Condition (3.9) holds in the baseline game but (3.16) and (3.17) fail.

Now, because $s \in (0, 1/b_{n-1})$, the LHS can be made arbitrarily large,[31] this yields strict "$>$". Thus, both signs occur when $n < N^0$. $\square$

The arguments above depend only on the one-step identity, Lipschitz bound, and enforceability cap (12). Therefore, either outcome can occur under admissible primitives. One-step identity, Lemma B.7, and Lemma B.8 complete the proof of Proposition 3.2.[32] Finally, the proof of Proposition 3.3 follows from the main text.

[31] If rival customers become (near) inactive, monopoly gains dominate the total gains in a game with more active players when marginal costs are the same. Choosing c_I in a considerably large neighborhood of c_R preserves this, so the inactivity corner strengthens (not weakens) the result.

[32] The maximum $\Delta F(C^{SC})$ is greater than zero because the additional $(n-1)(\pi_R(n-1) - \pi_R(n)) < 0$ is brought about by the share-contingent contracts.

Appendix C

A Derivation of f. Suppose using input R requires access to a service/coverage network (maintenance, depots, interoperability, support). If aggregate rival utilization is Q_R, the probability the network delivers full support is $p(Q_R)$, with $p'(Q_R) > 0$ and $p(Q_R) = 1$ for $Q_R \geq \bar{Q}$ (full coverage once scale is reached). When support fails, a buyer incurs an expected per-unit disruption cost $\ell > 0$ (delays, incompatibility, re-routing). Then the expected per-unit cost of using R is

$$w_R^{ef} \;=\; w_R + \ell\,(1 - p(Q_R)) \;\equiv\; w_R + f(Q_R),$$

where $f(Q_R)$ is decreasing on $[0, \bar{Q})$ and equals 0 for $Q_R \geq \bar{Q}$. Thus a scale-sensitive *effective price* arises endogenously from reliability/coverage increasing in utilization.

Penalty as a function of overall adoption. Suppose f is a function of overall adoption Q_R. The marginal payoff function of any downstream firm becomes:

$$\alpha - 2\beta q_i - \gamma Q_{-i} - w_R - f(Q_R) - f'(Q_R) q_i.$$

The condition $2\beta > \gamma + \tau$ still ensures symmetricity. Conditions that will ensure strict concavity may also be derived. The problem with this penalty function is that the derived equilibrium values do not easily lend themselves to interpretation, while the model with penalty depending on others' adoption we have the nice result $\pi_i^* = \beta(q_i^*)^2$.

Suppose a unique semi-symmetric equilibrium exists. The equilibrium output of an R-buyer satisfies

$$q_R^*(k) = \frac{(2\beta - \gamma)\alpha - \big(2\beta + \gamma(n-k-1)\big)\Big(w_R + f\big(Q_R^*(k)\big)\Big) + \gamma(n-k)\,w_I}{(2\beta - \gamma)\big(2\beta + \gamma(n-1)\big) + \big(2\beta + \gamma(n-k-1)\big)\,f'\big(Q_R^*(k)\big)}.$$

Given $q_R^*(k)$, the I-quantity is

$$q_I^*(k) = \frac{\alpha - w_I - \gamma k\, q_R^*(k)}{2\beta + \gamma(n-k-1)}.$$

For any I-buyer, the usual Cournot markup identity implies

$$\pi_I^*(k) = \beta\big(q_I^*(k)\big)^2.$$

For any R-buyer, the equilibrium profit is

$$\pi_R^*(k) = \big(\beta + f'\big(kq_R^*(k)\big)\big)\,\big(q_R^*(k)\big)^2.$$

That is, when the penalty depends only on others' adoption, $f(Q_R^{-i})$ is constant with respect to q_i in firm i's optimization problem. The first-order condition then gives $p_i - w_R - f(\cdot) = \beta q_i$, which immediately yields the convenient expression $\pi_i^* = \beta(q_i^*)^2$. In contrast, with $f(Q_R)$ the firm's own output changes the penalty through Q_R, adding the extra term $-q_i f'(Q_R)$ in the FOC. This breaks the simple markup identity and replaces it with $p_i - w_R - f(Q_R) = \big(\beta + f'(Q_R)\big)q_i$, so profits become $\pi_R^* = \big(\beta + f'(Q_R^*)\big)(q_R^*)^2$. Thus, we lose tractability in the model, while the implications remain the same.

Remark: Total-adoption penalties. If the penalty depends on *total* adoption, $f(Q_R)$, then buyer i internalizes the marginal effect of its choice on the penalty through the additional term $-q_i\, f'(Q_R)$ in the first-order condition. This breaks the convenient identity $\pi_i = \beta q_i^2$ that holds under peer-dependent penalties $f(Q_{-i}^R)$. Nevertheless, the mechanism emphasized in the paper is unchanged: a buyer's upstream choice affects the rival's effective marginal cost and therefore its strategic interaction in the downstream market. Consequently, the peer-RRC comparative statics continue to hold, even though the closed-form profit representation is no longer available.

Two buyers and the piecewise-constant equivalent (Footnote 8) When $n = 2$ and the benchmark specification $w_R^{ef} = w_R + f(Q_R^{-i})$ is used, buyer i faces only two relevant states for Q_R^{-i}: either the other buyer endorses R (so $Q_R^{-i} = q_j > 0$) or not (so $Q_R^{-i} = 0$). In the pricing region emphasized in the text, the penalty is strictly positive when a single buyer endorses the rival but collapses under full participation. Equivalently, one can represent the same incentives by a piecewise-constant penalty indexed by total adoption,

$$f(Q_R) = \begin{cases} \zeta > 0 & \text{if } Q_R < \bar{Q}_R, \\ 0 & \text{if } Q_R \geq \bar{Q}_R, \end{cases}$$

with $\bar{Q}_R$ chosen between the one-buyer and two-buyer adoption levels in the relevant region. Under this representation, a unilateral peel-off switches the rival from the zero-penalty region to the ζ-penalty region, which is exactly the discrete "penalty collapses at $k = 2$" logic described in Footnote 8.

Heterogeneous Bertrand Competition. Footnote 3 claims that the comparative statics is the same across the Cournot and Bertrand settings. This section provides an illustrative heterogeneous-Bertrand example in which the peer-RRC mechanism can arise.

Consider two downstream firms $i \in \{1, 2\}$ that set prices simultaneously. When both firms are active, firm i faces linear differentiated demand

$$q_i(p_i, p_j) = \frac{\alpha}{\beta+\gamma} - \frac{\beta p_i - \gamma p_j}{(\beta+\gamma)(\beta-\gamma)}.$$

Let w_i denote firm i's marginal input cost implied by its upstream choice. Solving the two-firm Bertrand game yields equilibrium prices

$$p_i^* = \frac{1}{2\beta+\gamma}\Big(\alpha(\beta-\gamma) + \frac{\gamma}{2\beta-\gamma}\big(2\alpha(\beta-\gamma) + \beta(w_i + w_j)\big) + \beta w_i\Big),$$

and associated equilibrium quantities $q_i^*(w_i, w_j)$.

Fix parameters

$$\{\alpha = 1, \beta = 1, \gamma = 0.75, c_R = 0, c_I = 0.05, \zeta = 0.1\},$$

where c_R is normalized to zero and the scale penalty is induced by a piecewise-constant rule. Assume upstream suppliers make best offers (marginal-cost pricing), so w_i equals the relevant upstream marginal cost plus any penalty borne by firm i.

When both buyers choose the same upstream supplier and, hence, no penalty is triggered, equilibrium outcomes are:

$$q_i^*(w_i = w_j = 0) = 0.457, \quad p_i^*(w_i = w_j = 0) = 0.20,$$
$$q_i^*(w_i = w_j = 0.05) = 0.434, \quad p_i^*(w_i = w_j = 0.05) = 0.24.$$

Hence total quantity under incumbent supply is approximately $Q_I^*(c_I) \approx 2 \times 0.434 = 0.868$. By the contestability assumption, $\bar{Q} < 0.868$, the rival can profitably enter when endorsed by both buyers.

This yields the reduced-form game over upstream choices:

	I	R
I	$\pi^*(I,I), \pi^*(I,I)$	$\pi^*(I,R), \pi^*(R,I)$
R	$\pi^*(R,I), \pi^*(I,R)$	$\pi^*(R,R), \pi^*(R,R)$

Consider the case with one endorsement of the rival ($k = 1$). Two regimes can obtain depending on whether the scale penalty is triggered.

If the penalty is not triggered, then for asymmetric costs $(w_i, w_j) = (0, 0.05)$ and $(0.05, 0)$,

$$q_i^*(0, 0.05) = 0.482, \quad p_i^*(0, 0.05) = 0.21,$$
$$q_i^*(0.05, 0) = 0.409, \quad p_i^*(0.05, 0) = 0.23.$$

Thus, the penalty is inactive whenever $\bar{Q} \leq 0.482$. In this regime, the firm served by the rival has both higher quantity and a higher markup than under (I, I), implying $\pi^*(R, I) > \pi^*(I, I)$ so (I, I) cannot be a Nash equilibrium. At the same time, the firm served by the incumbent has lower quantity/markup than under (R, R), implying $\pi^*(I, R) < \pi^*(R, R)$ so (I, R) cannot be an equilibrium either. Consequently the unique equilibrium is (R, R) (accommodation).

If instead $\bar{Q} > 0.482$, the scale penalty is triggered under $k = 1$, raising the effective cost of the rival's customer. Using $(w_i, w_j) = (0.1, 0.05)$ and $(0.05, 0.1)$,

$$q_i^*(0.1, 0.05) = 0.386, \quad p_i^*(0.1, 0.05) = 0.27,$$
$$q_i^*(0.05, 0.1) = 0.459, \quad p_i^*(0.05, 0.1) = 0.25.$$

In this regime, the incumbent-served firm enjoys higher quantity and markup than under (R, R), so $\pi^*(I, R) > \pi^*(R, R)$ and accommodation cannot be an equilibrium. Symmetrically, the rival-served firm is worse off than under (I, I), so $\pi^*(R, I) < \pi^*(I, I)$ and $k = 1$ cannot be an equilibrium. Therefore, the unique equilibrium outcome is exclusion, and the results are not Cournot artifacts.

Demand Cenralization in Homogeneous Bertrand. To begin with, suppose the final goods are homogeneous ($\gamma = \beta$) and strategies are prices, and f is a piecewise constant function of aggregate adoption Q_R such that $f(Q_R) = \zeta > 0$ if $Q_R < \bar{Q}_R \leq Q^*(\boldsymbol{c}_I)$.[33] Partition the representative consumer into $l \geq 1$ identical final consumers indexed by $r \in \{1, \ldots, l\}$ with

$$U_r(q) = \alpha q - \frac{1}{2}(\beta l)\, q^2. \tag{3.18}$$

Each buyer solves $\max_{q \geq 0}\{\alpha q - \frac{1}{2}(\beta l) q^2 - pq\}$. Let $p = (p_1, \ldots, p_n)$ denote purchasing prices and $\min(p)$ the set of immediate sellers (upstream firms or downstream firms)

[33] When downstream competition allows a single buyer to capture the whole market (e.g., homogeneous-goods Bertrand absent capacity constraints), it is most natural to index the scale disadvantage by aggregate adoption/quantity Q_R.

who charge the minimum price $p_{\min}$. Define the lowest-wins demand correspondence as in Ledvina and Sircar (2012):

$$q_i(p) = \frac{\alpha - p_{\min}}{\beta\,|\min(p)|} \cdot \mathbf{1}\{p_i \in \min(p)\}, \tag{3.19}$$

that is, total quantity is $(\alpha - p_{\min})/\beta$ and is split equally among the lowest-price sellers.

Lemma C.1 Under the primitives above and with the incumbent restricted to symmetric prices upstream, the following downstream structures induce the same 'lowest-wins' correspondence (3.19): (i) one buyer ($l = 1$) facing upstream firms; (ii) $l > 1$ final consumers freely communicating (CPNE selection) facing upstream firms; (iii) homogeneous-goods Bertrand with a single aggregate demander and n downstream firms.

Proof. (i) $l = 1$. With one final consumer and two upstream sellers posting symmetric prices, $U(Q) = \alpha Q - \frac{\beta}{2}Q^2$ implies $Q = (\alpha - p)/\beta$. The buyer purchases from the lowest-price outlet; ties split. This is (3.19). Since $c_R < c_I$, the rival can always undercut the incumbent–entry follows.

(ii) $l > 1$ with CPNE. Any profile assigning positive demand to an upstream firm's product whose price exceeds the minimum is blocked by a coalition redirecting to a minimizer and weakly improving all its members since each consumer's utility depends only on its own price. CPNE selects the same lowest-wins correspondence with equal sharing among ties, i.e., (3.19).

(iii) Homogeneous Bertrand with $l = 1$. With an aggregate demander in the final markets and n downstream firms competing a la Bertrand with homogeneous goods, the market goes entirely to the lowest downstream price (an R-group buyer); ties split. This again yields (3.19). □

Hence, homogeneous Bertrand corresponds to a centralization boundary, where the existence of a downstream market is irrelevant unless the incumbent is allowed to make direct monetary transfers. This result formalizes the "consumer representation via retail competition" mapping: under extreme downstream competition and absent conditional transfers by the incumbent, buyers compete to become agents of a central purchasing agency because, with centralized final demand, extreme downstream competition forces a lowest-wins rule.[34]

[34]For reference, the case where $l > 1$ final consumers as immediate buyers is a typical contracting externalities model in any classical model such as Rasmusen et al. (1991).

Chapter 4

Exclusion Without Commitment: Financial Fragility and Entry Deterrence

Abstract

This paper shows how exclusion can arise without contractual pre-commitment when a dominant firm offers conditional rebates and a financially fragile rival requires scale to compete. In this setting, buyers impose costs on each other: if one switches to the rival and the other does not, the rival fails to reach scale, forcing buyers to top up from the incumbent at higher prices or face unmet demand. This risk deters switching and sustains exclusion. When buyers compete downstream, exclusion can also result from a raising rivals' costs effect or tacit coordination to soften competition—a mechanism I call *strategic chilling*. The model captures how rebate schemes interact with financial constraints and scale disadvantages to foreclose entry, even absent predation or explicit loyalty requirements.

4.1 Introduction

Classical theories of exclusion hold that a dominant incumbent, leveraging its incumbency advantage, can issue credible threats that deter buyers from turning to a more efficient rival. These threats typically rest on contractual pre-commitments: the incumbent either locks in buyers before the entrant arrives or keeps the entrant out while it extracts the rents needed to sustain exclusivity without losses—sometimes by re-contracting with parties that initially rejected exclusivity. Yet many recent antitrust cases involve no explicit contractual ties as such.[1] Instead, they rely on conditional discounts or off-list rebates, leaving all parties formally free to contract. Ide et al. (2016) confront this issue. In canonical post-Chicago settings, they show that once contractual pre-commitment is removed, sufficiently rich contracts are allowed, and all parties are present in bargaining, the dominant firm's simple pricing practices lose their exclusionary grip. The remaining question, then, is how modern rebate schemes can still cause competitive harm—and under which theoretical lens they should be evaluated.

This paper shows that conditional rebates, when combined with the entrant's financial fragility and scale requirements, can restore exclusion even without precommitment on the buyers' side. Although weak firms can often finance temporary losses through working capital or short-term credit, imperfect capital markets and financial constraints may still prevent them from covering operating costs below minimum scale, limiting their ability to serve customers. As a result, buyers who switch to such a rival risk being underserved or forced to purchase the shortfall from the incumbent at the undiscounted price—thereby generating classic negative demand externalities when buyers are independent.

To see how, imagine two buyers and two sellers. The dominant seller—already at efficient scale—offers an off-list rebate to anyone who relies on it exclusively. The weaker seller, by contrast, makes a counter-offer that undercuts the dominant firm's discounted price and sees its average cost fall with scale. The rival, however, has limited financial means to absorb losses on the way to its efficient scale. Since a single buyer's demand may be too small to bring the weaker seller's costs down to the dominant seller's level, it can only afford to supply a quantity within its financial reach. Its customer must then either under-consume or cover the shortfall by purchasing extra units from the dominant seller at the dominant firm's higher price. Because the rival's limited budget makes both its discount and its commitment

[1] European Commission v. British Airways (2003); European Commission v. Michelin II (2003); Post Danmark A/S v Konkurrencerådet (2015) are some examples.

to meet demand conditional on winning both buyers, its promise may not be credible: operating below scale leaves the rival unable to fully meet demand at its offered price. The result is a built-in commitment problem that turns the rival's financial fragility into a risk for its customers.

This commitment problem is precisely what differentiates this model from the early research on predatory pricing, which emphasizes how financial asymmetries and credit imperfections between the dominant firm and its rival lead to exclusion. The so-called deep pocket—or long purse—of the dominant firm allows it to sustain short-term losses from predatory pricing that fragile rivals cannot finance, thereby driving them out of the market in exchange for longer-term monopoly gains, according to this literature.[2] By contrast, in the model below, the financial constraints faced by the rival limit its ability to commit to meeting demand and undermine the credibility of its offer, which manifests as an off-the-equilibrium-path threat. Such threats take the form of negative demand externalities when buyers do not compete, and in this respect, the model below is closer in nature to these frameworks. One of its contributions, then, is to show how risks and threats that lead to exclusion can arise even in the absence of pre-commitment. Still, there is a nuance between the model developed here and others in the negative demand externalities paradigm in terms of the exclusionary mechanisms that could arise.

The literature on negative demand externalities—more precisely, the strand focused on scale-related disadvantages—highlights three familiar buyer-decision problems. First, when a single buyer's demand is sufficient to bring the entrant to minimum efficient scale—or when the entrant can finance the losses incurred below that scale—buyers converge on a unique equilibrium in which they all choose the entrant, ensuring its viability and effectively insuring themselves against scale risk. Second, scale-related externalities can create a coordination problem, yielding multiple equilibria in which buyers either collectively support the entrant or stay with the dominant seller (Fumagalli and Motta, 2008; Rasmusen et al., 1991; Segal and Whinston, 2000). Depending on the configuration, these decision problems may also arise under downstream competition. In some cases, downstream competition may undermine the effectiveness of exclusionary strategies that rely on buyer miscoordination: downstream firms working with a more efficient rival can capture business from those that remain with the incumbent, thereby ensuring the scale the rival needs to operate viably. However, the threats buyers impose on one another may be too strong to count as mere externalities. Thus, as a third mechanism, buyers

[2]The standard references are Benoit (1984) and Telser (1966).

may deliberately withhold support from the rival in order to gain a competitive edge over those who do, resulting in a unique equilibrium in which no buyer patronizes the rival (Sevük, 2025).

In addition to these channels, a further and independent source of anticompetitive harm emerges in the below model: buyers can deliberately chill down competition in their own downstream market. When buyers compete, relying on the same upstream supplier sharpens rivalry and erodes their margins. To blunt that pressure, they may tacitly collude on splitting their patronage—each turning to a different supplier—to soften downstream competition. One buyer then captures rents by aligning with the dominant firm, while the other enjoys partial discounts over the units the rival could offer by supporting the financially constrained rival. Anticipating this tacitly collusive outcome, the fragile rival may stay out of the market altogether, leaving the dominant firm as the only seller with no competing practice. The dominant firm may prefer those practices that invoke this effect in order to avoid serious antitrust scrutiny, especially if the existence of a competing practice is more likely to trigger investigation.

In what follows, I present two versions of the model: one with independent buyers and one with competing buyers. In the independent-buyer case, I adopt a simplified setting to show how negative demand externalities can arise without pre-commitment, leading to exclusion even though buyers decide after observing all contracts and thus all relevant parties are present in the bargaining. This simplification does not affect the nature of the decision problems faced and is made purely for clarity. In contrast, the case with competing buyers is presented in a more general framework, as simplifying the game risks losing key aspects of the mechanisms at work. While this choice forces the analysis to focus extensively on buyer choice, it enables a unified treatment of the strategic forces that drive the results. The paper concludes with a brief summary of the model and a discussion of the Post Danmark case through its lens.

4.2 Model

We consider two upstream sellers—a dominant incumbent D and a smaller rival R—who produce identical goods and compete for the business of two downstream buyers. The interaction unfolds in three stages, common to both settings analyzed below (non-competing and competing buyers):

Dominant firm's offer (t_1) The incumbent posts a list price p_D^L and a discounted price $p_D < p_D^L$. Buyers who source exclusively from D pay the discounted price p_D, while those who do not are charged the higher list price p_D^L on all units purchased from D.

Rival's response (t_2) The rival may either stay out or announce its own price p_R.

Buyer decisions (t_3) Each buyer chooses how much to purchase from each seller.

The list price p_D^L functions as a stick: if a buyer splits its purchases, it forfeits the rebate and pays p_D^L on every unit from D. This discourages dual sourcing and reinforces effective exclusivity.

To capture the incumbent's cost advantage, we assume D already operates at efficient scale and produces at constant marginal cost c_D. The rival R, by contrast, operates below efficient scale. Its total cost function is strictly increasing and convex until it reaches a threshold quantity $\bar{q}_R$, beyond which marginal cost falls to its minimum level $c_{R,\min} < c_D$. The rival can finance operating losses up to a budget $B > 0$. If losses from serving demand at p_R exceed B, R must scale back output.

We assume:

$$\infty > c_R(q_R = 0) > c_D,$$

so the rival's initial marginal cost is finite but strictly above the incumbent's.

Let $q_R^*(p_R, k)$ denote the total demand faced by R at price p_R when $k \in \{1, 2\}$ buyers support it. To impose contestability, assume:

$$q_R^*(p_R = c_D, k = 2) > \bar{q}_R \quad \text{and} \quad AC_R\big(q_R^*(c_D, 2)\big) < c_D,$$

where $AC_R(\cdot)$ is the rival's average cost.[3] Define $p_{R,\min}$ as the lowest sustainable price (when both buyers support R), implicitly given by:

$$AC_R\big(q_R^*(p_{R,\min}, 2)\big) = p_{R,\min} > c_{R,\min}.$$

We further assume R's profit function is strictly quasi-concave in price and attains a unique maximum at $p_R^m > c_D$.

To focus on the relevant case, suppose R cannot profitably serve a single buyer. In particular, maintain that even if R offers the minimum price, its average cost is higher than c_D:

$$AC_R\big(q_R^*(c_{R,\min}, 1)\big) > c_D.$$

[3]Note that the average cost function is strictly decreasing in q_R.

Now, suppose $p_D = c_D$ and R sets some $p_R \in [c_{R,\min}, c_D]$. Let B denote R's budget. If

$$(p_R - AC_R(q_R^*(p_R, 1))) \cdot q_R^*(p_R, 1) + B \geq 0,$$

then the rival can serve one buyer's demand in full. Otherwise, R can supply only a local-capacity quantity $q_R^0(p_R, B) > 0$, implicitly defined by:

$$(p_R - AC_R(q_R^0)) \cdot q_R^0 + B = 0. \tag{1}$$

Implicit differentiation of (1) yields:

$$\frac{dq_R^0}{dp_R} = -\frac{q_R^0}{p_R - c_R(q_R^0)} > 0, \tag{2}$$

where $c_R(q)$ is the marginal cost. Thus, a higher rival price relaxes the budget constraint and increases the financed batch size—an effect we use throughout the analysis.

4.2.1 Production Feasibility and Credible Offers

This subsection introduces three general results that apply across both market settings.[4] In both variants of the game:

1. The rival's offer must satisfy $p_R \leq p_D$, i.e., it must undercut the incumbent's discounted price;
2. The rival must be able to supply at least some units at its announced price to eliminate the no-expansion equilibrium (D, D);
3. To meet this condition when only one buyer endorses it, the rival must extend working capital $B > 0$.

Buyers have identical utility functions $U_i(q_i, Q)$, where q_i is buyer i's own consumption and Q is aggregate consumption. The utility function satisfies:

- Strong concavity in own consumption: $U_{q_i}(q_i, Q) > 0$, $U_{q_i q_i}(q_i, Q) < 0$;
- Non-increasing in aggregate consumption: $U_Q(q_i, Q) \leq 0$, $U_{q_i Q}(q_i, Q) \leq 0$.

In the independent-buyer setting, we assume $U_Q = U_{q_i Q} = 0$; under downstream competition, both are strictly negative.

[4] Readers who accept these may proceed to the next section without loss.

Each buyer maximizes net utility:

$$U_i(q_i, Q) - S_i(q_i^D, q_i^R),$$

where $S_i(q_i^D, q_i^R) = S_i(q_i^D) + S_i(q_i^R)$ is the total expenditure. Assuming $B > 0$, the cost function takes the form:

$$S_i(q_i^D, q_i^R) = \begin{cases} p_D \cdot q_i & \text{if } q_i^R = 0, \\ p_D^L \cdot q_i^D + p_R \cdot q_i^R & \text{if } q_i^R > 0. \end{cases}$$

Since $p_D^L > p_D$, the rebate scheme discourages dual sourcing. However, if the rival lacks sufficient working capital, a buyer sourcing from the rival may need to top up from the incumbent at list price p_D^L, reducing effective utility.

We represent the strategic interaction as follows. Let $a_i \in \{D, R\}$ denote buyer i's primary supplier. The utility from a sourcing profile (a_i, a_j) is denoted $V_i(a_i, a_j)$. The generic payoff matrix is given in Table-1.

Table 4.1: Generic Payoff Matrix

	D	R
D	$V_i(D, D)$	$V_i(D, R)$
R	$V_i(R, D)$	$V_i(R, R)$

Each entry reflects realized utility, conditional on the rival's ability to supply as promised. For example, if the rival quotes price p_R but fails to deliver the full quantity, the buyer may incur a higher effective price due to topping up.

Suppose, for now, that the rival can fulfill full demand at $p_R > p_D = c_D$. Then, since utility is decreasing in price:

$$V_i(R, R) < V_i(D, R), \quad \text{and} \quad V_i(R, D) < V_i(D, D),$$

so no buyer would prefer to source from the rival under these conditions. Consequently, to support the expansion equilibrium (R, R), the rival must offer a price $p_R \leq p_D$. Note that even if $p_R \leq p_D$, the rival must be able to credibly and fully serve at least one buyer to eliminate the no-expansion outcome (D, D).

Suppose instead $B = 0$. Then if two buyers make purchases at $p_R \in [p_{R,\min}, c_D]$, the rival earns non-negative profits and can supply both. But if only one buyer endorses it, the rival's average cost exceeds c_D for all such prices:

$$AC_R(q_R^*(p_R, 1)) > c_D \quad \Rightarrow \quad (p_R - AC_R(q_R)) \cdot q_R < 0.$$

Without working capital, the rival cannot supply even a partial order at its quoted price. Hence, a buyer would infer that the rival's offer is not credible unless it is backed by positive B.

If a buyer advances $S_i(q_i^R)$ to the rival, she expects to receive:

$$q_i^R = C_R^{-1}(S_i(q_i^R)),$$

i.e., she effectively pays the rival's average cost. Since this exceeds c_D when the rival serves only one buyer, the dominant firm remains strictly preferred unless $B > 0$.

To eliminate the no-expansion equilibrium and make its offer credible, the rival must extend financial resources sufficient to serve at least some quantity. We henceforth restrict attention to cases where $B > 0$, allowing the rival to deliver positive quantity at its announced price and enabling meaningful strategic interaction.

4.2.2 Independent Buyers

We first analyze the case of two independent buyers—e.g., final consumers or isolated downstream monopolists. Each buyer i has net utility

$$U_i(q_i) - S_i(q_i^D, q_i^R),$$

where $U_i'(q_i) > 0$ and $U_i''(q_i) < 0$. When sourcing from a single seller at price p, this gives rise to a demand function $D(p)$ with $D'(p) < 0$, and corresponding indirect utility $V_i(p)$, where $V_i'(p) = -D(p)$.

To simplify the analysis, we assume that marginal willingness to pay exceeds the rival's marginal cost for quantities below the scale threshold $\bar{q}_R$:

$$U_i'(q_i) > c_R(q_R) \quad \text{for all } q_R < \bar{q}_R.$$

Suppose the dominant firm offers $p_D = c_D$, and the rival matches it: $p_R = c_D$. If both buyers expect the other to patronize the rival, then total demand is $2D(c_D)$. Recall that by assumption

$$AC_R(2D(c_D)) < c_D,$$

so the rival makes positive profits and can serve both buyers. Hence, an expansion equilibrium (R, R) always exists if $p_R \in [p_{R,\min}, c_D]$. Also, because c_D lies below the rival's monopoly price, matching it is a best response when full endorsement is anticipated.

Now consider the opposite belief profile: each buyer expects the other to stay with the incumbent. If only one buyer approaches the rival, demand is $D(c_D)$, and

$$AC_R(D(c_D)) > c_D,$$

so supplying this demand would be unprofitable. However, if the rival's working capital B satisfies

$$(c_D - AC_R(D(c_D))) \cdot D(c_D) + B \geq 0,$$

then the rival can still meet that buyer's full demand. Since lower prices yield higher utility and the rival can slightly undercut the dominant firm,[5] each buyer has a unilateral incentive to deviate, making expansion the unique equilibrium.

By contrast, if

$$(c_D - AC_R(D(c_D))) \cdot D(c_D) + B < 0, \tag{5}$$

then the rival is budget-constrained. It can only supply a reduced quantity $q_R^0(p_R, B)$, implicitly defined by:

$$(p_R - AC_R(q_R^0)) \cdot q_R^0 + B = 0.$$

Because a budget-constrained rival cannot meet a single buyer's full demand, that buyer must either under-consume or top up from the dominant firm at the higher list price. This creates an unpriced risk: if one buyer remains loyal to the incumbent, she imposes a negative demand externality on the other. The rest of this subsection examines how this externality leads to multiple equilibria.

Lemma 1. *If condition (5) holds, then the parity price $p_R = c_D$ cannot support expansion as the unique equilibrium.*

Although $p_R = c_D$ cannot sustain expansion alone, the rival might try to break the no-expansion equilibrium by cutting price. If a lower price $p_R < c_D$ could attract one buyer, the other would follow—since $V_i(p)$ decreases in p. This might restore expansion if a discount relaxed the rival's single-buyer budget constraint.

However, the following result shows that this strategy fails.

[5] One could also maintain that buyers who see two redundant strategies choose the more efficient party, R.

Lemma 2. *If condition (5) holds at $p_R = c_D$, then for every $p_R \in [p_{R,\min}, c_D]$,*

$$(p_R - c_R(D(p_R))) \cdot D(p_R) + B < 0.$$

Thus, no feasible price cut in this range restores R's ability to serve the demand in full. The rival remains constrained, and price-cutting alone cannot induce switching.

Even so, the rival may try to pick the utility-maximizing price in that interval. If this price induced higher utility—even with partial delivery—buyers might still deviate. But in practice, two issues arise: the optimal price need not lie in the feasible interval, and even if it does, deviation depends on the incumbent's list price.

For every $p_R \in [p_{R,\min}, c_D]$, define the *choke price* $\bar{p}_D^L(p_R, B)$ implicitly by:

$$D(\bar{p}_D^L) = q_R^0(p_R, B),^6$$

i.e., the highest list price at which a buyer can top up from the incumbent after receiving only q_R^0 from the rival.

This defines two types of incumbent strategies:

- **Top-up strategy:** $p_D^L < \bar{p}_D^L(p_R, B)$, where buyers supplement rival supply from the incumbent;
- **Refusal-to-sell strategy:** $p_D^L \geq \bar{p}_D^L(p_R, B)$, where topping up is too expensive or infeasible.

Lemma 3. *Under condition (5), if the incumbent sets $p_D^L \geq \bar{p}_D^L(p_{R,\min}, B)$, no buyer will unilaterally switch to the rival when the other remains with the incumbent.*

Proof. See appendix. □

Lemma 3 is pretty intuitive: If topping up is too expensive, the buyer suffers from foregone consumption. Even if the rival offers a better unit price, the utility loss from under-consuming outweighs the gain.

Can the incumbent deter switching under top-up strategies? Not always. If the top-up price is low enough, a buyer might still prefer partial supply from the rival plus topping up, thereby destroying no-expansion equilibrium. However, there always exists a top-up strategy that could lead to exclusion.

[6] The existence of a local choke price is implied by the existence of a finite choke price ($U'(q=0)$ being finite) and continuity of the utility function.

Lemma 4. *If the rival is quantity-constrained when serving a single buyer, there exists a cutoff list price $\underline{p}_D^L \geq c_D$ such that any $p_D^L > \underline{p}_D^L$ eliminates unilateral incentives to switch.*

Taken together, Lemmas 1–4 define when budget constraints give rise to multiple equilibria. If condition (5) binds:

- The rival cannot support expansion at $p_R = c_D$;
- Price cuts cannot overcome its budget constraint;
- The incumbent can raise its list price above $\underline{p}_D^L$ to block unilateral defection.

Hence, for every discounted price $p_D = c_D$ satisfying condition (5), there exists at least one list price p_D^L supporting both expansion and no-expansion. Let $\bar{p}_D$ denote the highest such discounted price consistent with all four lemmas.[7]

Proposition 1. *There are two cases:*

- ***Case 1:*** *If condition (5) fails, then expansion is the unique equilibrium:*

$$p_D = c_D, \quad p_R = c_D{}^8.$$

- ***Case 2:*** *If condition (5) holds at $p_R = c_D$, both expansion and no-expansion equilibria can arise for*

$$p_D \in [c_D, \bar{p}_D], \quad p_R \in [p_{R,\min}, p_D], \quad p_D^L > \underline{p}_D^L(p_D, p_R).$$

Proposition 1 clarifies how financial fragility influences equilibrium. If the rival can serve one buyer at $p_R = c_D$, it attracts both and wins. If not, the risk of insufficient supply may discourage unilateral switching, enabling the dominant firm to preserve exclusivity.[9]

We now turn to the setting where buyers compete downstream and new strategic forces emerge.

[7] That is, $\bar{p}_D$ is the highest discounted price such that no rival price $p_R \geq \bar{p}_D$ violates Condition (5), and at least the top-up strategy deters unilateral deviation.

[8] Or one that involves a slight undercut.

[9] Notice that the mechanism does not rely on the assumption that $U_i'(q_i) > c_R(q_R)$ for all $q_R < \bar{q}_R$. It rests solely on the rival's capacity limit and the resulting externalities among buyers. That assumption emerges merely as an assumption that eases the exposition.

4.2.3 Competing Buyers

This subsection explores the decision problems that arise when the two buyers also compete downstream. We intentionally avoid a numerical example or a fixed utility form—as such choices may obscure or rule out entire classes of strategic effects. Instead, we adopt a general oligopoly framework to map all possible outcomes. The tradeoff is analytic tractability, but the gain is a more complete picture of strategic forces under downstream competition.

Downstream competition reshapes incentives in ambiguous ways. It can weaken exclusion: a single buyer switching to a more efficient rival may trigger entry via business stealing, especially under Bertrand competition or mild rival disadvantages (Fumagalli and Motta, 2006, 2008). But, it can also eliminate expansion: a buyer may stay with the incumbent simply to impose a cost handicap on the rival, echoing the classic raising-rivals'-costs mechanism (Sevuk, 2025). A third effect is miscoordination—as in the independent-buyer game. A fourth, new effect is what we term *strategic chilling*: because the rival can only finance part of one buyer's demand, buyers may split their sourcing to avoid intense rivalry, leading to losses and to exit despite eliminating (D, D) as an equilibrium.

We model downstream interaction as a generalized duopoly—an *aggregative game*. Each buyer-firm i has a twice-differentiable net-profit function:

$$U_i(q_i, q) - S_i(q_i^D, q_i^R),$$

where $q = q_i + q_j$ is the aggregate quantity. Define the marginal utility as:

$$MU_i(q_i, q) := \frac{\partial U_i}{\partial q_i} + \frac{\partial U_i}{\partial q}, \quad \text{with } MU_i(0,0) < \infty.$$

We assume:

$$\frac{\partial MU_i}{\partial q_i} < 0, \quad \frac{\partial MU_i}{\partial q} < 0,$$

ensuring well-defined best responses $q_i^*(p_i, p_j)$ and associated indirect utilities $V_i(p_i, p_j)$.[10]

Because profits in aggregative games can decline after uniform cost reductions due to a profit-overshifting (Seade, 1985), we impose:

$$V(c, c) < V(c - s, c - s) \quad \text{for all } s > 0.$$

[10]Derivations of these are in Appendix B. For those who would like to see a numerical example and get an idea about the comparative statics, Appendix C provides worked examples based on a simple linear demand structure.

We also impose two standing assumptions:

Active buyers: For all $p_R \in [p_{R,\min}, c_D]$,

$$MU_i\left(0, q_j^*(q_i = 0, c_D)\right) > c_D,$$

ensuring that rival-backed buyers remain active.

Regularity: if for a $p_{R,min} \leq p_R = \bar{p} < c_D$

$$A(\bar{p}) = \bar{p}_D^L - c_R(q_R^0(p_R, B)) + U_Q^*(q_R^0, Q^*(q_R^0, c_D)) \cdot \frac{dq_j^*(q_R^0, c_D)}{dq_R^0} > 0,$$

$A = 0$ does not have a solution $p_R \in [\bar{p}, c_D]$.

This subgame generalizes the independent-buyer game, so many qualitative results carry over. Proposition 1 already showed that financial constraints can deter unilateral switching. Downstream rivalry adds two opposing forces: it may soften miscoordination equilibria (by boosting the rival's expected demand), or strengthen buyers' incentive to prevent rival expansion (by preserving an input cost gap). Which dominates depends on the severity of the rival's budget constraint and the game's structure.

Suppose again $p_D = c_D$. Define the condition:

$$(p_R - AC_R(q_i^*(p_R, c_D))) \cdot q_i^*(p_R, c_D) < 0. \tag{6}$$

This expresses the rival's inability to profitably serve a single buyer at p_R. For exclusion to arise, Condition (6) must hold for all $p_R \in [p_{R,\min}, c_D]$.[11]

Because $MU_i(0, 0)$ is finite, there exists for each buyer a monopoly-preserving price $\check{p}(p_i)$ such that:

$$MU_j(0, q_i^*(0, p_i)) = \check{p}(p_i),$$

from which one can define the choke prices. Continuity implies that the choke price $\bar{p}_D^L(p_R, c_D, B)$, defined implicitly by the quantity cap $q_R^0(p_R, B)$, satisfies:

$$\bar{p}_D^L(p_R, c_D, B) < \check{p}(p_i),$$

and is increasing in p_D, decreasing in p_R.

Notice when $p_R = c_D$, no unit is actually sold at a price lower than the incumbent's. Thus, as before, expansion fails, since a buyer that switches to the incumbent

[11]However, the relationship between p_R and $q_R^0(p_R, B)$ as given in (3) remains intact as it is implied by the rival's off-equilibrium profit function.

raises its rival's input cost without affecting its own.

Thus, as in isolated-buyers case, $p_R < c_D$ must hold for expansion to be feasible. As shown, in Appendix B, the rival's utility-maximizing price remains either $p_R = c_D$ or $p_R = p_{R,\min}$. For this reason, we restrict attention to $p_R = p_{R,\min}$.

To state conditions for an exclusionary outcome, define $V_i(p_i, \check{p}(p_i))$ as buyer i's monopoly profit under price p_i. A necessary condition for the incumbent to destroy expansion is:

$$V_i(c_D, \check{p}(c_D)) > V_i(p_R, p_R). \tag{7}$$

If condition (7) holds, continuity implies that there exists an indifference cutoff $p_D^{L,1} < \check{p}(c_D)$ such that:

$$V_i(p_D, p_D^{L,1}) = V_i(p_R, p_R).$$

If the quantity cap $q_R^0(p_R, B)$ implies:

$$\bar{p}_D^L(p_R, c_D, B) > p_D^{L,1},$$

then the incumbent can set $p_D^L > p_D^{L,1}$ to eliminate expansion from the equilibrium set.

Of course, ruling out expansion does not by itself pin down which cell of Table 1 will emerge. In particular, elimination of (R, R) as an equilibrium need not lead to (D, D). To capture the list-price that deters any deviation from (D, D), re-define the deterrence cutoff $\underline{p}_D^L(p_D, p_R)$ by

$$V_i(c_D, c_D) = V_i(\underline{p}_D^L(p_D, p_R), c_D) + (\underline{p}_D^L(p_D, p_R) - p_R)q_R^0.$$

Note that, if

$$V_i(c_D, c_D) < V_i(\bar{p}_D^L, c_D) + (\bar{p}_D^L - p_R)q_R^0, \tag{8}$$

then $\underline{p}_D^L(p_D, p_R)$ does not exist or is economically irrelevant, which means that (D, D) cannot be an equilibrium.

Unfortunately, without further assumptions one cannot derive a straightforward ordering between $\bar{p}_D^L$, $p_D^{L,1}$, and $\underline{p}_D^L(p_D, p_R)$, which is the main result of this section because it is precisely the relative magnitudes of these three benchmarks and their existence, or inexistence, that determine which equilibria—miscoordination, full expansion, asymmetric split, or outright exclusion—can arise in a game.

Proposition 2. *The following holds:*

- *Neither $\bar{p}_D^L$ nor $\underline{p}_D^L(p_D, p_R)$ has a fixed order relative to $p_D^{L,1}$; and*

- *The cutoffs $p_D^{L,1}$ and $\underline{p}_D^L(p_D, p_R)$ need not exist.*

Proof: *In Appendix B.*

Now, we can discuss the implications of Proposition 2. In doing so, however, I will maintain that both cutoffs exist if Condition (6) holds. Brief explanations on cases where these cutoffs do not exist are given in the footnotes.

Expansion arises as the unique equilibrium when Condition 6 fails outright for at least one $p_R \in [p_{R,\min}, c_D]$: a single buyer's demand already makes the rival viable, so any slight undercut by the rival drags both buyers away. It also means that in extremely competitive environments, such as homogeneous Bertrand, the unique equilibrium must be (R, R) as a small efficiency differential allows the rival's customer to capture the whole market. As before, the rival knows some price yields full expansion, so, in the t_1 subgame, it will choose that winning offer, driving p_D down to c_D.[12]

In order for coordination failures to arise, it suffices that the deterrence cutoff $\underline{p}_D^L(p_D, p_R)$ exists and lies below the indifference cutoff $p_D^{L,1}$. If the incumbent quotes a list price $p_D^L \in (\underline{p}_D^L(p_D, p_R), p_D^{L,1})$, each buyer faces the familiar decision problem: switching alone to the rival risks a capacity-shortfall and costly top-ups, while staying loyal means forgoing the entrant's low cost if the other buyer does switch. Neither buyer can be confident that the other will join or stay, so both may choose to remain with the incumbent—despite the rival's lower potential price—simply to avoid being the only one exposed. That fear of losing out generates a classic miscoordination equilibrium.[13]

If $\bar{p}_D^L > p_D^{L,1}$, the dominant firm eliminates (R, R) by quoting any $p_D^L > p_D^{L,1}$. We need to distinguish between two cases though. When $p_D^{L,1} \geq \underline{p}_D^L(p_D, p_R)$, the dominant firm can make (D, D) the only equilibrium by quoting $p_D^L > p_D^{L,1}$. This is the raising-rivals'-costs mechanism (Sevük, 2025): each buyer gains from imposing cost on its competitor, so neither supports the rival, which never reaches efficient scale and all purchases go to the incumbent.[14]

[12] If $\bar{p}_D^L < p_D^{L,1}$ and $\underline{p}_D^L$ is absent, i.e. Condition (8) holds, or both $\underline{p}_D^L$ and $p_D^{L,1}$ are non-existent, i.e. Condition (7) also fails, the expansion outcome is the unique equilibrium prediction. That is, the rival's local capacity $q_R^0(p_R, p_D, B)$ is large enough, and equilibrium prices rise so steeply when output falls, that a lone deviation still pays. No refusal-to-sell or top-up threat can stop it. In either scenario, the rival knows some price yields full expansion, so, in the t_2 subgame, it will choose that winning offer, driving p_D down to c_D.

[13] Indeed, it is the only strategy the dominant firm can pursue to deter expansion if $p_D^{L,1} \geq \bar{p}_D^L > \underline{p}_D^L(p_D, p_R)$ or $\bar{p}_D^L > \underline{p}_D^L(p_D, p_R)$ and $p_D^{L,1}$ is absent.

[14] In this case, the rival may also try to rely on coordination failures if $p_D^(L, 1)$ is strictly higher than $\underline{p}_D^L$.

When expansion is eliminated as a possibility, the following order surely holds:

$$V(p_D, q_R^0(c_D, B)) > V(p_R, p_R) > V(c_D, c_D).$$

The incumbent therefore beats p_R. What remains unclear is how the profit of a single buyer who sources part of its demand from the capacity-constrained rival compares with $V(c_D, c_D)$. Because that buyer receives a discount on the first $q_R^0(p_R, B)$ units and market prices may overshift (Hamilton, 1999; Seade, 1985) when aggregate output falls, it is possible that

$$V(p_D^L, c_D) + (p_D^L - p_R)q_R^0(p_R, B) > V(c_D, c_D).$$

This requires the choke list price to be sufficiently high ($\bar{p}_D^L > p_D^{L,1}$) and the deterrence cutoff to exceed the indifference cutoff ($\underline{p}_D^L(p_D, p_R) > p_D^{L,1}$). If the dominant firm sets

$$p_D^L \in (p_D^{L,1}, \underline{p}_D^L(p_D, p_R)),$$

an asymmetric equilibrium emerges: one buyer remains with the incumbent and enjoys rents from the market, while the other buys the discounted tranche from the rival and makes a higher profit than a symmetric equilibrium due to increase in prices. Neither has an incentive to mimic the other, so the split is stable. We label this outcome *strategic chilling*: the incumbent's high list price dampens—chills—downstream competition should the rival make an offer. Depending on the broader context, this split can also be read as tacit collusion, with each buyer implicitly accepting different input sources to soften head-to-head competition.

In contrast to the raising-rivals'-costs mechanism—where the rival loses nothing by posting its preferred discount and buyers themselves reject it—strategic chilling works by hitting the rival's own break-even point. Faced with a list price in the band $(p_D^{L,1}, \underline{p}_D^L(p_D, p_R))$, the rival's best responses shrink to two unappealing moves: (i) keep the old discount and absorb a loss whenever only one buyer turns up, (ii) refrain from making an offer or, equivalently, quote higher prices that do not pose an actual challenge to the dominant firm. To avoid losses, the rival will always follow the second strategy. Therefore, no actually competing contract appears and both buyers remain with the incumbent by default. The incumbent may prefer this tactic whenever published contracts feed an active antitrust authority: a chilled rival either leaves no observable offer and lets the dominant firm point to a "high but unilateral" list price rather than an overt exclusionary rebate or makes an offer that is qualitatively indistinguishable from that of the dominant firm and, hence, cannot really be seen as a challenge to the dominant firm's practice by an outsider.

In short, the model identifies three distinct ways in which exclusion can arise without any need for contractual commitment. With independent buyers, the risk of being left alone with the rival—who may be unable to supply—discourages defection and creates a coordination problem. Under downstream competition, additional forces emerge. A buyer may deliberately undermine its competitor by sourcing from the incumbent and raising the rival's costs, or both buyers may implicitly split their patronage to soften market competition. In both cases, the rival's financial fragility and the design of the dominant firm's rebates lead to exclusion.

4.3 Conclusion

This paper examined when a rebate scheme without explicit pre-commitment or lump-sum transfers can yield exclusionary effects without predation. The model shows that exclusion emerges naturally when an entrant's financial fragility intersects with scale economies, generating a credibility problem intensified by the incumbent's rebate scheme. Specifically, the incumbent's pricing strategy squeezes the rival's margins, exacerbating its financial vulnerability and limiting its ability to achieve minimum efficient scale. Consequently, buyers contemplating the rival's offer face the risk of unmet demand or forced purchases at the incumbent's punitive list price. Thus, by remaining loyal to the incumbent, each buyer effectively imposes negative demand externalities on others, reinforcing the entrant's fragility and the exclusionary equilibrium.

The paper clarifies that this causal mechanism closely aligns with well-known negative demand externality frameworks (Ide et al., 2016). In the case of non-competing buyers, exclusion manifests primarily as a coordination failure, leaving open the possibility of entry unless contracts or market environments are more complex. When buyers compete downstream, coordination failures may persist but can also transform into deliberate strategies aimed at increasing competitors' costs or softening downstream competition. A novel insight is the emergence of a distinct "strategic chilling" equilibrium: competing buyers may implicitly coordinate to split their patronage—one choosing the incumbent and the other the financially constrained entrant—thereby reducing downstream rivalry and maximizing joint profits. Anticipating sub-scale operation, the entrant rationally stays out or makes offers indistinguishable from those of the dominant firm, achieving exclusion without overt predation or contractual pre-commitment.

The model resonates strongly with the *Post Danmark II* case. Bring Citymail—the main entrant and the incumbent's only credible competitor—faced profound financial challenges and scale limitations exacerbated by Post Danmark's rebate thresholds. The incumbent's retroactive rebates severely constrained buyers from shifting volumes to the rival, directly hindering Bring Citymail from reaching profitable scale and density. Consequently, Bring Citymail incurred unsustainable losses (approximately €67 million) before exiting the market entirely. Recognizing this interplay of financial constraints and scale economies, both the Danish Competition Authority and ultimately the European Court of Justice explicitly declined to apply an as-efficient-competitor test. They emphasized instead the structural characteristics—financial unsustainability and scale thresholds—as sufficient conditions for exclusionary harm.

Thus, this paper underscores the necessity for antitrust policy to recognize how apparently neutral rebate structures, combined with rivals' inherent financial and scale constraints, can facilitate exclusion without predation or formal contractual pre-commitment.

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Appendix A: Proofs for Section 2.2

This appendix provides proofs for the results in Section 2.2. For the independent-buyers case, local choke prices follow directly as special cases of the general aggregative-game derivations in Section 2.3, so repeating the algebra here is unnecessary. Each lemma here is the formal counterpart of its statement in the main text and is mathematically equivalent.

Lemma 5. *If* $p_R = c_D$ *and*

$$(c_D - AC_R(D(c_D))) \cdot D(c_D) + B < 0,$$

then $V_i(R, D) < V_i(D, D)$.

Proof. When $p_R = c_D$, the rival can only serve a quantity q_R^0 satisfying

$$(c_D - AC_R(q_R^0)) \cdot q_R^0 + B = 0.$$

If a buyer demands $D(p_D^L) > q_R^0$, its utility is

$$V_i(p_D^L) + (p_D^L - c_D) \cdot q_R^0.$$

If instead $D(p_D^L) < q_R^0$, then q_R^0 exceeds the buyer's demand and the buyer consumes only from the rival, achieving utility

$$V_i(\bar{p}_D^L) + (\bar{p}_D^L - c_D) \cdot q_R^0,$$

where $\bar{p}_D^L$ is defined by $D(\bar{p}_D^L) = q_R^0$.

By the mean value theorem, there exists $p_M < p_D^L$ such that

$$V_i(c_D) - V_i(p_D^L) = D(p_M)(p_D^L - c_D).$$

Because $D(p_M) > D(p_D^L) > q_R^0$, it follows that

$$V_i(c_D) - V_i(p_D^L, q_R^0) > 0.$$

Hence, no buyer has an incentive to unilaterally deviate when $p_R = c_D$. □

Lemma 6. *If* $c_D < p_R^m$ *and*

$$(c_D - AC_R(D(c_D))) \cdot D(c_D) + B < 0,$$

then

$$(p_R - AC_R(D(p_R))) \cdot D(p_R) + B < 0 \quad \forall p_R \in [p_{R,\min}, c_D].$$

Proof. Differentiate the rival's profit function:

$$\frac{d}{dp_R}\big[(p_R - AC_R(D(p_R))) \cdot D(p_R)\big] = D(p_R) + (p_R - c_R(D(p_R))) \cdot D'(p_R).$$

Write the monopoly profit as

$$2\,(p_R - AC_R(2D(p_R)))\cdot D(p_R).$$

Since $c_D < p_R^m$, its derivative is positive on $[p_{R,\min}, c_D]$:

$$2\big(D(p_R) + (p_R - c_R(2D(p_R)))\cdot D'(p_R)\big) > 0.$$

Because $c_R(2D(p_R)) \le c_R(D(p_R))$ and $D'(p_R) \le 0$, we have

$$D(p_R) + (p_R - c_R(D(p_R)))\cdot D'(p_R) \;\ge\; D(p_R) + (p_R - c_R(2D(p_R)))\cdot D'(p_R) \;>\; 0.$$

Therefore $(p_R - AC_R(D(p_R)))\cdot D(p_R)$ is increasing on $[p_{R,\min}, c_D]$. If it is negative at $p_R = c_D$ (by the premise), it is negative for every $p_R < c_D$ in that interval. □

Lemma 7. *If*

$$(c_D - AC_R(D(c_D)))\cdot D(c_D) + B < 0,$$

and $p_D^L \ge \bar{p}_D^L(p_{R,\min}, B)$, then $V_i(R,D) < V_i(D,D)$.

Proof. The first condition implies that when addressed by a single buyer the rival is quantity-constrained; denote its output by $q_R^0(p_R, B)$. By Lemma 2, the rival is also quantity-constrained for every $p_R \in [p_{R,\min}, c_D]$.

If $p_D^L \ge \bar{p}_D^L(p_{R,\min}, B)$, a buyer who turns to the rival obtains net utility

$$U_i(q_R^0(p_R,B)) - p_R\, q_R^0(p_R,B).$$

Differentiating with respect to p_R gives

$$\frac{d}{dp_R}\big[U_i(q_R^0(p_R,B)) - p_R\, q_R^0(p_R,B)\big] = -\frac{U_i'(q_R^0(p_R,B)) - c_R(q_R^0(p_R,B))}{p_R - c_R(q_R^0(p_R,B))}\, q_R^0(p_R,B).$$

This derivative is positive for all $p_R \in [p_{R,\min}, c_D]$, since $U_i'(q) > c_R(q)$ when $q < \bar{q}_R$, and $p_R - c_R(q_R^0(p_R,B)) < 0$ because q_R^0 lies on the downward-sloping part of the rival's profit curve.

Hence the buyer's net utility is increasing in p_R on $[p_{R,\min}, c_D]$ and is therefore maximized at $p_R = c_D$, which does not trigger a deviation under refusal-to-sell. (Note that $U_i'(q_R^0(p_R,B)) = \bar{p}_D^L$.) Thus $V_i(R,D) < V_i(D,D)$. □

Lemma 8. *If the rival is quantity-constrained with one buyer, there exists $\underline{p}_D^L > c_D$ such that any $p_D^L > \underline{p}_D^L$ deters unilateral deviation.*

Proof. Begin by noting that the first derivative of the net utility function is the same as that in the proof of Lemma 3, with the difference that now $U_i'(q_R^0(p_R,B)) = p_D^L$:

$$-\frac{(p_D^L - c_R(q_R^0(p_R,B)))}{(p_R - c_R(q_R^0(p_R,B)))}\cdot q_R^0.$$

Since $p_D^L, c_R(q_R^0(p_R,B)) \in (c_D, \bar{p}_D^L)$, there exists $p_D^L = c_R(q_R^0(p_R,B)) < \bar{p}_D^L$ at which the above expression equals zero for a given price $p_R \in [p_{R,\min}, c_D]$. Let the above expression be equal to zero at some interior value $p \in [p_{R,\min}, c_D]$. Since $q_R^0(p_R, B)$ increases with p_R, the above expression takes positive values for $p_R > p$ and negative values for $p_R < p$, which means that there exist two candidates for maxima: one at $p_{R,\min}$ and the other at c_D.

Since there exists a negative relationship between the local choke price $\bar{p}_D^L(p_R, B)$ and p_R—as the former is implicitly defined by the identity $U'(q_R^0(p_R, B)) = \bar{p}_D^L(p_R, B)$—then for the price $p_D^L = c_R(q_R^0(p_{R,\min}, B))$, the above expression equals zero at $p_{R,\min}$, and the net utility's derivative for all higher prices will be positive, making $p_R = c_D$ the utility-maximizing price. We know that this price cannot incentivize unilateral deviation.

Likewise, for a low enough p_D^L, the above expression will be non-positive for some connected set of feasible p_R values, making $p_{R,\min}$ the utility-maximizing price. This implies that there must exist a list price $p_{D,0}^L$ at which the net utility at both local maxima are equal, and for any list price below that value, the maximum net utility is attained when $p_R = p_{R,\min}$.

Since at this value both local maxima yield the same utility and at c_D the unilateral deviation from the dominant firm is strictly unprofitable, there must exist a list price lower than $p_{D,0}^L$ (denoted $\underline{p}_D^L$) at which the buyer is indifferent between choosing the dominant firm and the rival firm (though quantity-constrained), since the utility of a deviating buyer under the top-up strategy is negatively related to the list price.

Finally, when $p_D^L = c_D$, every buyer will want to deviate, since any price $p_R < c_D$ will work as a rent transfer from the rival, yielding her a net utility of

$$V(p_D^L = c_D, q_R^0) = V(p = c_D) + (c_D - p_R) \cdot q_R^0(p_R, B) > V(p = c_D).$$

Thus, the list price that leaves the buyer indifferent between deviating from the dominant firm and remaining with it, $\underline{p}_D^L$, is higher than c_D whenever $p_R < c_D$. Finally, because $\underline{p}_D^L$ is such that $V(p = p_D) = V(\underline{p}_D^L, q_R^0)$, it is defined implicitly by the dominant firm's offer. In particular, $\underline{p}_D^L(p_D)$ increases in p_D, because p_D is negatively related to $V(p = p_D)$, and $\underline{p}_D^L$ is negatively related to $V(\underline{p}_D^L, q_R^0)$. □

Proposition 3. *Two cases arise:*

1. *If Condition (5) fails at $p_R = c_D$, then the unique equilibrium is expansion: $p_D = c_D$, $p_R = c_D$.*

2. *If Condition (5) holds at $p_R = c_D$, then both expansion and exclusion equilibria may arise for $p_D \in [c_D, \bar{p}_D]$, $p_R \in [p_{R,\min}, p_D]$, and $p_D^L > \underline{p}_D^L(p_D)$.*

Proof. In Case 1, the rival can serve a single buyer fully. If $p_D > c_D$, the rival can profitably undercut, making $p_D = p_R = c_D$ the unique equilibrium.

In Case 2, if Condition (5) holds throughout $[p_{R,\min}, c_D]$, then the rival is constrained. By Lemmas 1–4, there exists $\underline{p}_D^L$ such that no buyer deviates unilaterally. Hence, exclusion is sustainable over a range of prices, which follows from continuity of the relevant benchmarks. □

Appendix B: Proofs for Section 2.3

We begin by expanding the utility function and reviewing the main relationships. The utility function is

$$U_i(q_i, q) - S_i(q_i^D, q_i^R).$$

One can think of $U_i(q_i, Q)$ as being composed of an inverse demand function and own quantity: that is,

$$D^{-i}(q_i, q) \cdot q_i = U_i(q_i, Q),$$

where $D^{-i}(q_i, q)$ is the inverse demand function with $\frac{\partial P(q_i,Q)}{\partial Q} < 0$. The Nash equilibrium is achieved when, for each player,

$$U_i(q_i^*, Q^*) - pq_i^* \geq U_i(q_i, Q^* - q_i^* + q_i) - pq_i$$

for any q_i. At the Nash equilibrium, no player has an incentive to deviate, which reduces to the condition:

$$MU_i(q_i, q) - p = 0.$$

Since marginal utility is decreasing in both q_i and q, the equilibrium quantity can be written as

$$q_i^*(\downarrow p_i, \uparrow p_j), \quad V(\downarrow p_i, \uparrow p_j),$$

or

$$q_i^*(\downarrow q_j, \downarrow c_i), \quad V(\downarrow p_i, \downarrow q_j).$$

Note that all equilibrium relationships follow from the implicit function theorem as we shall see.

Recall that there exists a monopoly-preserving price, denoted $\check{p}(p_i)$. For any player facing the input price p_i whose opponent receives the input at the price $\check{p}(p_i)$, this price preserves monopoly for that buyer. Equivalently, if $p_i < MU_i(0, 0)$, then $\check{p}(p_i)$ is defined by the condition

$$q_j^*(\check{p}(p_i), p_i) = 0.$$

For any price $p_j \in (p_i, \check{p}(p_i))$, q_j^* is continuous and monotone in p_j.

Local Choke Price Because buyers who choose to work with a quantity-constrained rival receive these units at a price $p_R \leq p_D < \check{p}(p_i)$, the rival's customer will always remain active. However, since such a buyer can receive at most $q_R^0(p_R^0, B) < q_j^*(p_D, p_D)$, there must exist a finite local choke price $\bar{p}_D^L(p_R, c_D, B)$ such that

$$q_i^*(\bar{p}_D^L, p_D) = q_R^0(p_R^0, B).$$

Top-up v. Refusal-to-Sell If $\bar{p}_D^L \leq p_D^L$ (so that D follows a refusal-to-sell strategy), the utility of R's customer is

$$U_i(q_R^0, q_R^0 + q_j^*(q_R^0, p_D)) - p_R q_R^0 = V_i(\bar{p}_D^L, p_D) + (\bar{p}_D^L - p_R)q_R^0.$$

Likewise, if D adopts a top-up strategy ($\bar{p}_D^L > p_D^L$), the utility is

$$U_i(q_R^0, q_R^0 + q_j^*(q_R^0, p_D)) - p_R q_R^0 = V_i(p_D^L, p_D) + (p_D^L - p_R) q_R^0.$$

By definition, in either case MU_i equals the list price, as this is the effective marginal input price. In both cases, the first term on the right-hand side ($V_i(p_D^L, p_D)$ or $V_i(\bar{p}_D^L, p_D)$) represents the value the rival's customer extracts from the final market. The second term $[(p_D^L - p_R)q_R^0$ or $(\bar{p}_D^L - p_R)q_R^0]$ is what we refer to as the *partial discount* from working with the rival.

Aggregate Quantity Q^* when R is Financially Fragile Now, we show a key identity: when the rival is capacity-constrained, the aggregate quantity is lower than what would be in a symmetric equilibrium. Suppose that one of the players faces a constraint $q_R^0 < q_j^*(p_j, p_i)$, e.g., due to a supplier switch. If aggregate quantity remains the same, Player i's quantity increases to

$$q_i = q_i^*(p_i, p_j) + q_j^*(p_j, p_i) - q_R^0 > q_i^*(p_i, p_j).$$

However, by strong concavity,

$$MU_i(q_i^*, q_i^* + q_j^*) = 0 > MU_i(q_i, q_i^* + q_j^*).$$

Thus, the aggregate quantity must fall, implying that input prices effectively increase.

Shocks to Aggregate Quantity Q^* Under Refusal-to-Sell A notable implication is that when the rival's customer is constrained to receive at most q_R^0, a shock that raises the rival's capacity increases the aggregate quantity—if $p_D^L > \bar{p}_D^L$. Suppose we are in an equilibrium where

$$MU_i(q_R^0, Q^*(q_R^0, c_D)) = \bar{p}_D^L, \quad MU_j(q_j^*(q_R^0, c_D), Q^*(q_R^0, c_D)) = c_D,$$

with $\bar{p}_D^L > c_D > p_R$, and $\bar{p}_D^L$ implicitly defined by

$$MU_i(q_R^0, Q^*) = \bar{p}_D^L(q_R^0).$$

Suppose a positive change in q_R^0 leads to a reduction in the equilibrium quantity:

$$q_R^0 + q_j^* = Q^*(q_R^0, c_D) > Q^*(q_R^0 + dq_R^0, c_D).$$

This implies

$$MU_j(q_j^*(q_R^0, c_D), Q^*(q_R^0, c_D)) < MU_j(q_j^*(q_R^0, c_D), Q^*(q_R^0 + dq_R^0, c_D)),$$

which requires

$$q_j^*(q_R^0, c_D) < q_j^*(q_R^0 + dq_R^0, c_D),$$

a contradiction, as it implies

$$q_j^*(q_R^0 + dq_R^0, c_D) + q_R^0 + dq_R^0 > Q^*(q_R^0, c_D).$$

If instead

$$Q^*(q_R^0, c_D) = Q^*(q_R^0 + dq_R^0, c_D),$$

then

$$MU_j(q_j^*(q_R^0, c_D) - dq_R^0, Q^*(q_R^0, c_D)) = c_D,$$

which contradicts the assumption that $q_j^*(q_R^0, c_D)$ is an equilibrium. Thus,

$$Q^*(q_R^0, c_D) < Q^*(q_R^0 + dq_R^0, c_D).$$

Natural Candidates for a Rival's Customer's Utility The result that either c_D or $p_{R,\min}$ maximizes the buyer's utility when the rival is capacity-constrained does not readily hold with competing buyers. The buyer's utility is given by:

- If $p_D^L \geq \bar{p}_D^L$:
$$U_i(q_R^0, Q^*(q_R^0, c_D)) - p_R q_R^0,$$
- If $p_D^L < \bar{p}_D^L$:
$$U_i(q_i^*(p_D^L, c_D), Q^*(p_D^L, c_D)) - p_D^L q_i^*(p_D^L, c_D) + (p_D^L - p_R) q_R^0.$$

Note: $\bar{p}_D^L$ is decreasing in q_R^0, and thus in p_R; also, since $\check{p}(p_D)$ increases in p_D, $\bar{p}_D^L$ is increasing in c_D. Suppose the dominant firm sets a list price $p_D^L < \bar{p}_D^L(p_R = c_D, c_D, B)$, so that for all $p_R \in [p_{R,\min}, c_D]$, the rival pursues a top-up strategy. The derivative of the utility with respect to p_R is

$$-\frac{(p_D^L - c_R(q_R^0(p_R, B)))}{(p_R - c_R(q_R^0(p_R, B)))} q_R^0.$$

where $p_D^L = MU_i(q_i^*(p_D^L, c_D)$. If $p_D^L > c_R(q_R^0(p_R, B))$, the rival's customer maximizes utility at $p_R = c_D$, which cannot trigger entry. If instead $p_D^L < c_R(q_R^0(p_R = p_{R,\min}, B))$, then either $p_R = c_D$ or $p_R = p_{R,\min}$ maximizes the rival's customer utility under a top-up strategy[15], making $p_{R,\min}$ a natural candidate.

The case of refusal-to-sell is more complex. The first derivative of the rival's customer utility is

$$MU_i(q_R^0, Q^*(q_R^0, c_D)) \frac{dq_R^0}{dp_R} + \frac{d}{dQ} U_i(q_R^0, Q^*(q_R^0, c_D)) \frac{dq_j^*(q_R^0, c_D)}{dq_R^0} \frac{dq_R^0}{dp_R} - q_R^0 - p_R \frac{dq_R^0}{dp_R},$$

which simplifies to:

$$-\frac{MU_i(q_R^0(p_R, B)) - c_R(q_R^0(p_R, B))}{(p_R - c_R(q_R^0(p_R, B)))} q_R^0 + K$$

[15]This follows because as c_R decreases with p_R and, hence, the derivative might change sign.

where

$$K = \frac{d}{dQ} U_i(q_R^0, Q^*(q_R^0, c_D)) \cdot \frac{dq_j^*(q_R^0, c_D)}{dq_R^0} \cdot \frac{dq_R^0}{dp_R} > 0.$$

The additional term K captures the consumption benefits gained as the rival's customer increases quantity, reclaiming some downstream share from the dominant firm's customer.

Although $p_R = c_D$ and $p_R = p_{R,\min}$ are natural candidates, irregularities—such as multiple crossings of $MU_i - c_R(q_R^0(p_R, B))$, or non-smooth behavior in K—may result in other maximizers. However, a necessary condition for this is that $p_R = p_{R,\min}$ is the maximizer for the single defecting buyer at some $p_D^L < \bar{p}_D^L$. It is because

$$-\frac{(p_D^L - c_R(q_R^0(p_R, B)))}{(p_R - c_R(q_R^0(p_R, B)))} q_R^0$$

increases monotonically in p_D^L.[16] Thus, if, at some $p_D^L < \bar{p}_D^L$, $p_R = c_D$ is the maximizer for buyer's utility, higher p_D^L only reinforces that strategy up to $\bar{p}_D^L(p_R = c_D)$. Since both $\bar{p}_D^L(p_R = c_D)$ and c_R decrease with p_R,

$$-\frac{(p_D^L - c_R(q_R^0(p_R, B)))}{(p_R - c_R(q_R^0(p_R, B)))} q_R^0.$$

also increases for any $p_R < c_D$, which further reinforces $p_R = c_D$. For any refusal to sell strategy, raising $p_D^L > \bar{p}_D^L(p_R = p_{R,min})$ does not have any impact on the utility dynamics. Yet, for a given p_R, an increase in p_D^L may turn the top-up strategy to refusal-to-sell for $p_D^L \in [\bar{p}_D^L(p_R = c_D), \bar{p}_D^L(p_R = p_{R,min})$. In this range, at any list price $p_D^L = \bar{p}_D^L = MU_i(q_R^0(p_R, B))$, and beyond that point p_D^L does not have any impact on the buyer's utility. Since at this point the additional positive term K kicks in, it increases the impact of p_R further reinforcing $p_R = c_D$ as a maximizer.

Therefore, we must have $p_R = p_{R,min}$ as the maximizer for a single buyer's utility even at $p_D^L = \bar{p}_D^L(p_R = c_D)$, which can be the case if and only if $p_D^L < c_R(q_R^0(p_R, B))$. Since under top-up strategies c_R decreases with p_R, at a price above $p_{R,min}$, say p^0, increases in p_R might increase utility. As we have seen, if a top-up strategy is turned into a refusal-to-sell strategy by an increase in list price, this only increases the marginal benefits to customer from price increases, thereby turning the impact of p_R in a neighborhood to the left of p^0 and increasing the impact of those to the right of p^0 unanimously (if it exists). Nevertheless, such a shock either favors $p_R = c_D$ as a maximizer or, only if K is sufficiently irregular (non-monotone), it can generate an interior maximizer $p_R \in (p_{R,\min}, c_D)$; under standard smooth primitives this is very unlikely and is not necessarily potent enough to eliminate $p_R = p_{R,min}$ as a maximizer.

Note that under a top-up strategy the derivative of a single buyer's utility can

[16] This means higher list prices make higher rival quantities more attractive for defecting buyers, eventually disincentivizing defection, as rival prices must also rise.

be written as

$$-\frac{MU_i(q_R^0(p_R,B)) - c_R(q_R^0(p_R,B)) + \frac{d}{dQ}U_i(q_R^0, Q^*(q_R^0, c_D)) \cdot \frac{dq_j^*(q_R^0,c_D)}{dq_R^0}}{(p_R - c_R(q_R^0(p_R,B)))} q_R^0.$$

We know that the denominator is always negative and, hence, the sign of the derivative depends merely on

$$MU_i(q_R^0(p_R,B)) - c_R(q_R^0(p_R,B)) + \frac{d}{dQ}U_i(q_R^0, Q^*(q_R^0, c_D)) \cdot \frac{dq_j^*(q_R^0, c_D)}{dq_R^0}.$$

We also know that for a given p_R,

$$MU_i(q_R^0(p_R,B)) - c_R(q_R^0(p_R,B)).$$

increases in $p_D^L \to \bar{p}_D^L(p_R)$. After that point, we have $\bar{p}_D^L(p_R) - c_R(q_R^0(p_R))$ and the numerator becomes the highest, with the additional effect from $U_Q^*(q_R^0) \cdot \frac{dq_j^*(q_R^0,c_D)}{dq_R^0}$. If at a p_R, $\bar{p}_D^L(p_R) \geq c_R(q_R^0(p_R))$, which means that it is positive for all higher p_R, reinforcing $p_R = c_D$. However, if, at a p_R, $\bar{p}_D^L(p_R) < c_R(q_R^0(p_R))$, it could be that the numerator exhibits changing sign patterns. The regularity assumption that if for a $p_{R,min} \leq p_R = \bar{p} < c_D$

$$A(\bar{p}) = \bar{p}_D^L - c_R(q_R^0(p_R,B)) + U_Q^*(q_R^0, Q^*(q_R^0, c_D)) \cdot \frac{dq_j^*(q_R^0, c_D)}{dq_R^0} > 0,$$

$A = 0$ does not have a solution $p_R \in [\bar{p}, c_D]$ rules out an intermediate maximum.

Basics for Proposition 2 To prove why all four decision problems might arise, we first note some facts. First, whenever $\underline{p}_D^L$ exists or economically relevant, it is weakly lower than $\bar{p}_D^L$ by definition. Indeed, $\bar{p}_D^L$ is the definitive threshold for $\underline{p}_D^L$. Thus, either

$$\underline{p}_D^L \leq \bar{p}_D^L$$

or $\underline{p}_D^L$ is not economically relevant.

Second, when $p_R = p_D = c_D$ and Condition 6 holds, we have

$$\underline{p}_D^L = p_D^{L,1} < \bar{p}_D^L$$

This also follows from the definitions of the thresholds. For instance, when $p_R = p_D$, because

$$V_i(p_R, c_D) > V_i(p_D^L, c_D) + (p_D^L - p_R)q_R^0$$

for any $p_D^L > p_R$, the only price that satisfies

$$V_i(c_D, c_D) = V_i(\underline{p}_D^L, c_D) + (\underline{p}_D^L - c_D)q_R^0$$

is $\underline{p}_D^L$. Likewise, under the no-profit-overshifting assumption, the only list price that satisfies $V_i(p_R, p_R) = V_i(p_D, p_D^{L,1})$ is $p_R = p_D$.

Third, we have not imposed any upper restriction on the size of the locality of feasible p_R values.

The Behavior of Equilibrium Quantities To show why no global ordering exists between the three thresholds, we must analyze how equilibrium quantities respond locally to price shocks (both symmetric and asymmetric). Assume the utility function is twice differentiable in both arguments, and write the no-unilateral-deviation condition for a Nash equilibrium with respect to a generic buyer i:

$$U_{q_i} + U_Q - p_i = 0$$

This defines a system of implicit functions

$$F(p_1, p_2; q_1^*, q_2^*) = \begin{bmatrix} F_1(p_1, p_2; q_1^*, q_2^*) \\ F_2(p_1, p_2; q_1^*, q_2^*) \end{bmatrix} = \begin{bmatrix} U_{q_1} + U_Q - p_1 \\ U_{q_2} + U_Q - p_2 \end{bmatrix} = 0$$

Now, take an asymmetric perturbation dc_1 (or dc_2) to prices. This yields:

$$\begin{bmatrix} U_{q_1q_1} + 2U_{q_1Q} + U_{QQ} & U_{q_1Q} + U_{QQ} \\ U_{q_2Q} + U_{QQ} & U_{q_2q_2} + 2U_{q_2Q} + U_{QQ} \end{bmatrix} \begin{bmatrix} \dfrac{dq_1}{dc_1} \\ \dfrac{dq_2}{dc_1} \end{bmatrix} + \begin{bmatrix} -1 \\ 0 \end{bmatrix} = 0$$

Or more compactly:

$$\begin{bmatrix} \dfrac{\partial F_1}{\partial q_1} & \dfrac{\partial F_1}{\partial Q} \\ \dfrac{\partial F_2}{\partial Q} & \dfrac{\partial F_2}{\partial q_2} \end{bmatrix} \begin{bmatrix} \dfrac{dq_1}{dc_1} \\ \dfrac{dq_2}{dc_1} \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

By strong concavity, both $\frac{\partial F_i}{\partial q_i}$ and $\frac{\partial F_i}{\partial Q}$ are negative, with $\frac{\partial F_i}{\partial q_i} < \frac{\partial F_i}{\partial Q}$.

At a symmetric equilibrium, we have $\frac{\partial F_1}{\partial q_1} = \frac{\partial F_2}{\partial q_2} = F_{q_i}$ and $\frac{\partial F_1}{\partial Q} = \frac{\partial F_2}{\partial Q} = F_Q$. By the implicit function theorem:

$$\begin{bmatrix} \dfrac{dq_1}{dc_1} \\ \dfrac{dq_2}{dc_1} \end{bmatrix} = \begin{bmatrix} \dfrac{F_{q_i}}{F_{q_i}^2 - F_Q^2} \\ \dfrac{-F_Q}{F_{q_i}^2 - F_Q^2} \end{bmatrix}$$

For a symmetric perturbation dc, the result is:

$$\begin{bmatrix} \dfrac{dq_1}{dc} \\ \dfrac{dq_2}{dc} \end{bmatrix} = \begin{bmatrix} \dfrac{1}{F_{q_i} + F_Q} \\ \dfrac{1}{F_{q_i} + F_Q} \end{bmatrix}$$

The Behavior of Benchmarks The deterrence cutoff $\underline{p}_D^L$ is implicitly defined by:

$$V_i(c_D, c_D) = V_i(\underline{p}_D^L, c_D)+(\underline{p}_D^L - p_R)q_R^0 = U_i(q_i^*(\underline{p}_D^L, c_D), Q^*(\underline{p}_D^L, c_D)) - \underline{p}_D^L q_i^*(\underline{p}_D^L, c_D)+(\underline{p}_D^L - p_R)q_R^0$$

Thus:

$$\left[(U_{q_i} + U_Q - \underline{p}_D^L)\frac{\partial q_i}{\partial p_i} + U_Q \frac{\partial q_{-i}}{\partial p_i} - (q_i^* - q_R^0)\right] d\underline{p}_D^L = \left[q_R^0 - (\underline{p}_D^L - p_R)\frac{dq_R^0}{dp_R}\right] dp_R$$

By the envelope theorem, $U_{q_i} + U_Q - \underline{p}_D^L = 0$. At a symmetric equilibrium:

$$\frac{d\underline{p}_D^L}{dp_R} = \frac{q_R^0 - (\underline{p}_D^L - p_R)\frac{dq_R^0}{dp_R}}{U_Q\frac{-F_Q}{F_{q_i}^2 - F_Q^2} - (q_i^* - q_R^0)} = \frac{(\underline{p}_D^L - c_R(q_R^0))q_R^0}{U_Q\frac{-F_Q}{F_{q_i}^2 - F_Q^2} - (q_i^* - q_R^0)}(p_R - c_R(q_R^0))$$

Notice that at $p_R = p_D = c_D$, $\frac{d\underline{p}_D^L}{dp_R} < 0$.

The indifference cutoff $p_D^{L,1}$ is defined by

$$V_i(p_R, p_R) = V_i(p_D, p_D^{L,1})$$

or

$$U_i(q_i^*(p_R, p_R), Q^*(p_R, p_R)) - p_R q_i^*(p_R, p_R) = U_i(q_i^*(p_D, p_D^{L,1}), Q^*(p_D, p_D^{L,1})) - p_D q_i^*(p_D, p_D^{L,1})$$

Which implies:

$$\left[(U_{q_i} + U_Q - p_R)\frac{\partial q_i}{\partial p} + U_Q \frac{\partial q_i}{\partial p} - q_i^*\right] dp_R = \left[(U_{q_i} + U_Q - p_R)\frac{\partial q_i}{\partial p_{-i}} + U_Q \frac{\partial q_{-i}}{\partial p_{-i}}\right] dp_D^{L,1}$$

Evaluated at $p_R = p_D = c_D$:

$$\frac{dp_D^{L,1}}{dp_R} = \frac{U_Q\frac{1}{F_{q_i} + F_Q} - q_i^*}{U_Q\frac{F_{q_i}}{F_{q_i}^2 - F_Q^2}} < 0$$

The no-profit-overshifting assumption means

$$U_Q\frac{1}{F_{q_i} + F_Q} - q_i^* < 0$$

Thus, at $p_R = p_D = c_D$, both $\frac{d\underline{p}_D^L}{dp_R}$ and $\frac{dp_D^{L,1}}{dp_R}$ are negative, while $\frac{dp_D^{L,1}}{dp_R}$ and q_R^0 can both approach zero. Therefore, either

$$\frac{d\underline{p}_D^L}{dp_R} \leq \frac{dp_D^{L,1}}{dp_R} \quad \text{or} \quad \frac{d\underline{p}_D^L}{dp_R} > \frac{dp_D^{L,1}}{dp_R}$$

Since all benchmarks and functions are continuous, the model does not imply any ordering between $p_D^{L,1}$ and $\underline{p}_D^L$. By the mean value theorem and because we have not restricted $p_{R,\min}$, the ordering observed for local derivatives can also hold for finite differences. This establishes the fact that $p_D^{L,1}$ and $\underline{p}_D^L$ do not universally follow any given ordering.

The framework also imposes no universal ordering between $p_D^{L,1}$ and $\bar{p}_D^L$; either ordering can arise under admissible primitives.

As $B \to 0$, $q_R^0 \to 0$. Thus,

$$\bar{p}_D^L \to \check{p}(p_D),$$

the monopoly-preserving list price that drives the opponent's quantity to zero. Since $p_D^{L,1}$ is weakly lower than $\check{p}(p_D)$ whenever it exists, we may have

$$p_D^{L,1} \leq \bar{p}_D^L.$$

Likewise, there may exist B large such that

$$p_D^{L,1} \ \geq \ \bar{p}_D^L(B).$$

We have not restricted (i) the elasticity of the cost function that partially determines $\bar{p}_D^L(B)$ under symmetric changes, (ii) the responsiveness of equilibrium utility to cross-price changes, or (iii) $p_{R,\min}$. Hence

$$B \uparrow \Rightarrow \ q_R^0 \uparrow \quad \text{and} \quad \bar{p}_D^L(B) \downarrow (c_D + k(p_R \downarrow)) \quad \text{(continuously)},$$

where $k(p_R)$ can be made arbitrarily small by suitable primitives and equals 0 at $p_R = c_D$.

Define

$$\Delta := V_i(p_R, p_R) - V_i(c_D, c_D) > 0,$$

for some fixed symmetric $p_R < c_D$. Since $V_i(p_D, p)$ is increasing in p, for large B we have

$$V_i\big(c_D, \bar{p}_D^L(B)\big) \ \leq \ V_i(c_D, c_D) + \tfrac{1}{2}\Delta \ < \ V_i(p_R, p_R).$$

Let $g(p) := V_i(p_D, p) - V_i(p_R, p_R)$, which is increasing in p. Then

$$g\big(\bar{p}_D^L(B)\big) \leq 0 \ \Rightarrow \ p_D^{L,1} = \{p : \ g(p) = 0\} \ \geq \ \bar{p}_D^L(B).$$

These examples show only that both orderings $p_D^{L,1} \leq \bar{p}_D^L$ and $p_D^{L,1} \geq \bar{p}_D^L$ are admissible; they do not assert that either ordering holds generically.

Non-existence of $p_D^{L,1}$. Let $g(p) := V_i(p_D, p) - V_i(p_R, p_R)$. In our setup g is continuous and (strictly) increasing in the opponent's price p. If

$$V_i\big(p_D, \check{p}(p_D)\big) \ < \ V_i(p_R, p_R),$$

then $g(p_D) \leq 0$ and $g\big(\check{p}(p_D)\big) < 0$, hence $g(p) < 0$ on $[p_D, \check{p}(p_D)]$ and no $p_D^{L,1}$ exists. *Equilibrium implication:* no opponent-price level up to $\check{p}(p_D)$ can make the buyer indifferent, so a a deviation from (R, R) cannot be sustained.

Non-existence of $\underline{p}_D^L$. Define $F(x) := V_i(x, c_D) + (x - p_R)q_R^0 - V_i(c_D, c_D)$ and let $\bar{p}_D^L$ be the top-up/refusal threshold. On $(-\infty, \bar{p}_D^L)$ (top-up region) F is strictly decreasing; for $x \geq \bar{p}_D^L$ (refusal) we have $F(x) = F(\bar{p}_D^L)$. If

$$V_i(c_D, c_D) \ < \ V_i(\bar{p}_D^L, c_D) + (\bar{p}_D^L - p_R)\, q_R^0 \quad (\Leftrightarrow \ F(\bar{p}_D^L) > 0),$$

then $F(x) > 0$ for all x and no $\underline{p}_D^L$ exists. *Equilibrium implication:* no list price can deter a deviation to the financed tranche, so (D, D) is impossible; every equilibrium has at least one buyer purchasing the rival tranche.

The first failure arises for sufficiently low p_R (the symmetric outcome is too profitable even relative to $\check{p}(p_D)$) or because the competition is not intense so that cross-prices do not matter. The second arises for sufficiently large B (so q_R^0 is high and $\bar{p}_D^L$ low) and low marginal utility at q_R^0, making the asymmetric split payoff exceed the no-expansion payoff.

Appendix C: Worked Examples

To keep things simple, suppose that the rival's cost function, which depends on the number of buyers who choose the rival, is given by

$$c_R = \begin{cases} c_h & \text{if } k = 1, \\ p_{R,min} & \text{if } k = 2. \end{cases}$$

where $c_h > c_D > p_{R,min}$. We maintain that so that expansion is profitable.

The market is characterized by the inverse demand

$$D_i = \alpha - \beta q_i - \gamma q_{-i}$$

with $0 < \gamma \leq \beta$. The ratio $\vartheta = \gamma/\beta$ can be interpreted as the degree of product differentiation and, hence, the degree of competition in downstream markets for a given market situation. To appeal to readers interested in comparative statics, I rewrite the inverse demand function as

$$D_i = \alpha - \beta(q_i + \vartheta q_{-i}).$$

The buyer's utility may be written as $U_i = D_i q_i$. Thus, the first-order condition for a Nash equilibrium, assuming an interior solution, can be written as

$$MU_i = \alpha - \beta(2q_i + \vartheta q_{-i}) = p_i,$$

which yields the reaction function, the equilibrium quantity, and the aggregate quantity:

$$r_i = \frac{\alpha - p_i}{2\beta} - \frac{\vartheta q_{-i}}{2}, \quad q_i^* = \frac{(2-\vartheta)\alpha - 2p_i + \vartheta p_{-i}}{\beta(2+\vartheta)(2-\vartheta)}, \quad Q^* = \frac{2\alpha - (p_i + p_{-i})}{\beta(2+\vartheta)}.$$

The local choke price $\bar{p}_D^L$ solves $q_i^* = q_R^0$; hence,

$$\bar{p}_D^L = \frac{(2-\vartheta)\alpha + \vartheta p_{-i} - \beta(2+\vartheta)(2-\vartheta)q_R^0}{2}.$$

Note that this expression decreases with q_R^0 and hence with B. It is useful to examine the rival's profit when a single player chooses the rival with c_D:

$$(p_R - c_h)\left(\frac{(2-\vartheta)\alpha - 2p_R + \vartheta c_D}{\beta(2+\vartheta)(2-\vartheta)}\right).$$

Its first derivative is

$$\frac{(2-\vartheta)\alpha - 4p_R + \vartheta c_D + 2c_h}{\beta(2+\vartheta)(2-\vartheta)} > q_i^*(c_D) = \frac{(2-\vartheta)(\alpha - c_D)}{\beta(2+\vartheta)(2-\vartheta)} > 0.$$

Thus, if $p_R = c_D$ and $(c_D - c_h)q_i^*(c_D, c_D) + B < 0$, then no lower price can relax the budget constraint and make profitable expansion the unique equilibrium.

There is an intrinsic relationship between the equilibrium quantities arising from marginal effective input prices and the equilibrium profits in the market game. In particular,

$$V_i = \beta\, q_i^{*2}.$$

Thus, it is enough to check which list price $p_D^{(L,1)}$ equates $q_i^*(p_R, p_R)$ with $q_i^*(c_D, p_D^{(L,1)})$ (if it exists, for which the condition can now be written as $q_i^*(p_D^{(L,1)}, c_D) > 0$). Thus,

$$p_D^{L,1} = \frac{2(c_D - p_R) + \vartheta p_R}{\vartheta}.$$

The tricky part is finding an expression for $\underline{p}_D^L$. It is defined by

$$\beta\left[\left(\frac{\beta(2-\vartheta)(\alpha - c_D)}{\beta^2(2+\vartheta)(2-\vartheta)}\right)^2 - \left(\frac{\beta(2-\vartheta)\alpha - 2\beta\,\underline{p}_D^L + \beta\vartheta c_D}{\beta^2(2+\vartheta)(2-\vartheta)}\right)^2\right] - (\underline{p}_D^L - p_R)q_R^0 = 0.$$

Solving for $\underline{p}_D^L$ in the last equation yields a closed form. Define

$$A := \beta(2+\vartheta)^2(2-\vartheta)^2\, q_R^0, \qquad k := 4(2-\vartheta)(\alpha - c_D) - A.$$

Then the *economically relevant* root is

$$\underline{p}_D^L = c_D + \frac{k - \sqrt{k^2 + 16A\,(p_R - c_D)}}{8}.$$

Equivalent form:

$$\underline{p}_D^L = c_D + \frac{2A\,(c_D - p_R)}{k + \sqrt{k^2 + 16A\,(p_R - c_D)}}.$$

Note that this expression increases in q_R^0 and, hence, in B.

Of course, the latter expression is too complicated to compare with the other benchmarks. For this reason, I present how these mentioned decision problems can arise using numerical examples. In all examples, I take $c_h = 6.6$, $p_{R,min} = 5.88$, and $c_D = 6$. Suppose that$\beta = 6$, and $\vartheta = 1$. Thus, assuming the benchmark pricing scheme where $p_D = c_D$ and $p_R = p_{R,min}$, we find that $p_D^{L,1} = 6.12$. Let us also check when the rival is capacity-constrained. We know that, since the single-buyer profit of the rival increases with the price it charges, the sufficient condition for that is the following:

$$(c_D - c_h)q_i^*(c_D, c_D) + B < 0.$$

This implies the following relationship between $q_R^0(p_R, B)$ and $q_i^*(c_D, c_D)$:

$$\frac{c_h - p_{R,min}}{c_h - c_D} q_R^0(p_R, B) < q_i^*(c_D, c_D).$$

Finally, note that there exists a threshold $\bar{B}$ such that

$$(c_D - c_h)q_i^*(c_D, c_D) + \bar{B} = 0,$$

which implies that

$$\frac{\bar{B}}{c_h - c_D} = q_i^*(c_D, c_D),$$

Note that as $B \to \bar{B}$, $q_R^0(p_R = c_D, B) \to q_i^*(c_D, c_D)$ and

$$q_R^0(p_R = p_{R,min}, B) \to \frac{c_h - c_D}{c_h - p_{R,min}} q_i^*(c_D, c_D).$$

Also, as $B \to 0$, $q_R^0 \to 0$ and $\underline{p}_D^L \to p_D = c_D$. Finally if $B > \bar{B}$, then expansion is the unique equilibrium.

In the first example, we take $\alpha = 60$, which yields $q_i^*(c_D, c_D) = 3$ and $\bar{B} = 1.8$. Thus, for $B \in (0, 1.8)$ there exists a single value of $q_R^0(p_R = p_{R,min} \in (0, 2.5)$. Since $p_D^{L,1}$ is not affected by B while the other benchmarks move monotonously in opposite directions with it, it is sufficient to compare the benchmarks $\bar{p}_D^L$ and $p_D^{L,1}$ in cases where $B \to 0$ and $B \to \bar{B}$ is sufficient to detect which decision problems may arise in that given class of games and which mechanisms may be at D's disposal. So, as $B \to 0$, we have

$$\underline{p}_D^L \to 6, p_D^{L,1} = 6.12, \bar{p}_D^L \to 33$$

By continuity then, in the given game, we might well see the following ordering $\bar{p}_D^L > p_D^{L,1} > \underline{p}_D^L$, meaning that the dominant firm can choose between two mechanisms to exclude. If the dominant firm quotes a $p_D^L > p_D^{L,1}$ expansion is eliminated as a possible equilibrium of the t_3 subgame, and, since $p_D^L > p_D^{L,1} > \underline{p}_D^L$, there is no incentive to deviate from a no-expansion equilibrium. That is, D can rely on a raising-rival's cost mechanism to rule out entry. If, however, $p_D^{L,1} > p_D^L > \underline{p}_D^L$, then although there is no unilateral incentive to deviate from (D, D) the same applies to expansion equilibrium (R, R). Therefore, for some sufficiently low B values, the dominant firm can rely on miscoordination and raising-rivals'-cost mechanisms to exclude a more efficient rival.

On the other end, where $B \to \bar{B}$, we have

$$\underline{p}_D^L \to 6.2, p_D^{L,1} = 6.12, \bar{p}_D^L \to 10.5$$

Thus, we might also have $\bar{p}_D^L > \underline{p}_D^L > p_D^{L,1}$. In this case, D might still use a raising-rivals-cost mechanism: by quoting $p_D^L > \underline{p}_D^L$, it eliminates asymmetric split and (R, R) as an equilibrium as this pricing strategy implies also that $p_D^L > p_D^{L,1}$. However, the dominant firm can also rely on tacit collusion between buyers by quoting $\underline{p}_D^L > p_D^L > p_D^{L,1}$. This way, unilateral deviation from (R, R) is incentivized $(p_D^L > p_D^{L,1})$ but also that from (D, D) to an asymmetric equilibrium is also incentivized $(\underline{p}_D^L > p_D^L)$. Therefore, both raising-rivals'-costs effect and strategic-chilling effect is at disposal of D for some set of sufficiently high financial means for the rival. One can think of this situation as one where the rival can induce one buyer to deviate from the dominant firm but is unable to make its operations profitable; hence, choosing to stay out.

Let us consider a different example now. Suppose that $\alpha = 9$ so that $q_i^*(c_D, c_D) = \frac{1}{6}$ and $\bar{B} = 0.1$. Thus, $q_R^0(p_R = 0.58, B) \in (0, \frac{5}{36}$. As $B \to 0$, $\bar{p}_D^L \to 7.5$, which yields the same set of mechanisms as in the example with $\alpha = 60$. In contrast, when $B \to 0.1$, although $\bar{p}_D^L \to 6.25$, our expression yields an economically irrelevant $\underline{p}_D^L$: $\underline{p}_D^L \to 6.26$. Since the list price is effectively capped at $\bar{p}_D^L$, this means that the deterrence cutoff may be treated as non-existent, meaning that D cannot prevent unilateral deviation from no-expansion equilibrium. Nevertheless, by charging a list price $p_D^L > p_D^{L,1}$, it can always deter expansion. Thus, relying on strategic chilling down of competition by the buyers, the dominant firm can force the rival to stay out, and it is the only strategy it can pursue to keep the market.

Discussion and Conclusion

Chapter 1 shows that third-party litigation funding alters both who files and how much is learned before filing. When a claim is not worth pursuing under priors unless merits are investigated, funding contracts expand access to justice: the funder's efficiency allow meritorious claims that would not otherwise be taken to court to proceed. By contrast, when a claim is already attractive to file without further investigation, funders' lower costs and weaker private gains from additional information can deter investigation that some self-financed plaintiffs would have undertaken. The result is less pre-trial information and higher wasteful litigation spending, even though frivolous suits are perfectly filtered by the courts. Thus, TPLF's access to justice gains sit alongside an social costs arising from frivolous filings.

Chapters 2 and 3 develop a unified foreclosure logic. With downstream competition, a single pivotal defection to the incumbent can push the entrant below scale and raise the costs of other buyers high enough that exclusion becomes the unique Nash equilibrium. Chapter 3 demonstrates that this effect can arise without buyer pre-commitment and analyzes the Chicago-style presumptions to show that allowing communication can favor the incumbent; bilateral rich contracts, even if allowed only for the entrant, generically fail to insure the aggregate "others-join" risk; and aggregate-contingent menus cannot generically implement entry without full commitment—implementing entry requires credible loss-commitment below scale for the entrant. Outside centralized-demand or full-commitment corners, simple forms such as symmetric prices can foreclose.

Chapter 4 shows when buyers remain formally free and the entrant lacks commitment, the incumbent's rebate scheme pushes the entrant's fragility onto buyers: switching alone can entail capacity shortfalls for the rival and forces costly top-ups for the other buyer at the incumbent's higher list price. This introduces a novel strategic-chilling mechanism whereby buyers split their sourcing to soften rivalry and, anticipating losses, the entrant self-excludes—so both buyers remain with the incumbent by default. The upshot is that conditional rebates can foreclose when the entrant faces commitment issues due to limited financing.

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