Supplier Retaliation and the Illinois Brick Rule

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August 29, 2023

Abstract

Suppliers have sometimes refused to deal with retailers that sue for antitrust damages. I examine if the threat of a refusal to deal can deter retailers from initiating litigation against their suppliers. I find that such deterrence can occur when the size of the claim is sufficiently small, the input is vital for the retailer's profitability, and sales to the retailer are relatively unimportant for the supplier. When retailers refrain from suing their suppliers due to the threat of retaliation, permitting indirect purchaser suits (i.e., a reversal of the Illinois Brick rule) may strengthen private antitrust enforcement. However, a reversal of the Illinois Brick rule can also weaken private antitrust enforcement in other cases.

Keywords: Antitrust, Damages, Refusal to Deal, Retaliation

JEL Codes: L4, K2, C7

I thank David Sappington, Germàn Bet, Edward Snyder and Roger Blair for helpful comments. Florida Polytechnic University, Lakeland, FL 33805, USA (dturner@floridapoly.edu).

1 Introduction

Parties harmed by an antitrust violation have a right to sue for damages under Section 4 of the Clayton Act. In practice, private damage claims account for the vast majority (approximately 90%) of antitrust enforcement in the United States (Canenbley and Steinvorth, 2011; Hovenkamp, 2011). While private antitrust suits were historically less common in the European Union, private suits continue to grow in importance and regularity since the 2014 EU Damage Directive.[1] Private damages are intended to both compensate victims and deter antitrust violations. The efficacy of private damage litigation rests on the ability and willingness of victims to pursue damage claims. The primary victims of antitrust violations are typically final consumers and any intermediate suppliers. However, retailers may be unwilling to pursue private damage claims against their supplier if they fear the supplier will retaliate by, for example, refusing to provide the input to retailers that sue.[2] There are a variety of instances where suppliers accused of an antitrust violation have retaliated against suing retailers.[3] Additionally, a number of well-known antitrust cases never resulted in direct purchaser (i.e., retailer) suits, potentially due to the threat of supplier retaliation.[4] The purpose of this study is to analyze the possibility of suppliers retaliating against suing retailers and, relatedly, the threat of retaliation deterring retailers from filing damage claims.

Suppliers refusing to deal with retailers that sue for damages often cite a desire to avoid future business dealings with, what they believe to be, highly litigious customers. This suggests that suppliers believe suing retailers are likely to file additional, costly lawsuits in the future. To reduce their exposure to such litigation, suppliers terminate their business relationship with the retailer by refusing to supply the input. To capture this effect, I develop a two-stage model of incomplete information. In the model, a supplier is initially uncertain of a retailer's likelihood of filing lawsuits against the supplier (termed the retailer's propensity to sue or litigiousness). In the first stage, the retailer decides whether to sue their supplier for antitrust damages. In the second stage, the supplier, after observing the retailer's decision, decides whether to continue to provide the input to the retailer. Choosing to file a suit in the first stage signals a high propensity to bring additional costly litigation in the future (if the supplier continues to do business with the retailer) while declining to sue indicates the retailer is unlikely to sue

[1] For example, Laborde (2019) finds an approximately five-fold increase in the (cumulative) number of private cartel damage actions in the EU between 2014 and 2019. Also, see Rengier (2020) and Commission Staff Working Document on the implementation of Directive 2014/104/EU of the European Parliament and of the Council of 26 November 2014 on certain rules governing actions for damages under national law for infringements of the competition law provisions of the Member States and of the European Union (14 December 2020).

[2] See discussion in Harris and Sullivan (1979*a*); Lande (2009); Gehring (2010); Snyder (1985); Hovenkamp (2003); Smith (2021); Gavil (2009) and Blair and Harrison (1999).

[3] See examples cited in Section 2.

[4] See examples cited in Section 2 including the Microsoft case *(United States of America v. Microsoft Corporation*, 253 F.3d 34 (D.C. Cir. 2001)) and the Ticketmaster case *(Campos v. Ticketmaster Corp.,* 140 F.3d 1166 (8th Cir. 1998))).

in the future. I find that suppliers may retaliate against suing retailers in equilibrium if they believe suing retailers to be highly litigious. Additionally, I find that, to avoid appearing litigious and, as a result, losing access to the input, retailers may refrain from suing their supplier. Retailers are most likely to be deterred from filing a damage claim when the size of the claim is small, the input is vital for the retailer's profitability, and sales to the retailer are relatively unimportant for the supplier.

Next, I explore the implications of my findings for the on-going debate surrounding indirect purchasers' right to sue and the Illinois Brick rule. *Illinois Brick Co. v. Illinois*[5] established that only direct purchasers (i.e., those who purchase directly from the infringing supplier) have standing to sue for damages in the United States. However, critics of the decision contend that retailers have weak incentives to sue their suppliers, because they may fear retaliation in future business dealings.[6] If retailers do not file damage claims due to the threat of retaliation from manufacturers, infringing firms may evade private antitrust enforcement altogether and, as a result, incentives to engage in harmful activity are enhanced.

Some scholars[7] have argued that a reversal of the Illinois Brick decision, which would allow indirect purchaser suits, is necessary to counteract this effect.[8] They argue that the threat of private litigation from indirect purchasers would help deter antitrust violations in cases where direct purchasers do not sue. To study this issue, I compare two private antitrust enforcement regimes: one where only direct purchasers can sue (i.e., as is the case under the Illinois Brick rule) and one where the right to sue is divided between direct and indirect purchasers (i.e., a reversal of the Illinois Brick rule). For relatively large claims, allocating the entirety of the right to sue to direct purchasers results in greater expected damages. When claims are large, direct purchasers are willing to sue despite the risk of supplier retaliation. However, if the Illinois Brick rule was reversed and the value of direct purchasers' claims were reduced (in order to allocate a portion to indirect purchasers), retailers may decline to sue their suppliers due to the threat of retaliation. For relatively small claims, a reversal of the Illinois Brick decision may be optimal. When claims are small, retailers decline to sue their suppliers as the loss in profit from losing access to the input exceeds the value of the claim. In this case, allocating a portion of the right to sue to another party (i.e., indirect purchasers) enhances private antitrust enforcement and

[5] *Illinois Brick Co. v. Illinois* 431 U.S. 720 (1977).

[6] See discussion in Harris and Sullivan (1979*a*); Lande (2009); Gehring (2010); Snyder (1985); Hovenkamp (2003); Smith (2021); Gavil (2009) and Blair and Harrison (1999). As Lande (2009) argues, even if a firm's lawyers have a fiduciary obligation to sue, they may choose to settle on terms favorable to the supplier if they fear retaliation.

[7] See discussion in Harris and Sullivan (1979*a*,*b*); Landes and Posner (1979*a*,*b*); Snyder (1985) and Smith (2021).

[8] In fact, this concern was raised in the original *Illinois Brick Co. v. Illinois* Supreme Court opinion:

> *We recognize that direct purchasers sometimes may refrain from bringing a treble-damages suit for fear of disrupting relations with their suppliers.*

See *Illinois Brick Co. v. Illinois*, 431 U.S. 720 (1977) and discussion in Indirect Purchaser Litigation Handbook, ABA Section of Antitrust Law (2007).

increases expected damages. In summary, my results suggest that the possibility of supplier retaliation does not provide unequivocal support for or against the Illinois Brick rule–the Illinois Brick regime is optimal (in terms of expected damages) when claims are large, but a reversal of Illinois Brick may be optimal for small claims.

Schinkel, Tuinstra and Rüggeberg (2008) also analyze direct purchasers' incentives to pursue damage claims. In their model, downstream firms do not sue because they profit from upstream manufacturers' collusion. This is the case because manufacturers restrict their output to create artificial scarcity in the downstream market and forward a share of cartel profits to downstream firms. I analyze a setting where downstream firms choose not to file damage claims due to the threat of retaliation from suppliers, not because they benefit from the antitrust violation.

Empirical evidence regarding direct purchasers' incentives to sue is mixed. Landes and Posner (1979*b*) and Snyder (1985), using a time series and cross sectional approach respectively, found that allocating the right to sue entirely to direct purchasers led to an increase in the number of suits. However, Smith (2021), using a differences-in-differences approach and additional data, suggests that the prohibition of indirect purchaser suits reduced private damage litigation by twenty percent.

The remainder of this study is organized as follows. Section 2 discusses a number of known cases of supplier retaliation and instances where direct purchasers declined to sue, possibly due to the threat of retaliation. In Section 3, I introduce and solve a model of supplier retaliation, motivated by case examples and quotes from retaliating suppliers. The Illinois Brick rule is discussed and analyzed in Section 4. Section 5 concludes. All proofs are placed in Appendix A. Additional analytic results, extensions, and robustness analysis are presented in an additional technical appendix (i.e., Appendix B).

2 Case Examples

In this section, I discuss a number of instances where suppliers refused to deal with suing direct purchasers and discuss suppliers' stated motivations for retaliating against direct purchasers filing damage claims against them. In one of the earliest known examples, *House of Materials, Inc. v. Simplicity Pattern*,[9] a sewing pattern manufacturer refused to supply fabric stores with its patterns after they initiated antitrust litigation against the manufacturer. In *Zoslaw v. MCA Distributing Corp.*,[10] a record store alleged that record distributors violated the Robinson-Patman Act by selling records to retail chain stores at lower prices. After settling the case, one distributor terminated their

[9] *House of Materials, Inc. v. Simplicity Pattern* 298 F.2d 867 (2d Cir. 1962).
[10] *Zoslaw v. MCA Distributing Corp.* 693 F.2d 870 (9th Cir. 1982).

relationship with the retailer and refused to, at least directly, supply it with records. The distributor explained their decision by stating that their intent was to avoid "future litigation whose costs exceeded the benefits from doing business with appellants."

In *Rochester Drug Co-operative v. Braintree Labs.,*[11] a group of drug wholesalers alleged a drug manufacturer monopolized the market for a particular laxative. The wholesalers claimed that, as a result of these efforts to monopolize the market, they paid artificially inflated prices. After the case was filed, the manufacturer informed the wholesalers that it no longer wished to do business with them. The manufacturer stated their desire was to "limit future litigation exposure from these class litigants." The wholesalers in this case appear to have developed a reputation for litigious behavior as they "collectively filed more than sixty (60) antitrust complaints as direct purchasers against pharmaceutical companies." Additionally, less than 1% of the manufacturer's total sales involved the suing wholesalers which suggests retaliation (i.e., a refusal to deal) would not result in a significant loss in profit for the manufacturer. The manufacturer may have concluded that the relatively small profit from sales to the wholesalers was not worth enduring relatively frequent lawsuits and legal costs.

In a more recent case, *In re Blue Cross Blue Shield Antitrust Litigation,*[12] Blue Cross Blue Shield medical insurance companies were accused of a conspiracy to geographically allocate markets for insurance. Physicians involved in the case expressed a concern that the defendants (Blue Cross Blue Shield medical insurance) may retaliate by terminating their contracts with the insurer. Plaintiffs noted that the ability to accept Blue Cross Blue Shield insurance was vital to their profitability.[13] These concerns proved well founded when a pediatrician's contract with Blue Cross Blue Shield of Kansas was terminated, without explanation, less than two months after becoming a named plaintiff in the case, despite a sixteen year record as a Blue Cross Blue Shield provider.[14] In *Marin Tug Barge v. Westport Petroleum*,[15] Shell Oil Co., when explaining its decision to refuse to supply a barge company with oil after it filed a civil suit, stated "we do not choose to expose Shell to the possibility of additional unfounded claims."

These cases[16] likely represent only a small subset of instances where a supplier refused to deal with

[11] *Rochester Drug Co-operative v. Braintree Labs.* 796 F. Supp. 2d 560 (D. Del. 2011).

[12] *In re Blue Cross Blue Shield Antitrust Litigation* MDL No. 2406, No. 2:13-CV-20000-RDP (S.D. Ala. filed July 1, 2013). See, also, Berger and Seymore (2015).

[13] "[W]e have lots of Class representatives...that are very worried about retaliation...[Physician-plaintiffs] have to do business with [Blue Cross Blue Shield insurance companies] or they're out of business" (*In re Blue Cross Blue Shield Antitrust Litigation* Evidentiary Hr'g Tr. (Docket No. 60), 61:2-14–April 23, 2013).

[14] *In re Blue Cross Blue Shield Antitrust Litigation* Mot. for Prelim. Injunction (Docket No.102), at 1-2, filed September 17, 2013.

[15] *Marin Tug Barge v. Westport Petroleum* 271 F.3d 825 (9th Cir. 2001).

[16] In addition to the cases cited above, other examples of supplier retaliation include *Bergen Drug Company v. Parke, Davis Company* 307 F.2d 725 (3d Cir. 1962) and citing cases, *Orson, Inc. v. Miramax Film Corp.* 836 F. Supp. 309 (E.D. Pa. 1993), *Phillips v. Crown Central Petroleum Corp.* 395 F. Supp. 735 (D. Md. 1975), and *Feesers, Inc. v. Michael Foods, Inc.* Civil No. 1:CV-04-0576 (M.D. Pa. 2009).

a suing direct purchaser. Observed cases include only instances where the direct purchaser appealed to the court for an injunction to prevent the supplier's refusal to deal or filed an additional suit against the supplier related to its refusal to deal. In many cases, the direct purchaser may have filed no such appeal or suit and, as a result, no court record of the retaliation exists.

There are also instances where direct purchasers may have refrained from suing their supplier due to the threat of retaliation. In the Microsoft case,[17] none of the direct purchasers (original equipment manufacturers) filed damage actions (Schinkel, Tuinstra and Rüggeberg, 2008). Hovenkamp (2003) and Richman and Murray (2007) argue that direct purchasers did not sue out of fear of disrupting their future business relationship with Microsoft, a powerful input supplier. In the Ticketmaster case,[18] the direct purchasers (concert venues) also never sued (Smith, 2021).

In general, these examples suggest that the filing of a lawsuit soured the business relationship between a supplier and the retailer/direct purchaser. After receiving a lawsuit from a retailer, the supplier re-examined their expectations regarding the likelihood of future legal costs/lawsuits and concluded that future dealings with the retailer would be unprofitable. The model developed in the following section is intended to capture this phenomenon and identify circumstances under which retailers may be deterred from suing their suppliers.

3 Model

Let D denote a downstream retailer[19] that purchases an input from an upstream supplier U.[20] I consider a two stage game where, prior to the initial period, D develops a suspicion that U committed an antitrust violation, which harmed D, in the past.[21] This suspicion may be the result of a government investigation or conviction, news reports, complaints by other retailers, or anomalously high input prices.[22] In the first stage of the game, D decides whether to sue U for damages. Thus, D has two possible strategies: C (for "Claim") and NC (for "No Claim").

Certain retailers are more likely to initiate lawsuits for a number of reasons. First, legal costs may

[17] *United States of America v. Microsoft Corporation*, 253 F.3d 34 (D.C. Cir. 2001)

[18] *Campos v. Ticketmaster Corp.,* 140 F.3d 1166 (8th Cir. 1998)

[19] Throughout this section, I use the term retailer to refer to direct purchasers of the upstream supplier, for ease of exposition. However, some direct purchasers may sell to other intermediary firms rather than directly to final consumers.

[20] In Appendix B.3, I consider a setting wherein two retailers purchase the input from the supplier and engage in downstream retail competition. I find that, as in the model of the main text, supplier retaliation can occur in equilibrium and retailers may be deterred from filing damage claims due to the threat of retaliation.

[21] In the main text, I assume that U's antitrust violation has ended prior to the initial stage. In Appendix B.6, I consider an alternative setting wherein U's antitrust violation is ongoing and D's filing of a damage suit can end the violation (i.e., cause the supplier to cease the conduct in question).

[22] For example, D may discover that larger retailers were receiving the input on more favorable terms. Alternatively, D may become aware of a complaint from an upstream competitor that U illegally monopolized the upstream market. I assume the supplier's violation ended prior to the initial period.

vary across retailers. For example, the legal cost of pursuing a damage claim may be smaller for firms with in-house legal staff or attorneys on retainer. Thus, these firms may be more likely to initiate suits. Second, some retailers may be more likely to sue because they overestimate the likelihood of winning the case or negotiating a favorable settlement. Third, some firms may place a higher value on cash windfalls from damage awards (Blanchard, Lopez-de Silanes and Shleifer, 1994). This may be the case if retailers differ in their interest rates, debt levels, or potential investment opportunities. Fourth, certain executives may be more likely to sue if their compensation is tied to cash windfalls or they overestimate their ability to successfully invest surplus funds from damage awards or settlements (Malmendier, Tate and Yan, 2011). Let $\gamma \in [0, \bar{\gamma}]$ denote D's propensity to sue or litigiousness. I make no restriction on the underlying source of differences in retailers' propensity to sue, but I do require that retailers' propensity to sue can be represented by a single index γ.

$F > 0$ denotes the size of the damage claim. F is the payment U would be required to make to D if the case went to trial and D prevailed.[23] The retailer decides whether to pursue the damage claim in stage 1 on the basis of a private, subjective estimate of the value of pursuing the claim. Let $v(F, \gamma)$ denote a type-γ retailer's subjective estimate/valuation of the payoff to be earned from pursuing a damage claim of size F. If $v(F, \gamma) < 0$, then the retailer never wishes to pursue the claim. This occurs if, for example, the retailer believes that the expected legal cost of the claim exceeds the expected damage award.[24] Note that $v(F, \gamma)$ captures the retailer's perceptions regarding the likelihood of winning the case, the legal costs of pursuing the claim, the out of court settlement process, the retailer's estimate of the size of the claim (which may be biased), and any other relevant factors that impact the retailer's perception of the value of pursuing the claim. I assume $v(F, \gamma)$ satisfies the following assumption.

Assumption 1. *$v(F, \gamma)$ satisfies*

i) $\frac{\partial v(F,\gamma)}{\partial \gamma} > 0$ *for* $F > 0$ *and* $\gamma \in (0, \bar{\gamma})$,

ii) $\frac{\partial v(F,\gamma)}{\partial F} > 0$ *for* $\gamma \in (0, \bar{\gamma}]$ *and* $F > 0$,

iii) $v(F, 0) < 0$ *for all* $F \geq 0$, *and*

iv) $v(0, \gamma) < 0$ *for* $\gamma \in [0, \bar{\gamma}]$.

[23] In the U.S., under the Illinois Brick rule (see Section 4) and the treble damages rule, $F = 3Q_C (p_C - p_{BF})$ where Q_C is the quantity D purchased from U during the antitrust violation. p_C is the (supra-competitive) price paid during the violation. p_{BF} is the but-for price or the price that D would have paid for the input in the absence of an antitrust violation.

[24] Expected legal costs in antitrust suits can be substantial due to "the complexity of competition cases; the demands for economic evidence and the heavy reliance on substantial quantities of documentary evidence" (Riley and Peysner, 2006). If legal costs must be paid upfront and/or retailers are required to pay the supplier's legal costs if unsuccessful, then legal costs may be a "major disincentive for many potential claimants to bring civil actions" (Riley and Peysner, 2006). Reflecting these substantial costs, relatively un-litigious retailers (i.e., retailer's with small γ values) do not pursue small claims (see Assumption 1).

Assumption 1(i) states that retailers' subjective valuations of the claim are increasing in their litigiousness. Additionally, Assumption 1(ii) ensures that retailers' subjective valuations are increasing in the size of the damage claim. Assumption 1(iii) implies that a retailer with a propensity to sue of zero never wishes to sue. $\gamma = 0$ is a boundary case and, in the model to follow, will occur with probability zero. Assumption 1(iv) states that all retailers' subjective valuations of a claim of size zero are negative. In other words, if the damage claim is worthless, no retailer wishes to pursue the claim. This reflects the time and legal costs involved in pursuing a damage claim. The function $v(F, \gamma) = \gamma F - L$, where $L > 0$ represents legal and time costs and $\gamma \in [0, \bar{\gamma}]$ represents a retailer's subjective belief regarding the likelihood of the lawsuit succeeding (thus, $\bar{\gamma} \leq 1$), satisfies Assumption 1. In Appendix B.1, I provide a number of examples of functions $v(F, \gamma)$ which satisfy Assumption 1.

Let $F_{min}(\gamma)$ solve $v(F_{min}(\gamma), \gamma) = 0$ for $\gamma \in (0, \bar{\gamma}]$. $F_{min}(\gamma)$ represents the threshold claim size such that a type-γ retailer's subjective valuation is positive if the size of the claim exceeds this threshold. If $v(F, \gamma) = \gamma F - L$, then $F_{min}(\gamma) = \frac{L}{\gamma}$. In Appendix A.2, I show that a unique, positive $F_{min}(\gamma)$ exists all $\gamma \in (0, \bar{\gamma}]$. Additionally, I show that $F_{min}(\gamma)$ is declining in γ (i.e., more litigious retailers positively value a wider range of damage claims). Analogously, let $\gamma_{min}(F)$ solve $v(F, \gamma_{min}(F)) = 0$ for $F \geq F_{min}(\bar{\gamma})$. $\gamma_{min}(F)$ represents a threshold value of γ such that a type-γ retailer positively values a claim of size F if $\gamma > \gamma_{min}(F)$ and negatively values a claim of size F if $\gamma < \gamma_{min}(F)$. If $v(F, \gamma) = \gamma F - L$, then $\gamma_{min}(F) = \frac{L}{F}$. In Appendix A.2, I show that a unique, positive $\gamma_{min}(F)$ exists for $F \geq F_{min}(\bar{\gamma})$. Additionally, I show that $\gamma_{min}(F)$ is declining in F (i.e., a larger number of retailers positively value a larger claim than a small claim).

In the second stage, suppliers observe the retailer's decision in the first stage. Additionally, suppliers decide whether to continue to supply the input or refuse to supply the input to the retailer.[25] Thus, there are two possible information sets: one where a suit is observed (denoted "information set 1") and one where a suit is not observed (denoted "information set 2"). The supplier has two possible actions at each information set: refuse to deal (denoted "R") and not refuse to deal (denoted "NR"). I refer to the act of refusing to supply a retailer that files a damage claim as "retaliation" against the retailer.

U's expected discounted present value of continuing to supply a retailer with a propensity to sue of γ is $V_U(\gamma)$. If the supplier refuses to deal with the retailer, then the supplier loses any profit from sales to the retailer. However, the supplier also avoids any future lawsuits from the retailer (as the two parties no longer have any contractual or business relationship). The supplier earns a discounted

[25] Since *United States v. Colgate & Co.*, 250 U.S. 300 (1919), refusals to deal are considered lawful unless the refusal is the product of an anticompetitive agreement/conspiracy. Courts have decided that a defendant's "acknowledged purpose of avoiding future litigation whose costs exceeded the benefits from doing business with appellants qualified as a legitimate business reason for refusing to deal" (*Zoslaw v. MCA Distributing Corp.* 693 F.2d 870 (9th Cir. 1982)). Also, see *House of Materials, Inc. v. Simplicity Pattern* 298 F.2d 867 (2d Cir. 1962).

present value of $\tilde{V}_U$ when it refuses to supply the retailer. $V_U(\gamma)$ and $\tilde{V}_U$ are assumed to satisfy the following assumption.

Assumption 2. *$V_U(\gamma)$ and $\tilde{V}_U$ satisfy*

i) $\frac{\partial V_U(\gamma)}{\partial \gamma} < 0$ *for* $\gamma \in (0, \bar{\gamma})$,

ii) $V_U(\bar{\gamma}) < \tilde{V}_U$, *and*

iii) $\tilde{V}_U < V_U(0)$.

Assumption 2(i) ensures that the discounted present value of supplying the input is declining in the litigiousness of the retailer. In other words, supplying a highly litigious retailer is less profitable than supplying a relatively un-litigious retailer. This reflects three considerations. First, by continuing to supply the retailer, the supplier exposes itself to future litigation. Future litigation may consist of a distinct antitrust suit or a different type of lawsuit (e.g., a contract dispute). Retailers with a high propensity to sue are more likely to initiate future litigation. Second, recognizing the high risk of future litigation, suppliers may need to engage in costly actions to avoid future lawsuits when supplying highly litigious retailers. For example, the supplier may need to closely monitor antitrust compliance within the firm. Third, suppliers serving less litigious customers are more likely to successfully engage in future profit-enhancing antitrust violations.[26]

Assumption 2(ii) states that the supplier does not wish to supply a retailer with the maximum propensity to sue $\bar{\gamma}$.[27] Conversely, Assumption 2(iii) ensures that the supplier wishes to supply a retailer with zero propensity to sue. Recall that a retailer with a propensity to sue of zero negatively values all damage claims and therefore will never sue the supplier.

If the retailer is refused the input in stage 2, it may cease production of the retail good requiring the supplier's input, purchase alternative inputs from another supplier, or choose to manufacture the input themselves (i.e., vertically integrate into the upstream market). The retailer earns a discounted present value of $\tilde{V}_R$ if refused the input. If the retailer is not refused the input in stage 2, the retailer earns an expected present discounted value of $V_R(\gamma)$. $V_R(\gamma)$ and $\tilde{V}_R$ satisfy the following assumption.

Assumption 3. *$V_R(\gamma)$ and $\tilde{V}_R$ satisfy*

i) $\frac{\partial V_R(\gamma)}{\partial \gamma} \geq 0$ *for* $\gamma \in (0, \bar{\gamma})$,

[26] Highly litigious retailers may be more likely to accuse a supplier of anticompetitive behavior or report suspicions of an antitrust violation to government authorities.

[27] The possibility that a supplier would refuse to deal with a retailer that it suspects is highly litigious seems plausible in light of the frequency, costs, and harm of corporate lawsuits. Litigation transaction costs are growing as a percentage of corporate revenue (Litigation Cost Survey of Major Companies, Lawyers for Civil Justice, 2010 Conference on Civil Litigation). "Nearly 90% of US corporations are engaged in some type of litigation, and the average company balances a docket of 37 lawsuits. For $1 billion-plus companies, the average number of cases being juggled in the US soars to more than 140" (Second Annual Litigation Trends Survey, Fulbright & Jaworski L.L.P. http://www.fulbright.com/mediaroom/files/fj0536-us-v13.pdf). Bizjak and Coles (1995) find that defendants experience signifiant stock market losses after the announcement of a private antitrust suit.

ii) $V_R(0) > \tilde{V}_R$,

iii) $\frac{\partial v(F,\gamma)}{\partial \gamma} > \frac{\partial V_R(\gamma)}{\partial \gamma}$ *for* $\gamma \in (0, \bar{\gamma})$ *and* $F > 0$, *and*

iv) $\lim_{F\to\infty} v(F,\gamma) + \tilde{V}_R - V_R(\gamma) > 0$ *for* $\gamma \in (0, \bar{\gamma}]$.

Assumption 3(i) implies $V_R(\gamma)$ is non-decreasing in γ. This reflects the fact that retailers may anticipate benefiting from future lawsuits against the supplier. Together with the previous assumption, Assumption 3(ii) states that all retailers prefer to receive the input from the supplier than to be refused the input. Assumption 3(iii) requires that $v(F,\gamma)$ increases more rapidly with the retailer's litigiousness than does $V_R(\gamma)$. This assumption reflects the fact that any proceeds from future lawsuits against the supplier will occur in later periods (and therefore would be time discounted). Additionally, opportunities to pursue future lawsuits may not arise.[28] In Appendix B.2, I examine an extended game wherein the opportunity to pursue a second lawsuit arrises after stage 2. I show that, in this setting, the functions $V_U(\gamma)$ and $V_R(\gamma)$ satisfy Assumption 2, Assumption 3, and Assumption 4.

The retailer expects to receive a payoff of $v(F,\gamma) + \tilde{V}_R$ if refused the input after filing a damage claim. If the retailer does not sue and is not refused the input, the retailer earns a payoff of $V_R(\gamma)$. If the retailer expects to be refused the input after filing a claim but not if they refrain from suing, retailers pursue damage claims if $v(F,\gamma) + \tilde{V}_R > V_R(\gamma)$. Assumption 3(iv) ensures that retailers wish to endure retaliation (i.e., a refusal to supply) for sufficiently large damage claims.[29]

Suppose retailers expect a refusal to deal in stage 2 if they sue and do not expect a refusal to deal in stage 2 if they do not sue. Retailers therefore expect to earn a payoff of $v(F,\gamma) + \tilde{V}_R$ if they sue and a payoff of $V_R(\gamma)$ if they do not sue. Let $F^*(\gamma)$ satisfy $v(F^*(\gamma),\gamma) + \tilde{V}_R = V_R(\gamma)$. $F^*(\gamma)$ is a a threshold claim value such that a retailer with litigiousness γ wishes to sue (despite retaliation) if $F > F^*(\gamma)$ and not sue if $F < F^*(\gamma)$. If $v(F,\gamma) = \gamma F - L$ and $V_R(\gamma)$ is a constant $V_R > \tilde{V}_R$, then $F^*(\gamma) = \frac{V_R - \tilde{V}_R + L}{\gamma}$. In Appendix A.2, I show that a unique and positive $F^*(\gamma)$ exists for $\gamma \in (0, \bar{\gamma}]$. Additionally, I show that $F^*(\gamma)$ is declining in γ (i.e., more litigious retailers are willing to sue, despite retaliation, for a wider range of claim sizes). Analogously, let $\gamma^*(F)$ satisfy $v(F,\gamma^*(F)) + \tilde{V}_R = V_R(\gamma^*(F))$. $\gamma^*(F)$ is a threshold γ value such that such that any retailer with $\gamma > \gamma^*(F)$ wishes to sue (despite expecting a subsequent refusal to deal in stage 2) when the value of the damage claim is F. Correspondingly, any retailer with $\gamma < \gamma^*(F)$ does not wish to sue (if they expect a refusal to deal in stage 2) when the value of the damage claim is F. If $v(F,\gamma) = \gamma F - L$ and $V_R(\gamma)$ is a constant $V_R > \tilde{V}_R$, then $\gamma^*(F) = \frac{V_R - \tilde{V}_R + L}{F}$. In Appendix A.2, I show that a unique and positive $\gamma^*(F)$ exists for $F \geq F^*(\bar{\gamma})$.

[28] Note that this assumption holds trivially if $\frac{\partial V_R(\gamma)}{\partial \gamma} = 0$ by Assumption 1(i).

[29] Note that Assumption 3(iv) implies that $\lim_{F\to\infty} v(F,\gamma) > 0$ for $\gamma \in (0, \bar{\gamma}]$ as $\tilde{V}_R - V_R(\gamma) < 0$ by Assumption 3(i) and (ii). Thus, retailers' subjective valuations are positive for sufficiently large claims.

Additionally, $\gamma^*(F)$ is declining in F (i.e., a larger fraction retailers wish to pursue large claims than small claims).

Prior to the initial stage of the game, the supplier is uncertain of the retailer's propensity to sue. The supplier's initial beliefs regarding the retailer's type are captured by a positive probability density function $p(\gamma) : [0, \bar{\gamma}] \to (0, \infty)$ and corresponding CDF $P(\gamma) : [0, \bar{\gamma}] \to [0, 1]$. After observing the retailer's decision in stage 1, the supplier updates their beliefs regarding the retailer's type according to Bayes' rule. The following assumption governs the supplier's initial (or prior) beliefs.

Assumption 4. $\int_0^{\bar{\gamma}} V_U(\gamma)p(\gamma)d\gamma > \tilde{V}_U$

Assumption 4 states that, prior to the initial stage, the supplier believes that supplying the retailer is more profitable than refusing to supply the retailer. This assumption reflects the fact that the supplier chose to supply the retailer in the past and therefore believed it to be profitable. This assumption holds if suppliers believe that retailers are relatively unlikely to be highly litigious (i.e., $p(\gamma)$ is small when γ is large).

In the equilibria to follow, the filing of a claim will signal to the supplier that the retailer's litigiousness exceeds a particular value (which varies based on the equilibrium under consideration). Suppose the supplier determines that the retailer's litigiousness exceeds a threshold $\hat{\gamma} \in (0, \bar{\gamma})$ (i.e., the supplier learns that $\gamma > \hat{\gamma}$ with probability 1). The supplier's posterior beliefs regarding the retailer's type, updated using Bayes' rule, are $g_1(\gamma; \hat{\gamma}) = \frac{p(\gamma)}{1-P(\hat{\gamma})}$. The supplier's expected payoff from continuing to supply the input is $E_1[V_U(\gamma)|\hat{\gamma}] = \int_{\hat{\gamma}}^{\bar{\gamma}} V_U(\gamma)g_1(\gamma; \hat{\gamma})d\gamma$. Note that $E_1[V_U(\gamma)|\hat{\gamma}]$ is declining in $\hat{\gamma}$. Let γ_U solve

$$E_1[V_U(\gamma)|\gamma_U] = \int_{\gamma_U}^{\bar{\gamma}} V_U(\gamma)g_1(\gamma; \gamma_U)d\gamma = \tilde{V}_U. \tag{1}$$

γ_U denotes a threshold value of $\hat{\gamma}$ such that the retailer wishes to continue to supply the retailer if $\hat{\gamma} < \gamma_U$ and wishes to refuse to supply the input if $\hat{\gamma} > \gamma_U$. In Appendix A.2, I show that γ_U exists and is unique. Next, suppose the supplier determines that the retailer's litigiousness does not exceed a threshold $\hat{\gamma}$ (i.e., the supplier learns that $\gamma < \hat{\gamma}$ with probability 1). The supplier's posterior beliefs regarding the retailer's type, updated using Bayes' rule, are $g_2(\gamma; \hat{\gamma}) = \frac{p(\gamma)}{P(\hat{\gamma})}$. The supplier's expected payoff from continuing to supply the input is $E_2[V_U(\gamma)|\hat{\gamma}] = \int_0^{\hat{\gamma}} V_U(\gamma)g_2(\gamma; \hat{\gamma})d\gamma$. Note that $E_2[V_U(\gamma)|\hat{\gamma}]$ is declining in $\hat{\gamma}$.

I restrict attention to pure strategy perfect Bayesian equilibria (PBE).[30] A type-γ retailer's strategy

[30] A PBE specifies the strategies of each player and the beliefs of each player at each information set. Perfect Bayesian equilibria must be sequentially rational and consistent (i.e., beliefs are updated according to observed actions, equilibrium

can be summarized by $s_D(\gamma) \in \{C, NC\}$ where $s_D(\gamma) = C$ if D files a claim in stage 1 and $s_D(\gamma) = NC$ if D does not file a claim. U's strategy specifies its action at each information set. Thus, U's strategy is a tuple $s_U = (i, j) \in \{R, NR\} \times \{R, NR\}$ where i denotes U's action at information set 1 (which is reached when D files a claim in stage 1), j denotes U's action at information set 2 (which is reached when D does not file a claim in stage 1). After stage 1, U updates its beliefs regarding D's type according to Bayes' rule.[31]

There are two types of equilibria: pooling equilibria and separating equilibria. In a pooling equilibrium, all types of retailers follow the same strategy in the first stage (i.e., either all types of retailers sue or no retailer sues). In a separating equilibrium, certain types of retailers sue and other retailers do not sue. Absent the threat of retaliation (i.e., if the game ended after stage 1)[32] any retailer with $\gamma > \gamma_{min}(F)$ (i..e, any retailer with a positive subjective valuation of the claim) would choose to sue while any retailer with $\gamma < \gamma_{min}(F)$ would decline to sue (i.e., $s_D(\gamma) = C$ if $\gamma > \gamma_{min}(F)$ and $s_D(\gamma) = NC$ if $\gamma < \gamma_{min}(F)$).

3.1 Separating Equilibria

In this subsection, I characterize separating equilibria. First, suppose that all retailers with $\gamma \geq \gamma_{min}(F)$ sue in the first stage and all retailers with $\gamma < \gamma_{min}(F)$ do not sue. Thus, any retailer with a non-negative subjective valuation files a claim. Additionally, U does not retaliate regardless of whether it observes a claim in stage 1. The following theorem characterizes this equilibrium.

Theorem 1 (Separating-AC). *$s_D(\gamma) = C$ for all $\gamma \geq \gamma_{min}(F)$, $s_D(\gamma) = NC$ for all $\gamma < \gamma_{min}(F)$ and $s_U = (NR, NR)$ is a perfect Bayesian equilibrium if $F \geq F_{min}(\gamma_U)$.*

When the value of a damage claim is sufficiently large (i.e., $F \geq F_{min}(\gamma_U)$), even relatively un-litigious retailers wish to file a claim. Thus, observing a claim (i.e., reaching information set 1) does not necessarily imply that the retailer is highly litigious. The supplier remains uncertain if the retailer is a relatively un-litigious retailer, whom the supplier would wish to continue to supply, or a highly litigious retailer, whom the supplier would prefer not to supply (i.e., retaliate against). As a result, the supplier continues to supply the retailer in stage 2.

I refer to this equilibrium as the "Separating-AC" equilibrium as all retailers that place a non-

strategies and Bayes' rule). In the formal results to follow, I do not specify beliefs at each information set for ease of exposition. Equilibrium beliefs typically follow immediately from equilibrium strategies and are presented in the proofs.

[31] In some equilibria, certain information sets are not reached along the equilibrium path. At these information sets, the concept of perfect Bayesian equilibria allows U's beliefs to be specified arbitrarily. However, I will discuss intuitive justifications for chosen beliefs at these information sets.

[32] This outcome will also arise if the supplier's discounted present value from refusing to supply (i.e., $\tilde{V}_U$), contrary to Assumption 2(ii), is less than $V_U(\bar{\gamma})$.

negative value on the damage claim (i.e., $v(F,\gamma) \geq 0$) sue in equilibrium. Recall that, in the absence of the threat of retaliation (i.e., if the game ended after stage 1), the same set of retailers sue. Thus, any retailer that would sue in the absence of the threat of retaliation chooses to file a claim under the Separating-AC equilibrium. No retailer is deterred from suing by the possibility of losing access to the input in stage 2. Thus, the threat of supplier retaliation does not impact the effectiveness of private antitrust enforcement in this case.

When damage claims are smaller than those in Theorem 1, supplier retaliation emerges. When the size of the damage claim F is smaller, observing a claim in stage 1 sends a clearer message regarding the retailer's litigiousness. As only highly litigious retailers choose to sue in stage 1 when the claim is small, the supplier can infer that any retailer that chooses to sue is highly litigious and should be refused the input in stage 2. Conversely, the supplier infers that any retailer declining to sue in stage 1 is relatively un-litigious and, as a result, is worth continuing to supply. The following theorem characterizes this equilibrium.

Theorem 2 (Separating-PC). *$s_D(\gamma) = C$ for all $\gamma \geq \gamma^*(F)$, $s_D(\gamma) = NC$ for all $\gamma < \gamma^*(F)$ and $s_U = (R, NR)$ is a perfect Bayesian equilibrium if $F^*(\bar{\gamma}) < F \leq F^*(\gamma_U)$.*

Recall that $\gamma^*(F)$ is the cutoff value of γ for which retailers with $\gamma \geq \gamma^*(F)$ find it worthwhile to sue despite expecting retaliation while retailers with $\gamma < \gamma^*(F)$ do not. For this equilibrium to exist, the claim must be sufficiently small that retailers with a low propensity to sue do not wish to pursue the claim. Thus, observing a claim in stage 1 signals to suppliers that the retailer is relatively litigious. Additionally, the value of the claim must be sufficiently large that at least one retailer wishes to sue (and endure retaliation) in equilibrium. If no retailer wishes to sue, this constitutes a pooling equilibrium which will be discussed in the following subsection.

In this equilibrium, retailers with $\gamma \in [\gamma_{min}(F), \gamma^*(F))$ are deterred from suing by the threat of supplier retaliation. Absent the possibility of losing access to the input in stage 2, these retailers would sue as their subjective valuations of the claim are non-negative. However, profit losses from losing access to the input exceed these retailers' valuations of the damage claim and, as a result, these retailers decline to file a claim in equilibrium. Thus, the threat of supplier retaliation has weakened private antitrust enforcement by deterring moderately litigious retailers from filing claims. I refer to this equilibrium as the "Separating-PC" equilibrium as only a fraction of the retailers that place a non-negative value on the damage claim (i.e., $v(F,\gamma) \geq 0$) sue in equilibrium.

3.2 Pooling Equilibria

In this subsection, I characterize pooling equilibria. When damage claims are relatively small, the threat of retaliation can deter all retailers from suing. This possibility is formalized in the following theorem.

Theorem 3 (Pooling-NC1). *$s_D(\gamma) = NC$ for all $\gamma \in [0, \bar{\gamma}]$ and $s_U = (R, NR)$ is a perfect Bayesian equilibrium if $F_{min}(\bar{\gamma}) \leq F \leq F^*(\bar{\gamma})$.*

This equilibrium occurs for moderate values of F. F must be sufficiently small that no retailer, expecting retaliation, finds it worthwhile to sue and lose access to the input. Additionally, F must be sufficiently large that at least one retailer positively values the claim (i.e., $F_{min}(\bar{\gamma}) \leq F$). I consider the case of $F < F_{min}(\bar{\gamma})$ in the next theorem. In what follows, I refer to the equilibrium characterized by Theorem 3 as the "Pooling-NC1" equilibrium as no retailers sue in equilibrium.

Intuitively, retailers recognize that choosing to sue would signal a high level of litigiousness to the supplier. Additionally, retailers recognize that suppliers would refuse to deal with such a retailer (in order to avoid future litigation/costs from dealing with a highly litigious retailer). To avoid losing access to the input, the retailer chooses not to sue. In equilibrium, no retailer sues despite the fact that some retailers (i.e., those with $\gamma > \gamma_{min}(F)$) positively value the claim and, in the absence of the threat of retaliation, would choose to sue the supplier. Thus, the threat of supplier retaliation has deterred certain retailers from suing and weakened private antitrust enforcement under this equilibrium.

Next, for completeness, I consider exceptionally small damage claims in the following theorem.

Theorem 4 (Pooling-NC2). *$s_D(\gamma) = NC$ for all $\gamma \in [0, \bar{\gamma}]$ and $s_U = (R, NR)$ is a perfect Bayesian equilibrium if $F_{min}(\bar{\gamma}) > F$.*

This equilibrium exists for particularly small damage claims. Retailers do not sue in this equilibrium as they do not positively value the damage claim. In other words, the damage claim is so small that no retailer finds it worthwhile to incur the time and legal costs of pursuing the claim, regardless of the potential for supplier retaliation. The threat of supplier retaliation plays no role in this equilibrium. In what follows, I refer to the equilibrium characterized by Theorem 4 as the "Pooling-NC2" equilibrium.

In both the "Pooling-NC1" and "Pooling-NC2" equilibrium, no retailer sues the supplier. However, the source of this outcome differs across equilibria. Under the "Pooling-NC2" equilibrium, retailers choose not to sue as they negatively value the (relatively small) claim. Under the "Pooling-NC1" equilibrium, some retailers (i.e., $\gamma > \gamma_{min}(F)$) choose not sue out of fear of retaliation, despite positively valuing the claim. While the strategy profiles within each equilibrium are identical, I analyze each equilibrium separately as the underlying effect driving results is distinct.

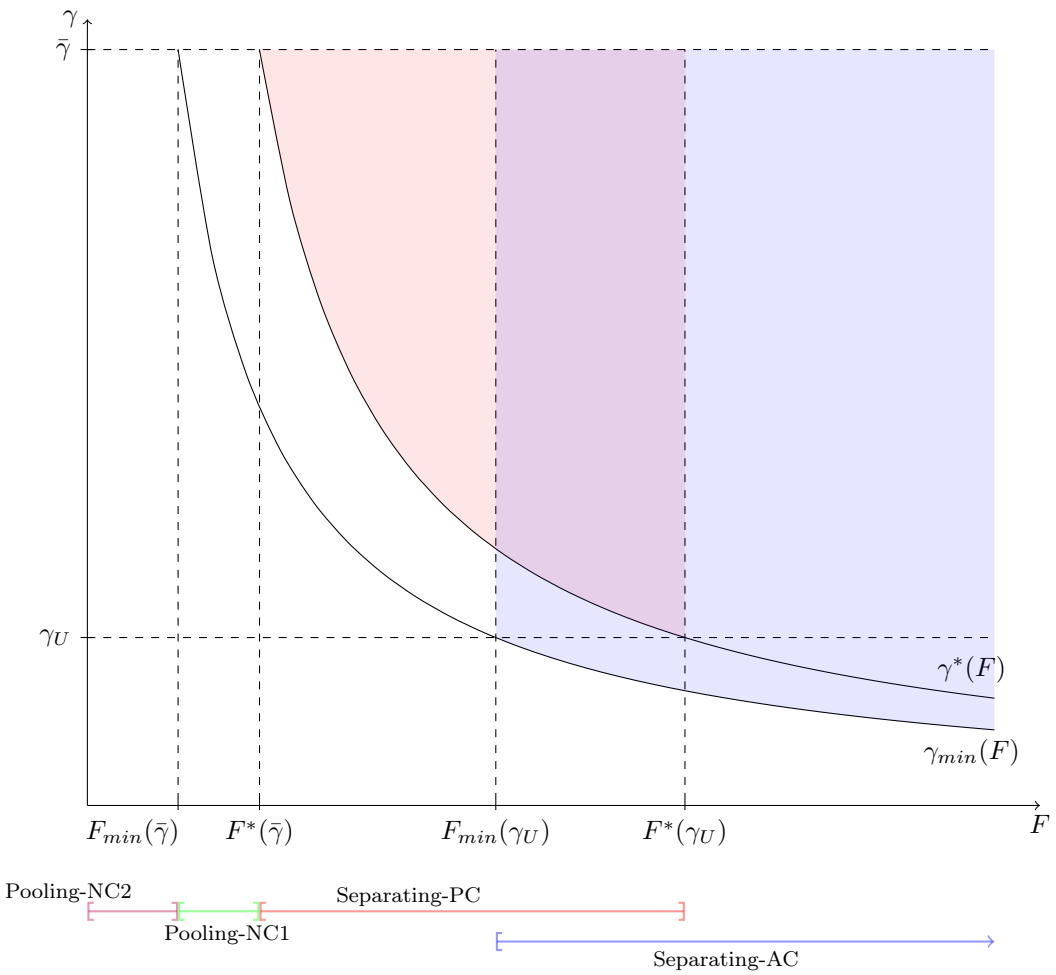

Figure 1: Case 1 Equilibrium in (F, γ) Space (Retaliation)

3.3 Discussion

The results of Subsection 3.1 and Subsection 3.2 suggest that there are four types of equilibria: an equilibrium where all retailers with a non-negative subjective valuation file claims (the "Separating-AC" equilibrium), an equilibrium where only a fraction of retailers with a non-negative subjective valuation file claims (the "Separating-PC" equilibrium), an equilibrium where no retailer sues due to the threat of retaliation (the "Pooling-NC1" equilibrium), and an equilibrium where no retailer sues as all retailers negatively value the claim (the "Pooling-NC2" equilibrium).

Figure 1 and Figure 2 depict the four types of equilibria graphically in (F, γ)-space. There are two cases to consider: $F_{min}(\gamma_U) > F^*(\bar{\gamma})$ (Case 1 in Figure 1) and $F_{min}(\gamma_U) < F^*(\bar{\gamma})$ (Case 2 in Figure 2). Case 1 occurs for smaller values of γ_U, and Case 2 occurs for larger values of γ_U. Larger values of γ_U indicate the supplier is unlikely to retaliate as the supplier believes it worthwhile to deal with the retailer unless the retailer is highly litigious (recall the definition of γ_U in Equation (1)). For

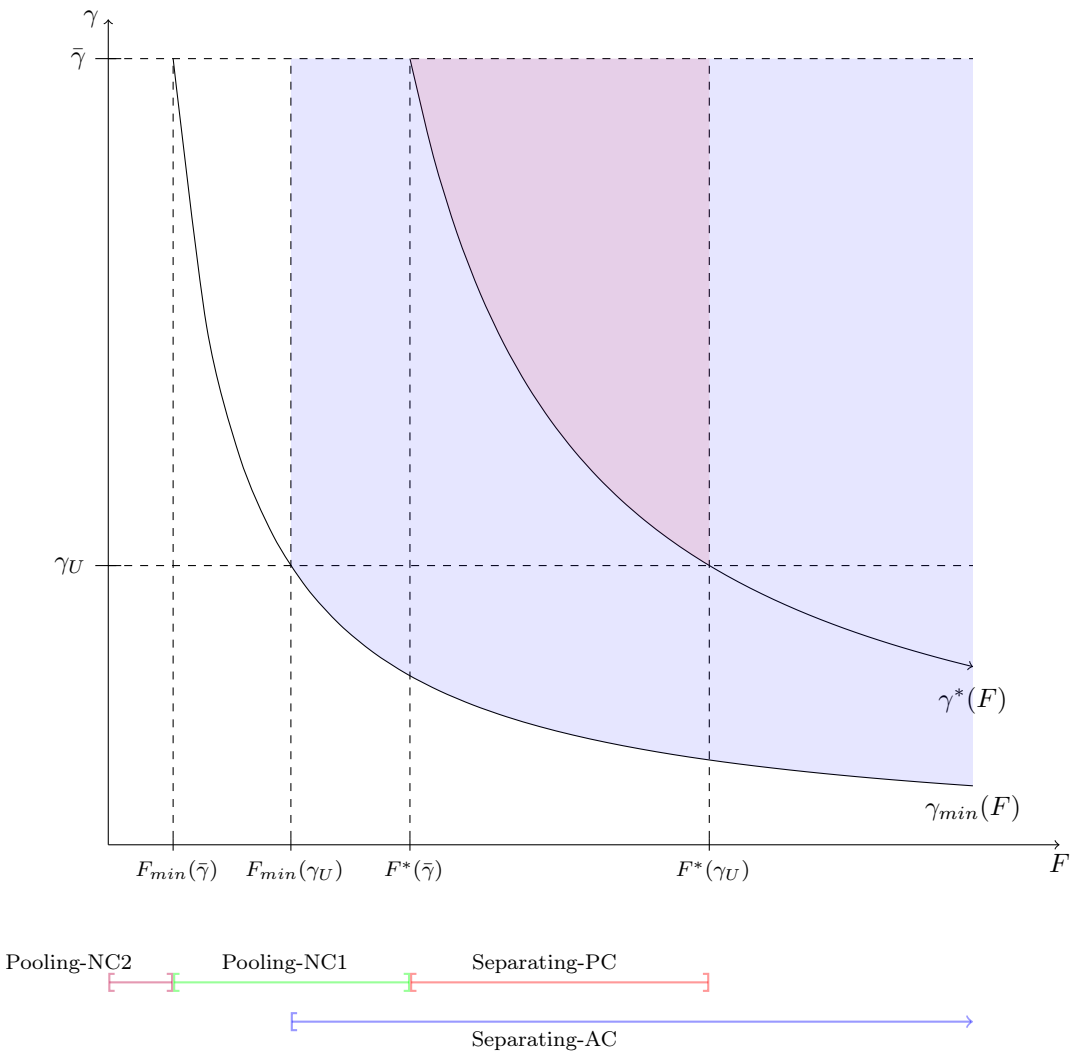

Figure 2: Case 2 Equilibrium in $F - \gamma$ Space (Retaliation)

example, γ_U is large if the loss in profit from terminating sales to the retailer is small (i.e., $\tilde{V}_U$ is small). Conversely, smaller values of γ_U indicate that the supplier would prefer not to supply the input to even moderately litigious retailers.

First, consider Case 1. Figure 1 depicts equilibria for Case 1 in (F, γ) space. Figure 1 also plots the functions $\gamma_{min}(F)$ and $\gamma^*(F)$ (note that both are downward sloping). A point (F, γ) is shaded red if a retailer with litigiousness γ files a claim of size F under the "Separating-PC" equilibrium (if this equilibrium occurs for this F value). A point (F, γ) is shaded blue if a retailer with litigiousness γ files a claim of size F under the "Separating-AC" equilibrium (if this equilibrium occurs for this F value). Figure 1 also shows the range of claim sizes F where both equilibria can occur (i.e., the region shaded blue and red).

For small claims (i.e., $F < F_{min}(\bar{\gamma})$), the "Pooling-NC2" equilibrium is the unique equilibrium. In

this region, the claim is so small that retailers' subjective valuations of the claim are negative. For moderately small claims (i.e., $F_{min}(\bar{\gamma}) < F < F_{min}(\gamma_U)$), the "Pooling-NC1" equilibrium is the unique equilibrium. In this region, claims are too small to incentivize retailers to sue due to the threat of retaliation. However, some retailers do positively value the claim as $\gamma_{min}(F) < \bar{\gamma}$ in this region. For moderately large claims, the "Separating-PC" equilibrium exists. Under this equilibrium, only highly litigious retailers sue. For sufficiently large claims, the "Separating-AC" equilibrium exists where all retailers (with a positive subjective valuation of the claim) sue. Note that both the "Separating-PC" and "Separating-AC" equilibrium occur (i.e., multiple equilibria) when $F_{min}(\gamma_U) \leq F \leq F^*(\gamma_U)$.[33]

Next, consider Case 2 which is depicted in Figure 2. Case 2 differs in that the "Separating-AC" equilibrium occurs for a wider range of F values and, as a result, the set of F values where the "Separating-PC" equilibrium occurs are a subset of the set of F values where the "Separating-AC" occurs. Additionally, the "Separating-AC" and "Pooling-NC1" can both exist (i.e., multiple equilibria) for certain F values. Generally, retailers are more likely to sue their suppliers in equilibrium under Case 2 than under Case 1. As a result, the threat of supplier retaliation results in fewer deterred damage claims than under Case 1. Recall that Case 2 occurs when γ_U is large and suppliers have weak incentives to retaliate (e.g., due to a low value of $\tilde{V}_U$).

For comparison, Figure 3 depicts the equilibria in (F, γ) space when retaliation is not possible (i.e., if the game ended after stage 1). The "Separating-PC" and "Pooling-NC1" equilibria do not occur absent the threat of retaliation. Additionally, the "Separating-AC" equilibrium occurs for a wider range of F values (i.e., $F \geq F_{min}(\bar{\gamma})$ rather than $F \geq F_{min}(\gamma_U)$).

In summary, results suggest that the threat of retaliation can deter retailers from suing their suppliers. Particularly, this result occurs for moderately sized claims. For large claims (i.e., $F \geq F^*(\gamma_U)$), the threat of retaliation does not deter retailers from suing. For small claims (i.e., $F \leq F_{min}(\bar{\gamma})$), retailers do not wish to pursue the claim, regardless of the potential for retaliation. In Appendix A.3, I show that the fraction of retailers deterred from filing a damage claim, under the "Separating-PC" equilibrium, is decreasing in $\tilde{V}_R$. Intuitively, a greater number of retailers are willing to sue and endure retaliation when the supplier's input is less vital for the retailer's profitability. Additionally, the fraction of retailers deterred from suing the supplier, under the "Separating-PC" equilibrium, is increasing in $\tilde{V}_U$ (see Appendix A.3 for a formal statement and proof). When $\tilde{V}_U$ is large, the retailer is relatively unimportant for the supplier's profitability and, as a result, the supplier is more likely to retaliate. Recognizing this, retailers are hesitant to sue their suppliers and risk

[33] Which equilibrium is selected may depend on previous play or the reputation of the upstream firm. For example, if the supplier has retaliated frequently in the past, the "Separating-PC" equilibrium may be focal and more likely to be selected.

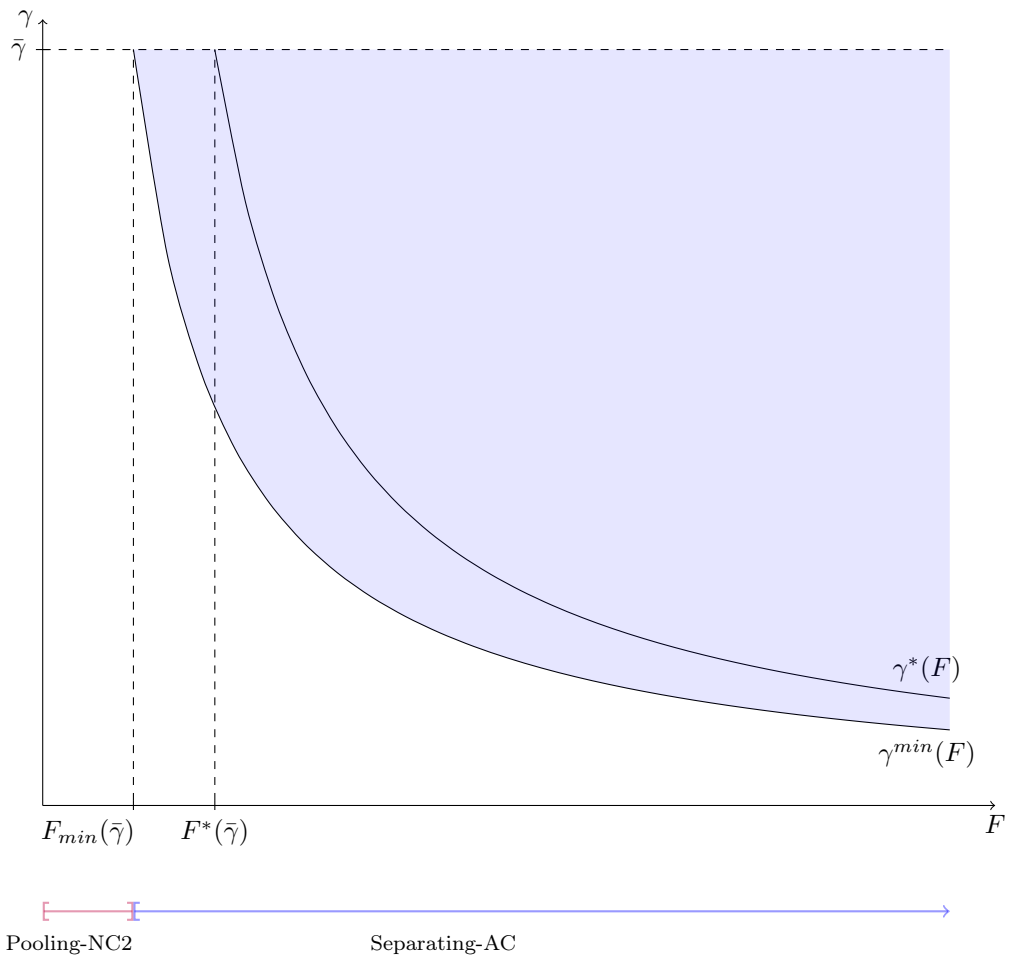

Figure 3: Equilibrium in (F, γ) Space (No Retaliation)

retaliation.

Results suggest that court enjoinments requiring suppliers to continue to provide the input to suing retailers could strengthen private antitrust enforcement. Specifically, a guarantee that the retailer would maintain access to the input for a specified period of time may help encourage retailers to sue. Enjoinments of this kind are uncommon but have been granted previously by courts.[34] However, such a policy has certain drawbacks. First, court enjoinments requiring suppliers to continue to sell to suing retailers could be manipulated by the plaintiff. For example, a retailer could file a frivolous lawsuit to maintain access to an input if the retailer suspected the supplier intended to switch to an alternative distributor. Second, suppliers may wish to limit or halt production of an input for reasons unrelated to antitrust litigation (for example, a change in demand or cost). Preventing the supplier from adjusting its production in response to changes in market conditions may inhibit the competitive process.

[34]In *House of Materials, Inc. v. Simplicity Pattern* 298 F.2d 867 (2d Cir. 1962), an enjoinment of this kind was initially granted, but the decision was overturned by the circuit court of appeals.

4 The Illinois Brick Rule

The preceding analysis demonstrates that input suppliers can, under certain circumstances, deter direct purchasers (i.e., retailers in the present model) from filing damage claims.[35] Due to the possibility of direct purchasers declining to pursue damage litigation against their suppliers, prior literature has conjectured that permitting indirect purchaser suits would help strengthen private antitrust enforcement.[36] In this section, I analyze this possibility. Throughout this section, retailers are assumed to purchase the input directly from the supplier and sell directly to final consumers. Thus, direct purchasers are retailers and indirect purchasers are final consumers.[37]

Two supreme court decisions shaped the current legal environment surrounding indirect purchaser damage suits: *Hanover Shoe Inc. v. United Shoe Machinery Corp.*[38] and *Illinois Brick Co. v. Illinois.*[39] In *Hanover Shoe Inc. v. United Shoe Machinery Corp.,* Hanover Shoe, a shoe manufacturer which leased machinery from United Shoe Machinery Corp., claimed damages from United's monopolization of the shoe machinery market. United invoked what is now known as the pass-on defense. Specifically, United argued that Hanover Shoe was not entitled to damages because its increased cost of machinery was passed on to its customers through elevated shoe prices. The Supreme Court determined that Hanover Shoe was entitled to damages based on the full overcharge despite the fact that a portion of that overcharge was passed on to its customers. Thus, the Supreme Court prohibited the pass-on defense.[40]

A decade later, in *Illinois Brick Co. v. Illinois*, the state of Illinois sued a block manufacturer alleging damages from a price-fixing violation. The state of Illinois was an indirect purchaser because the bricks were first sold to contractors hired by the state. The Supreme Court decided that the state of Illinois could not recover damages, effectively barring indirect purchaser suits.[41] The Illinois Brick decision was made in part to remain consistent with the Hanover Shoe decision. Allowing indirect purchaser suits when direct purchasers could recover damages based on the full overcharge, as established in the Hanover Shoe decision, would cause multiple liability for defendants.

[35] Direct purchasers are entities/individuals that purchase directly from the infringing firm(s). An indirect purchaser is an entity/individual that does not purchase directly from the infringing firm, but instead purchases from a direct purchaser or another purchaser downstream.

[36] See discussion in Harris and Sullivan (1979*a*,*b*); Landes and Posner (1979*a*,*b*); Snyder (1985) and Smith (2021).

[37] The results of this section seem likely to also apply when direct purchasers sell to other intermediary suppliers, rather than final consumers. However, supplier retaliation against indirect purchasers may be more likely if the set of indirect purchasers consists of a small number of firms, rather than many individuals. Contrarily, indirect purchasers may have stronger incentives to sue, absent retaliation, when indirect purchaser harm is concentrated with a few firms, rather than divided between many final consumers.

[38] *Hanover Shoe Inc. v. United Shoe Machinery* 392 U.S. 481 (1968)

[39] *Illinois Brick Co. v. Illinois.* 431 U.S. 720 (1977)

[40] Much of the discussion in this section is based on Smith (2021).

[41] While indirect purchaser suits are prohibited federally, they are permitted in some states through what are known as "Illinois Brick repealer laws."

Some economists and legal scholars have criticized the Illinois Brick decision and argued for the opposite approach (i.e., the permission of both indirect purchaser suits and the pass-on defense).[42] This approach is followed in the European Union where, as clarified in the recent EU damage directive,[43] both indirect purchaser suits and the pass-on defense are permitted.[44] Therefore, both indirect purchasers and direct purchasers have a right to sue for damages. However, each party is only entitled to a damage award commensurate to the harm suffered by that party. For example, if a large portion of the overcharge is passed on to final consumers, direct purchasers are entitled to a smaller claim, while indirect purchasers are entitled to a relatively large claim.

In this section, I compare these two opposing approaches to private antitrust enforcement using the model introduced in Section 3. Specifically, I compare a regime where both the pass-on defense and indirect purchaser suits are permitted (regime R) with a regime where both are prohibited (regime I). I compare the two regimes on the basis of expected damages.[45]

The expected damages paid by an infringing supplier depends on the likelihood of a direct/indirect purchaser suit, the size of the direct purchaser's claim, the size of the indirect purchasers' claims, and the likelihood of success at trial. For expositional clarity, I assume the probability of a damage suit (both for direct and indirect purchaser suits) succeeding (i.e., resulting in a claim of F) is 1.[46] Under the Illinois Brick regime, the size of the direct purchaser's claim is F and the size of the indirect purchaser's claim is 0. This is the case because indirect purchasers are forbidden to sue and the pass-on defense is not permitted. Under the reversal regime, the size direct and indirect purchasers' claims depend on the retail pass-through rate $\lambda \in (0, 1)$.[47] The pass-through rate is the rate at which an increase in the input price of a downstream firm is passed on to final consumers in the form of elevated retail prices. To illustrate, suppose an antitrust violation results in an increase in input prices from

[42] See references in footnote 36.

[43] European Parliament and Council of the European Union, Directive on Certain Rules Governing Actions for Damages under National Law for Infringements of the Competition Law Provisions of the Member States and of the European Union. PE-CONS 80/14. Brussels, October 24, 2014. See, also, European Commission, White Paper on Damages Actions for Breach of the EC Antitrust Rules. COM(2008) 165 final, Brussels, April 4, 2008.

[44] Other jurisdictions (e.g., Brazil, see Article 47 of the Brazilian Antitrust Law) also permit indirect purchaser suits.

[45] While there are other factors to consider when choosing between the two regimes (such as the proper compensation of victims and administrative convenience), the primary point of debate surrounding the Illinois Brick decision is deterrence (Gehring, 2010). If a firm (or group of firms) anticipates paying a smaller amount of damages under a particularly regime, this may enhance incentives to commit an antitrust violation. Conversely, stronger private antitrust enforcement regimes not only provide superior compensation for victims, but help deter antitrust violations. I discuss additional considerations when choosing between the two regimes in Subsection (4.5).

[46] Results are unchanged if the probability of a successful damage suit is a constant $\omega \in (0, 1)$ for both direct and indirect purchasers. If a direct purchaser suit is more likely to be successful than an indirect purchaser suit (e.g., due to stronger evidence), this widens the set of parameter values for which regime I is optimal.

[47] In theory, the pass-through rate can equal or exceed 1. If this is the case, direct purchasers have no right to a damage claim under the pass-on defense because the entirety of the overcharge is passed on to their customers. The possibility of the threat of retaliation deterring direct purchaser suits is therefore, in this case, irrelevant. If $\lambda = 0$, retailers do not pass on any portion of the overcharge to consumers. Consumers therefore incur no damage and are not entitled to a damage claim under regime R. Both regimes are equivalent in this case. Verboven and Dijk (2009) present a general framework for computing damage claims under the pass-on defense.

w_L to w_H. Additionally, let $p(w)$ denote the retail price when the input price is w. The pass-through rate of this increase in input prices is

$$\lambda = \frac{p(w_H) - p(w_L)}{w_H - w_L}. \tag{2}$$

When λ is 1, the entirely of the input price increase is passed on to final consumers. When λ is 0, the entirety of the input price increase is absorbed by retailers and not passed on to final consumers. Larger pass-through rates imply a larger portion of the total harm from an antitrust infringement is suffered by indirect purchasers. Smaller pass-through rates imply that the majority of the harm was suffered by direct purchasers. The size of the direct purchasers claim is $(1-\lambda)F$, and the size of the indirect purchasers claim is λF.[48]

Indirect purchasers (i.e., consumers) pursue their claim through a single, class action lawsuit.[49] I assume suppliers do not retaliate against indirect purchasers (which are final consumers in the present model). As Snyder (1985) notes, "sellers cannot retaliate easily against indirect purchasers." The class action nature of indirect purchaser suits makes it difficult for manufacturers to identify which consumers actually receive compensation from a damage suit. Additionally, many consumers are unaware of damage litigation or even the occurrence of an antitrust violation. Lastly, suppliers do not interact directly with final consumers and often cannot observe which retailer a consumer patronizes, which makes retaliation difficult.

Suppose retailer litigiousness is distributed according to a positive probability distribution $f(\gamma) : [0, \bar{\gamma}] \to (0, \infty)$. Note that $f(\gamma)$ is not necessarily the same distribution as $p(\gamma)$, the supplier's beliefs regarding retailer litigiousness. Thus,

$$\beta_{NR}(F) = \begin{cases} \int_{\gamma_{min(F)}}^{\bar{\gamma}} f(\gamma) d\gamma & \text{if } F \geq F_{min}(\bar{\gamma}) \\ 0 & \text{if } F < F_{min}(\bar{\gamma}) \end{cases}$$

denotes the probability of a direct purchaser (i.e., retailer) suit when retaliation is not possible (e.g., if

[48] To see this, suppose Q is the quantity sold during the antitrust violation, w is the input price charged during the antitrust violation, and w_{BF} is the "but-for" price, or the price which would have prevailed in the absence of an infringement. Additionally, suppose damages are trebled as in the US. The total size of the damage claim can be decomposed as follows:

$$\begin{aligned} F = 3Q(w - w_{BF}) &= 3Q(p(w) - p(w_{BF})) + 3Q(w - w_{BF} - (p(w) - p(w_{BF}))) \\ &= 3Q(w - w_{BF})\left(\frac{p(w) - p(w_{BF})}{w - w_{BF}}\right) + 3Q(w - w_{BF})\left(1 - \frac{p(w) - p(w_{BF})}{w - w_{BF}}\right) \\ &= \lambda F + (1 - \lambda)F. \end{aligned}$$

[49] As Cafferty (2010) writes, "class actions are the primary avenue for assertion of indirect purchaser antitrust claims."

the game ended after stage 1) and the size of the direct purchaser's claim is F. $\beta_{NR}(F)$ is increasing in the size of the claim when $F > F_{min}(\bar{\gamma})$. $\beta_{NR}(F)$ is zero for sufficiently small claims (i.e., the "Pooling-NC1" equilibrium occurs) and positive for larger claims (i.e., the "Separating-AC" equilibrium occurs), as shown in Figure 3.

The likelihood of an indirect purchaser suit is more challenging to quantify. When permitted, indirect purchaser claims are typically class action suits involving many small firms or consumers.[50] The likelihood of an indirect purchaser suit likely depends on the size of the claim (which depends on the pass-through rate), the strength of indirect purchasers' legal right to sue in the relevant jurisdiction,[51] the size of the harmed class, and the strength of evidence available to indirect purchasers regarding the supplier's guilt. Let $\alpha(F) : [0, \infty) \to [0, 1]$ denote the probability of an indirect purchaser suit when the size of the indirect purchasers' claim is F. I assume $\alpha(F)$ satisfies the following assumption.

Assumption 5. *α satisfies*

i) $\frac{\partial \alpha(F)}{\partial F} \geq 0$ *for all* $F > 0$,

ii) $\alpha(F) = \beta_{NR}(F) = 0$ *for all* $F \leq F_{min}(\bar{\gamma})$ *and* $\alpha(F) < \beta_{NR}(F)$ *for all* $F > F_{min}(\bar{\gamma})$, *and*

iii) $(1-\lambda)F\beta_{NR}((1-\lambda)F) + \lambda F\alpha(\lambda F) < F\beta_{NR}(F)$ *for all* $F > F_{min}(\bar{\gamma})$.

Assumption 5(i) states that the probability of a direct purchaser claim is non-decreasing in the size of the claim. Absent retaliation, and for equal claim sizes, indirect purchasers are less likely to sue than direct purchasers for a number of reasons. First, indirect purchasers do not interact directly with suppliers and, as a result, may be less likely to detect or develop suspicions of an antitrust violation (Landes and Posner, 1979*b*). Second, direct purchasers may possess stronger evidence of an antitrust violation due to their closer proximity to the supplier along the supply chain. Third, indirect purchaser suits (which are typically complex class action lawsuits) may involve larger legal costs. Assumption 5(ii) reflects these considerations.

Assumption 5(iii) states that, absent retaliation, allocating the entirety of the right to sue to direct purchasers (i.e., regime I) results in greater expected damages than dividing the right to sue between direct and indirect purchasers (i.e., regime R).[52] Thus, regime I is always optimal absent the threat of retaliation. This assumption holds if expected direct purchaser damages (i.e., $F\beta_{NR}(F)$) are convex in F and/or indirect purchasers are sufficiently less likely to file claims (i.e., $\alpha(\lambda F)$ is sufficiently

[50] I do not consider the possibility of class action lawsuits including both direct and indirect purchasers as these suits are exceedingly rare. Davis and Kohles (2021) finds that class action lawsuits including both direct and indirect purchasers constitute less than 1% of settlements in the US.

[51] For example, if indirect purchasers are permitted to sue, but there are few examples of successful suits, indirect purchasers may be uninterested in pursuing a claim.

[52] As Landes and Posner (1979*b*) write, "[t]he only argument we have heard that direct purchasers may be less efficient enforcers than indirect purchasers is that the first purchaser may be reluctant to sue his supplier lest an ongoing relationship beneficial to the purchaser be disrupted" (see pg. 613).

small).[53] Intuitively, splitting damages between two parties results in fewer expected damages than concentrating the right to sue entirely with the party most likely to sue (i.e., direct purchasers).[54] I discuss robustness to this assumption in Appendix B.4.

As discussed in Section 3, there are multiple equilibria for certain parameter values. Specifically, the "Separating-AC" equilibrium may occur alongside the "Separating-PC" or the "Pooling-NC1" equilibrium. In these cases, I assume the equilibrium with the smallest amount of expected damages occurs. I show that results are robust to the opposite assumption in Appendix B.5.

Assumption 6. *When there are multiple equilibria, the equilibrium involving the smallest expected damages occurs.*

Let $\beta_D(F)$ denote the probability of a direct purchaser suit when the size of the direct purchaser's damage claim is F and retaliation is possible. In light of the results of Section 3 and Assumption 6,

$$\beta_D(F) = \begin{cases} 0 & \text{if } F \leq F^*(\bar{\gamma}) \\ \beta_S(F) & \text{if } F^*(\bar{\gamma}) < F \leq F^*(\gamma_U) \\ \beta_{NR}(F) & \text{if } F > F^*(\gamma_U) \end{cases}$$

where $\beta_S(F) = \int_{\gamma^*(F)}^{\bar{\gamma}} f(\gamma) d\gamma$ is the probability of a direct purchaser suit under the "Separating-PC" equilibrium. $\beta_D(F)$ has three segments corresponding to the pooling no-claim equilibria (either the "Pooling-NC1" or "Pooling-NC2" equilibrium), the "Separating-PC" equilibrium, and the "Separating-AC" equilibrium. Let $X_i(F)$ denote expected damage payments under regime $i \in \{I, R\}$. $X_I(F) = \beta_D(F)F$ and $X_R(F) = \beta_D\left((1-\lambda)F\right)(1-\lambda)F + \alpha(\lambda F)\lambda F$.

When comparing the two regimes, there are four cases to consider: large claims (specifically, $F > F^*(\gamma_U)$) for which no retailer is deterred from suing due to the threat of retaliation under regime I (hereafter, "large" claims), moderately large claims (specifically, $F^*(\bar{\gamma}) < F \leq F^*(\gamma_U)$) for which some, but not all, retailers are deterred from suing due to the threat of retaliation under regime I (hereafter, "medium-large" claims), moderately small claims (specifically, $F_{min}(\bar{\gamma}) < F \leq F^*(\bar{\gamma})$) for which all retailers are deterred from suing under regime I despite some retailers having positive valuations of the claim (hereafter, "medium-small" claims), and exceptionally small claims (specifically, $F \leq F_{min}(\bar{\gamma})$) for which no retailer has a positive valuation (hereafter, "small" claims).

[53] See Subsection B.4 for formal proofs and additional discussion. Subsection B.4 also presents examples satisfying Assumption 5(iii) and discussion of the robustness of results to this assumption.

[54] This effect was cited as a motivation for the original Illinois Brick decision. See *Illinois Brick Co. v. Illinois*, 431 U.S. 720, 745 (1977).

4.1 Large F

First, consider large claims. Specifically, assume that the claim is sufficiently large that the "Separating-AC" equilibrium occurs and all retailers with a non-negative subjective valuation of the claim (i.e., $\gamma \geq \gamma_{min}(F)$) sue under regime I. Thus, $\beta_D(F) = \beta_{NR}(F)$ under the Illinois Brick regime and the threat of retaliation has no impact on expected damages under regime I.

Theorem 5. *$X_I(F) > X_R(F)$ if $F > F^*(\gamma_U)$.*

Theorem 5 states that a reversal of Illinois Brick would reduce expected damages. Put differently, a reversal of Illinois Brick weakens private antitrust enforcement of large damage claims. This is the case for two reasons. First, a reversal of Illinois Brick reduces the size of the direct purchaser's claim. Recall that direct purchasers have a right to sue only for the portion of the overcharge not passed on to indirect purchasers under regime R, while they may sue for damages based on the full overcharge under regime I. Due to the threat of retaliation, a reduction in direct purchasers' claims can have a significant effect on expected damages. A reduction in the size of direct purchasers' claims may result in a switch from the "Separating-AC" equilibrium to either the "Separating-FC," "Pooling-NC1," or "Pooling-NC2" equilibrium where some or all direct purchasers do not file claims.[55]

Second, even if direct purchasers are not deterred from filing claims under regime R (i.e., the "Separating-AC" equilibrium occurs under both regimes), a reversal of Illinois Brick still reduces expected damages. This is the case because regime R splits the right to sue between two parties (one of whom has weaker incentives to sue) which, as reflected in Assumption 5, reduces expected damages. Intuitively, a portion of the right to sue has been transferred from the party most likely to sue (i.e., direct purchasers absent retaliation) to a party less likely to sue (i.e., indirect purchasers). This effect is particularly large when indirect purchasers are relatively unlikely to sue (i.e., $\alpha(\lambda F)$ is small).

In the ongoing debate surrounding indirect purchaser suits, the threat of supplier retaliation is often cited as a motivation for allocating a portion of the right to sue to indirect purchasers.[56] However, when claims are sufficiently large that the threat of supplier retaliation plays no role under regime I, reducing direct purchasers' claims in order to allocate a portion of the claim to indirect purchasers may actually create the potential for supplier retaliation and result in retailers refraining from suing their suppliers due to the threat of retaliation. Intuitively, retailers are emboldened to sue, despite

[55] The negative impact of a reversal of Illinois Brick on direct purchasers' incentives to sue has been recognized by both sides of the Illinois Brick debate. "The availability of a passing-on defense will often have the effect of reducing the incentive to sue of intermediate purchasers-whose potential claims might otherwise be larger-to a point below the level at which litigating would be an attractive option" (Landes and Posner, 1979*b*). "...the contention that legislative overruling of Illinois Brick would inevitably deter direct-purchaser suits to some extent is supported by the conventional marginal analysis of theoretical economics" (Harris and Sullivan, 1979*a*).

[56] See prior literature and discussion cited in footnote 36 and footnote 2.

the threat of retaliation, when the claim is large. However, retailers' incentives to sue, and potentially endure retaliation, may be too weak if Illinois Brick is repealed and the size of their claim is reduced.

4.2 Medium-Large F

In this subsection, I compare expected damages under the two regimes for medium-large damage claims. Specifically, consider claims for which the "Separating-PC" equilibrium occurs under regime I (i.e., $F^*(\bar{\gamma}) < F \leq F^*(\gamma_U)$). In this case, results are more ambiguous. The Illinois Brick regime is optimal if

$$X_I(F) = F\beta_S(F) > (1-\lambda) F\beta_D\left((1-\lambda) F\right) + \lambda F\alpha(\lambda F) = X_R(F). \tag{3}$$

First, note that the inequality in (3) holds if $\alpha(\lambda F)$ is sufficiently small (i.e., indirect purchasers' incentives to sue are weak). Transferring a portion of the right to sue to a party that is unlikely to file a claim reduces expected damages. Second, note that the inequality in (3) is more likely to hold if the reduction in the size of the direct purchaser's claim (as a result of the permission of the pass-on defense) is large (specifically, $(1-\lambda) F < F^*(\bar{\gamma}) < F$). If the size of a direct purchaser claim is significantly reduced under regime R, this may result in a switch from the "Separating-PC" equilibrium to a pooling equilibrium under which no retailer sues. This would result in a significant reduction in expected damages.

Contrarily, the reverse of inequality 3 (i.e., regime R is optimal) occurs when the size of the claim F is small (i.e., F is close to $F^*(\bar{\gamma})$). This is the case as only highly litigious retailers sue under the "Separating-PC" equilibrium when F is small. Filing a claim signals a high level of litigiousness and results in the retailer losing access to the input in stage 2. Thus, only highly litigious retailers pursue small damage claims, and a direct purchaser claim is, a priori, unlikely under regime I. However, if the Illinois Brick rule is reversed, indirect purchasers, for whom the threat of retaliation does not impact, can now file claims, increasing expected damages and strengthening private antitrust enforcement. Intuitively, if direct purchasers are fearful of suing their suppliers due to the threat of retaliation, it is optimal to transfer a portion of the right to sue to a party with stronger incentives to file claims (i.e., indirect purchasers). Note that the threat of retaliation is crucial to this result. Direct purchasers always have stronger incentives to sue absent the threat of retaliation (see Assumption 5). However, when retaliation is possible and the claim is relatively small, direct purchasers may have weaker incentives to sue than indirect purchasers due to the threat of supplier retaliation. In these cases, regime R may be optimal. The following theorem formalizes this result.

Theorem 6. *There exists an* $\hat{F} \in (F^*(\bar{\gamma}), F^*(\gamma_U))$ *such that* $X_R(F) > X_I(F)$ *if* $F^*(\bar{\gamma}) < F < \hat{F}$ *and*

$\alpha(\lambda F^*(\bar{\gamma})) > 0$.

Theorem 6 states that regime R is optimal for relatively small claims. Thus, transferring a portion of the right to sue to indirect purchasers can strengthen private antitrust enforcement. In summary, no general conclusion regarding the optimal regime can made for medium-large values of F. Which regime is optimal depends on the likelihood of indirect purchaser claims, the size of the claim, and the pass-through rate.

4.3 Medium-Small F

Next, consider medium-small claims. Specifically, suppose claims are such that that the "Pooling-NC1" equilibrium occurs under regime I (i.e., $F_{min}(\bar{\gamma}) < F \leq F^*(\bar{\gamma})$). Therefore, no direct purchasers choose to sue due to the threat of retaliation. The following theorem characterizes the optimal regime for medium-small damage claims.

Theorem 7. *$X_R(F) > X_I(F)$ if $F_{min}(\bar{\gamma}) < F \leq F^*(\bar{\gamma})$ and $\alpha(\lambda F) > 0$.*

Theorem 7 states that regime R is optimal for medium-small damage claims if the likelihood of an indirect purchaser suit is positive under regime R. Claims are too small to incentivize direct purchasers to sue and risk retaliation from their supplier. As direct purchasers will not sue (regardless of the regime), it is optimal to transfer part of the right to sue to indirect purchasers as they are not subject to retaliation and, therefore, may sue. Permitting indirect purchaser suits creates the potential for damages where none would arise under the Illinois Brick rule, strengthening private antitrust enforcement.

Results of this subsection (and the previous subsection) suggest that the threat of supplier retaliation can provide a motivation for a reversal of Illinois Brick. Recall that regime I results in a greater amount of expected damages absent the threat of retaliation. However, when the possibility of suppliers retaliating against their retailers is introduced, regime R may be optimal.

While Theorem 7 (as well as Theorem 6) suggest a reversal of Illinois Brick can enhance private antitrust enforcement, caution is necessary when interpreting this result. First, note that $\alpha(\lambda F) > 0$ may not hold for exceptionally small claims or low pass-through rates. If $\alpha(\lambda F) = 0$ (i.e., there is no probability of an indirect purchaser claim), then both regimes result in zero expected damages. Second, note that when $\alpha(\lambda F) > 0$ does hold, the likelihood of an indirect purchaser suit under regime R may be relatively low (i.e., $\alpha(\lambda F)$ may be small). This occurs when the pass through rate is small. Thus, a reversal of Illinois Brick may increase expected damages, but only marginally. At a minimum, the results of Theorem 7 and Theorem 6 raise the possibility that, under certain circumstances, a

reversal of the Illinois Brick decision may increase expected damages and strengthen private antitrust enforcement.

4.4 Small F

In this subsection, I consider small claims. Specifically, suppose claims are sufficiently small that the "Pooling-NC2" equilibrium occurs under regime I (i.e., $F \leq F_{min}(\bar{\gamma})$). The following theorem characterizes expected damages under the two regimes for small damage claims.

Theorem 8. *$X_R(F) = X_I(F) = 0$ if $F \leq F_{min}(\bar{\gamma})$.*

Theorem 8 states that both regimes result in zero expected damages for small claims. Under regime I, the claim is sufficiently small that no retailer positively values the claim. As a result, direct purchasers never sue and $X_I(F) = 0$. If the Illinois Brick decision were reversed, the value of the direct purchaser's claim would be further reduced and direct purchasers would, as under regime I, choose not to sue. Indirect purchasers would also decline to sue by Assumption (5)(ii). Thus, expected damages are also zero under regime R. In summary, both regimes result in zero expected damages as claims are too small to incentivize either party to sue. This result is driven by the exceptionally small size of the claim, not by the threat of retaliation.

4.5 Discussion

To summarize, regime I is optimal for large claims (see Theorem 5) while regime R is optimal for medium-small claims (see Theorem 7) and, in some cases, medium-large claims (see Theorem 6). Both regimes result in zero expected damages for small damage claims (see Theorem 8). Figure 4 depicts expected damages, for one particular set of parameter values, under the two regimes. Figure 4 also reports the relevant equilibrium for each claim size under the two regimes.

When claims are large, the threat of supplier retaliation does not deter direct purchasers from filing claims. As a result, it is optimal to concentrate the right of sue with the party with the strongest incentives to sue (i.e., direct purchasers). As illustrated in Figure 4, the black line depicting damages under regime I exceeds the blue line depicting damages under regime R when claims are large. For medium-small claims (and relatively small medium-large claims), direct purchasers decline to sue as the loss in profit from losing access to the input exceeds their valuation of the claim. Thus, it is optimal to transfer a portion of the right to sue to indirect purchasers who are not subject to retaliation and may file a claim. Figure 4 demonstrates that damages under regime R (the blue line) can exceed damages under regime I (the black line) for moderate claim sizes. Generally, the results of this section

suggest that the possibility of supplier retaliation does not provide clear support for either regime in all cases.

There are a number of additional arguments (not captured by the preceding analysis) in favor of both regimes. Beginning with regime R, there are at least two additional reasons that this regime may be preferred. First, the preceding analysis has compared the two regimes on the basis of expected damages. Larger expected damages should help deter a greater number of antitrust violations. However, private antitrust suits are also intended to provide compensation to injured parties. This suggests that indirect purchasers, if harmed by antitrust violation, should have a right to pursue damages (which is possible only under Regime R). Second, suppliers may incur greater legal costs (perhaps due to the greater number of distinct lawsuits) under regime R.

Turning to regime I, there are at least three additional reasons why regime I may be preferable. First, note that the degree of harm (both to direct purchasers, indirect purchasers and society as a whole) caused by an antitrust violation is likely greater for larger damage claims. Thus, it may be optimal from a societal point of view to focus antirust policy so as to deter the most harmful violations (i.e., those where the damage claim would be large). This provides support for regime I as the Illinois Brick rule results in the greatest amount of expected damages (and therefore superior deterrence) for large claims. Second, regime R requires estimating the pass-through rate in order to determine the the size of direct and indirect purchasers' damage claims. The estimation of pass-through rates can be complex and imposes an additional burden on the court and legal system.[57] Third, if indirect purchasers possess weaker evidence regarding the supplier's guilt (perhaps as the indirect purchaser does not deal directly with the supplier), then indirect purchaser suits may be less likely to succeed at trial or less likely to negotiate a favorable settlement.

Currently, indirect purchaser suits and the pass-on defense (i.e., regime R) are permitted in the EU and forbidden in the US (at least, federally).[58] Interestingly, these policy choices may already reflect optimality in terms of expected damages for each jurisdiction. In the US, section 4 of the Clayton Act permits plaintiffs to sue for treble damages. In the EU, plaintiffs may pursue only single damages. If this distinction results in larger claims in the US than the EU, then regime I may be optimal in the US and regime R may be optimal in the EU, as is current practice in both jurisdictions.

[57] However, note that econometric/statistical methods, availability of data, and computing power have advanced considerably since the original Illinois Brick and Hanover Shoe decisions. The difficulty and cost of estimating a pass-through rate have likely declined. See Doose (2014) and Brander and Ross (2017) for discussion of how damages are estimated in practice.

[58] While indirect purchasers do not have standing to sue under federal law in the United States, indirect purchasers are permitted to sue in some states through what are known as "Illinois Brick repealer laws." Courts dealing with multiple direct and indirect purchaser suits have, at times, consolidated the claims into a single case (Winters, 2011). If such consolidation reduces the legal and time costs of suing the supplier or increases the likelihood of success at trial, then both direct and indirect purchasers' incentives to sue may be enhanced.

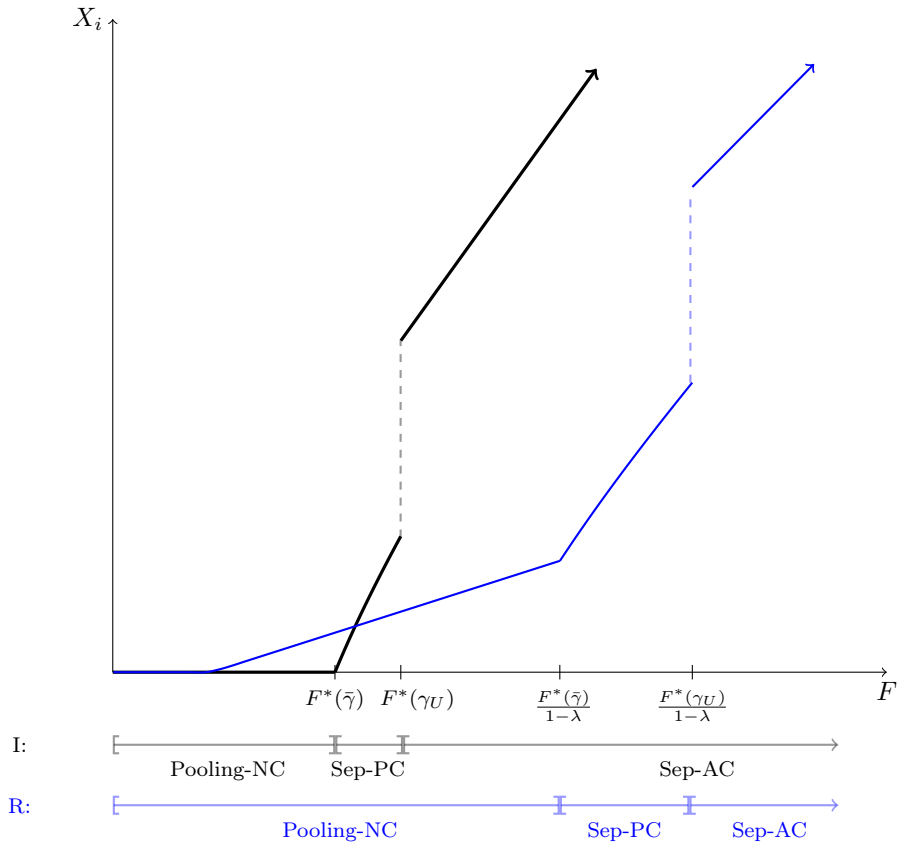

Figure 4: Expected Damage Amounts under Illinois Brick (Regime I, black) and Reversal (Regime R, blue)

5 Conclusion

I have examined the possibility of suppliers accused of an antitrust violation retaliating against downstream firms that sue for damages. I find that retailers may refrain from suing their supplier due to the threat of being refused the input in retaliation. The retailer chooses not to sue their supplier in order to avoid appearing litigious and likely to file future, costly lawsuits. Retailers are mostly likely to be deterred from filing claims when the size of the claim is relatively small, the supplier's input is vital for the retailer's profitability, and when sales to the retailer are relatively unimportant for the supplier.

Next, I analyze whether, in the context of the preceding model of supplier retaliation, indirect purchasers should be permitted to file antitrust damage claims. Specifically, I compare two regimes: one where indirect purchasers are barred from filing damage claims and the pass-on defense is prohibited (regime I) and one where both indirect purchaser suits and the pass-on defense are permitted (regime R). I find that neither regime results in a greater amount of expected damages in all cases. Regime I

results in stronger antitrust enforcement when claims are large, but regime R can be optimal for smaller damage claims. Generally, the results of this study suggest that the threat of supplier retaliation does not provide unequivocal support for or against the Illinois Brick rule.

A few other considerations warrant brief mention. First, supplier retaliation itself may have welfare consequences. For example, consumers may indirectly suffer harm if a retailer is refused an input (especially if the retailer is forced to exit the market as a result).[59] The magnitude of consumer harm from retaliation likely depends on the degree of competition downstream, consumer preferences, and the presence of barriers to entry downstream. Second, retaliation may have an additional benefit to suppliers if it hinders a suing retailer's ability to secure the participation of relevant witnesses or fund their lawsuit.[60] Third, retaliating against a retailer may help a supplier build a beneficial reputation for retaliation that deters other retailers (potentially in entirely different markets) from filing suits.[61] While results of this study are stated in terms of retaliation after antitrust violations, the model also applies to other lawsuits such as contract or tort disputes.[62]

[59]It is not clear which regime results in a greater likelihood of retaliation in equilibrium. Reducing the size of direct purchaser claims (i.e., permitting the pass-on defense) could cause a switch from the "Separating-AC" equilibrium (where no retaliation occurs) to the "Separating-PC" equilibrium (where retaliation occurs). However, permitting the pass-on defense could also cause a switch from the from the "Separating-PC" equilibrium (where retaliation occurs) to the pooling equilibria where no retaliation occurs.

[60]For example, in *Shires v. Magnavox Co.*, 432 F. Supp. 231 (E.D. Tenn. 1976), the plaintiffs argued that "franchise agreements were terminated by the defendant Magnavox for the purpose of frustrating this litigation, by reducing their income from their business operations during the pendency of this action and rendering it more difficult for them to finance the same."

[61]In a previous draft, I explored this possibility in a reputation effects model involving commitment types (Fudenberg and Levine, 1989; Milgrom and Roberts, 1982; Kreps and Wilson, 1982). I find that suppliers can successfully build a reputation for retaliation that deters future retailers from filing claims.

[62]For example, in *Marin Tug Barge v. Westport Petroleum*, 271 F.3d 825 (9th Cir. 2001), an oil supplier retaliated after a customer (a barge company) filed a suit alleging the supplier's oil contaminated its barge.

References

Berger, Leef, and Emily L Seymore. 2015. "Supplier Retaliation Against Civil Antitrust Plaintiffs Is Not a Major Concern." *The Bureau of National Affairs: Antitrust and Trade Regulation Report*, 108 ATRR 59.

Bizjak, John M, and Jeffrey L Coles. 1995. "The effect of private antitrust litigation on the stock-market valuation of the firm." *The American Economic Review*, 436–461.

Blair, Roger D, and Jeffrey L Harrison. 1999. "Reexamining the Role of Illinois Brick in Modern Antitrust Standing Analysis." *Geo. Wash. L. Rev.*, 68: 1.

Blanchard, Olivier Jean, Florencio Lopez-de Silanes, and Andrei Shleifer. 1994. "What Do Firms Do With Cash Windfalls?" *Journal of Financial Economics*, 36(3): 337–360.

Brander, James A, and Thomas W Ross. 2017. "Estimating Damages to Direct and Indirect Purchasers in Price-Fixing Actions." *Canadian Competition Law Review*, 30: 1.

Cafferty, Patrick E. 2010. "Indirect Purchaser Class Action Settlements."

Canenbley, Cornelis, and Till Steinvorth. 2011. "Effective Enforcement of Competition Law: Is There a Solution to the Conflict Between Leniency Programmes and Private Damages Actions?" *Journal of European Competition Law & Practice*, 2(4).

Davis, Joshua P, and Rose Kohles. 2021. "2020 Antitrust Annual Report: Class Action Filings in Federal Court." *Available at SSRN 3898782*.

Doose, Anna Maria. 2014. "Methods for Calculating Cartel Damages: A Survey." *Zeitschrift für Wettbewerbsrecht*, 12(3): 282–299.

Fudenberg, Drew, and David K. Levine. 1989. "Reputation and Equilibrium Selection in Games with a Patient Player." *Econometrica*, 57(4): 759–778.

Gavil, Andrew I. 2009. "Thinking Outside the Illinois Brick Box: A Proposal for Reform." *Antitrust LJ*, 76: 167.

Gehring, Andrew S. 2010. "The Power of the Purchaser: The Effect of Indirect Purchaser Damages Suits on Deterring Antitrust Violations." *NYUJL & Liberty*, 5.

Harris, Robert G, and Lawrence A Sullivan. 1979*a*. "Passing on the Monopoly Overcharge: A Comprehensive Policy Analysis." *U. Pa. L. Rev.*, 128: 269.

Harris, Robert G, and Lawrence A Sullivan. 1979*b*. "Passing On the Monopoly Overcharge: A Response to Landes and Posner." *U. Pa. L. Rev.*, 128: 1280.

Hovenkamp, Herbert. 2003. "The Rationalization of Antitrust." *Harv. L. Rev.*, 116(3): 917–944.

Hovenkamp, Herbert. 2011. "Quantification of harm in private antitrust actions in the United States." *University of Iowa Legal Studies Research Paper*.

Kreps, David M, and Robert Wilson. 1982. "Reputation and Imperfect Information." *Journal of Economic Theory*, 27(2): 253–279.

Laborde, Jean-François. 2019. "Cartel damages actions in Europe: How courts have assessed cartel overcharges." *Law & Economics, Concurrences*, 4.

Lande, Robert H. 2009. "New Options for State Indirect Purchaser Legislation: Protecting the Real Victims of Antitrust Violations." *Ala. L. Rev.*, 61: 447.

Landes, William M., and Richard A. Posner. 1979*a*. "Economics of Passing On: A Reply to Harris and Sullivan." *U. Pa. L. Rev.*, 128: 1274.

Landes, William M., and Richard A. Posner. 1979*b*. "Should Indirect Purchasers Have Standing to Sue under the Antitrust Laws? An Economic Analysis of the Rule of Illinois Brick." *U. Chi. L. Rev.*, 46(3): 602–635.

Malmendier, Ulrike, Geoffrey Tate, and Jon Yan. 2011. "Overconfidence and Early-Life Experiences: The Effect of Managerial Traits on Corporate Financial Policies." *The Journal of Finance*, 66(5): 1687–1733.

Milgrom, Paul, and John Roberts. 1982. "Predation, Reputation, and Entry Deterrence." *Journal of Economic Theory*, 27(2): 280–312.

Rengier, Lukas. 2020. "Cartel damages actions in German Courts: what the statistics tell us." *Journal of European Competition Law & Practice*, 11(1-2): 72–81.

Richman, Barak D, and Christopher R Murray. 2007. "Rebuilding Illinois Brick: A Functionalist Approach to the Indirect Purchaser Rule." *Southern California Law Review*, 81: 69.

Riley, Alan, and John Peysner. 2006. "Damages in EC antitrust actions: who pays the piper?" *European Law Review*, 31(5): 748.

Schinkel, Maarten Peter, Jan Tuinstra, and Jakob Rüggeberg. 2008. "Illinois Walls: How Barring Indirect Purchaser Suits Facilitates Collusion." *The RAND Journal of Economics*, 39(3): 683–698.

Smith, Spencer. 2021. "The Indirect Purchaser Rule and Private Enforcement of Antitrust Law: A Reassessment." *Journal of Competition Law & Economics*, 17(3): 642–685.

Snyder, Edward A. 1985. "Efficient Assignment of Rights to Sue for Antitrust Damages." *The Journal of Law and Economics*, 28(2): 469–482.

Verboven, Frank, and Theon van Dijk. 2009. "Cartel damages claims and the passing-on defense." *The Journal of Industrial Economics*, 57(3): 457–491.

Winters, Gary A. 2011. "Trial Issues In Consolidated Direct And Indirect Purchaser Cases: Lessons From the Sram Litigation." *ABA Antitrust Trial Practice Newsletter*.

A Proofs

A.1 Proofs from the Main Text

Proof of Theorem 1. First, consider stage 2. At information set 1, U's beliefs regarding D's type are

$$g_1(\gamma; \gamma_{min}(F)) = \frac{p(\gamma)}{1 - P(\gamma_{min}(F))}$$

U does not wish to deviate and retaliate if $E_1[V_U(\gamma)|\gamma_{min}(F)] = \int_{\gamma_{min}(F)}^{\bar{\gamma}} V_U(\gamma) g_1(\gamma; \gamma_{min}(F)) d\gamma \geq \tilde{V}_U$ or $\gamma_{min}(F) \leq \gamma_U$ which holds by $F \geq F_{min}(\gamma_U)$. At information set 2, U's beliefs regarding D's type are

$$g_2(\gamma; \gamma_{min}(F)) = \frac{p(\gamma)}{P(\gamma_{min}(F))}.$$

U does not wish to deviate and retaliate if $E_2[V_U(\gamma)|\gamma_{min}(F)] = \int_0^{\gamma_{min}(F)} V_U(\gamma) g_2(\gamma; \gamma_{min}(F)) d\gamma \geq \tilde{V}_U$ which follows from Assumption 4 and 2(i). As U never retaliates, D wishes to file a claim in stage 1 if $v(F, \gamma) \geq 0$ or $\gamma \geq \gamma_{min}(F)$. □

Proof of Theorem 2. At information set 1 in stage 2, $U's$ beliefs regarding R's type are given by $g_1(\gamma; \gamma^*(F))$. U does not wish to deviate to not retaliating against D if

$$E_1[V_U(\gamma)|\gamma^*(F)] = \int_{\gamma^*(F)}^{\bar{\gamma}} V_U(\gamma) g_1(\gamma; \gamma^*(F)) d\gamma \leq \tilde{V}_U$$

which holds if $\gamma^*(F) \geq \gamma_U$. At information set 2, $U's$ beliefs regarding R's type are given by $g_2(\gamma; \gamma^*(F))$. U does not wish to deviate to retaliating against D if

$$E_2[V_U(\gamma)|\gamma^*(F)] = \int_0^{\gamma^*(F)} V_U(\gamma) g_2(\gamma; \gamma^*(F)) d\gamma \geq \tilde{V}_U$$

which holds by assumption 4 and 2(i). Next, consider stage 1. No retailer wishes to deviate in stage 1 by the definition of $\gamma^*(F)$. □

Proof of Theorem 3. First, consider stage two. At information set 2, s_U does not wish to retaliate by Assumption 4. Next, consider information set 1. Information set 1 is off-equilibrium as a retailer suing in stage 1 occurs with probability 0 on the equilibrium path. Thus, the supplier wishes to retaliate if

off-equilibrium beliefs $h(\gamma) : [0, \bar{\gamma}] \to [0, \infty)$ satisfy[63]

$$\int_0^{\bar{\gamma}} V_U(\gamma) h(\gamma) d\gamma \leq \tilde{V}_U.$$

In stage 1, a retailer with litigiousness γ chooses not to file a claim if

$$\tilde{V}_R + v(F, \gamma) \leq V_R(\gamma)$$

which holds for all $\gamma \in [0, \bar{\gamma}]$ by $F \leq F^*(\bar{\gamma})$. □

Proof of Theorem 4. Note that $F_{min}(\bar{\gamma}) > F$ implies $v(F, \gamma) < 0$ for all $\gamma \in [0, \bar{\gamma}]$. First, consider stage two. At information set 2, U does not wish to retaliate by Assumption 4. Next, consider information set 1. Information set 1 is off-equilibrium as all retailers choose not to sue in stage 1. Thus, the supplier wishes to retaliate if off-equilibrium beliefs $h(\gamma) : [0, \bar{\gamma}] \to [0, \infty)$ satisfy[64]

$$\int_0^{\bar{\gamma}} V_U(\gamma) h(\gamma) d\gamma \leq \tilde{V}_U.$$

In stage 1, a retailer with litigiousness γ chooses not to file a claim if

$$\tilde{V}_R + v(F, \gamma) \leq V_R(\gamma)$$

which holds for all $\gamma \in [0, \bar{\gamma}]$ by $v(F, \gamma) < 0$ and Assumption 3(ii). □

Proof of Theorem 5. Note that $X_I(F) = F\beta_{NR}(F)$ as $F > F^*(\gamma_U)$. Under regime R, expected damages are bounded above by $(1-\lambda)F\beta_{NR}((1-\lambda)F) + \lambda F\alpha(\lambda F)$. Thus,

$$X_R(F) = (1-\lambda)F\beta_{NR}((1-\lambda)F) + \lambda F\alpha(\lambda F) < F\beta_{NR}(F) = X_I(F)$$

where the inequality follows from Assumption 5(iii) and $F > F_{min}(\bar{\gamma})$.[65] □

Proof of Theorem 6. Let $\hat{F} > F^*(\bar{\gamma})$ be sufficiently small that $\beta_S(\hat{F}) = \int_{\gamma^*(\hat{F})}^{\bar{\gamma}} f(\gamma) d\gamma < \lambda\alpha(\lambda F^*(\bar{\gamma}))$.[66]

[63] Intuitively, these off-equilibrium beliefs reflect a supplier belief that, as the size of the claim is small, any retailer deciding to file a claim must be highly litigious and therefore should be refused the input.

[64] As in the "Pooling-NC1" equilibrium, these off-equilibrium beliefs reflect a supplier belief that, as the size of the claim is small, any retailer deciding to file a claim must be highly litigious and therefore should be refused the input.

[65] Note that $F > F_{min}(\bar{\gamma})$ by $F > F^*(\gamma_U) \geq F_{min}(\gamma_U) \geq F_{min}(\bar{\gamma})$ where the first inequality follows by assumption, the second inequality follows from the definition of $F^*(\gamma_U)$ and $F_{min}(\gamma_U)$, and the third inequality follows from Lemma 1 part (iv).

[66] Such an $\hat{F}$ exists as i) $\beta_S(F)$ is increasing in F, ii) $\beta_S(F^*(\bar{\gamma})) = 0$, and iii) $\alpha(\lambda F^*(\bar{\gamma})) > 0$ (by assumption).

If $F^*(\bar{\gamma}) < F < \hat{F}$, then

$$X_I(F) = F\beta_S(F) < F\beta_S(\hat{F}) < \lambda F\alpha(\lambda F^*(\bar{\gamma})) \leq \lambda F\alpha(\lambda F) \leq X_R(F)$$

where the first inequality follows from $F < \hat{F}$, the second from the definition of $\hat{F}$, the third from Assumption 5(i) and $F^*(\bar{\gamma}) < F$, and the fourth from the definition of $X_R(F)$. □

Proof of Theorem 7. $X_I(F) = 0$ as $F_{min}(\bar{\gamma}) < F \leq F^*(\bar{\gamma})$ (i.e., the "Pooling-NC1" equilibrium). However, $X_R(F) = \lambda F\alpha(\lambda F) > 0$ by assumption. Thus, $X_I(F) < X_R(F)$. □

Proof of Theorem 8. Note that $F \leq F_{min}(\bar{\gamma})$ (i.e., the "Pooling-NC2" equilibrium) implies $\beta_D(F) = 0$. Thus, $X_I(F) = 0$. Additionally, $\beta_D\left((1-\lambda)F\right) = 0$ as $\beta_D(F)$ is non-decreasing in F. $\alpha(\lambda F) \leq \alpha(F) = 0$ where the first inequality follows from Assumption (5)(i) and the second equality follows from $F \leq F_{min}(\bar{\gamma})$ and Assumption (5)(ii). Thus, $\alpha(\lambda F) = 0$ and $X_R(F) = 0$. □

A.2 Cutoffs Proofs

The following lemma characterizes $F_{min}(\gamma)$.

Lemma 1. *For $\gamma \in (0, \bar{\gamma}]$, $F_{min}(\gamma)$ i) exists, ii) is positive, iii) is unique, and iv) satisfies $\frac{\partial F_{min}(\gamma)}{\partial \gamma} < 0$ for $\gamma \in (0, \bar{\gamma})$.*

Proof. i) The result follows from Assumption 1(iv) ($v(0, \gamma) < 0$), the monotonicity of v in F (Assumption 1(ii)), $\lim_{F\to\infty} v(F, \gamma) > 0$ (Assumption 3(iv)), and the intermediate value theorem.

ii) Recall that $v(F_{min}(\gamma), \gamma) = 0$ by the definition of $F_{min}(\gamma)$. If $F_{min}(\gamma) = 0$, $v(F_{min}(\gamma), \gamma) = v(0, \gamma)$ which implies $v(0, \gamma) = 0$ which is a contradiction of Assumption 1(iv).

ii) Uniqueness follows from the strict monotonicity of v in F (Assumption 1(ii)).

iii) The result follows from totally differentiating $v(F_{min}(\gamma), \gamma) = 0$:

$$\frac{\partial v(F_{min}(\gamma), \gamma)}{\partial F}\frac{\partial F_{min}(\gamma)}{\partial \gamma} + \frac{v(F_{min}(\gamma), \gamma)}{\partial \gamma} = 0$$

$$\implies \quad \frac{\partial F_{min}(\gamma)}{\partial \gamma} = -\frac{\frac{\partial v(F_{min}(\gamma), \gamma)}{\partial \gamma}}{\frac{\partial v(F_{min}(\gamma), \gamma)}{\partial F}} < 0 \quad \text{for } \gamma \in (0, \bar{\gamma})$$

where the inequality follows from Assumption 1(i), Assumption 1(ii), and $F_{min}(\gamma) > 0$. □

The following lemma characterizes $\gamma_{min}(F)$.

Lemma 2. *Let $F \geq F_{min}(\bar{\gamma})$. $\gamma_{min}(F)$ i) exists, ii) is positive, iii) is unique, and iv) satisfies $\frac{\partial \gamma_{min}(F)}{\partial F} < 0$ for $F > F_{min}(\bar{\gamma})$.*

Proof. i) The result follows from $v(F,0) < 0$ (Assumption 1(iii)), the monotonicity of v in γ (Assumption 1(i)), $v(F,\bar{\gamma}) \geq 0$ (which follows from $F \geq F_{min}(\bar{\gamma})$), and the intermediate value theorem.

ii) Recall that $v(F,\gamma_{min}(F)) = 0$ by the definition of $\gamma_{min}(F)$. If $\gamma_{min}(F) = 0$, $v(F,\gamma_{min}(F)) = v(F,0)$ which implies $v(F,0) = 0$ which is a contradiction of Assumption 1(iii).

iii) Uniqueness follows from the strict monotonicity of v in γ (Assumption 1(i)).

iv) First, I show that $\gamma_{min}(F) < \bar{\gamma}$ for $F > F_{min}(\bar{\gamma})$. Suppose $\gamma_{min}(F) = \bar{\gamma}$. Then, $\gamma_{min}(F) = \gamma_{min}(F_{min}(\bar{\gamma})) = \bar{\gamma}$ which implies $v(F,\bar{\gamma}) = v(F_{min}(\bar{\gamma}),\bar{\gamma}) = 0$ which contradicts Assumption 1(ii) as $F > F_{min}(\bar{\gamma}) > 0$.

The result follows from totally differentiating $v(F,\gamma_{min}(F)) = 0$:

$$\frac{\partial v(F,\gamma_{min}(F))}{\partial \gamma}\frac{\partial \gamma_{min}(F)}{\partial F} + \frac{\partial v(F,\gamma_{min}(F))}{\partial F} = 0$$

$$\implies \quad \frac{\partial \gamma_{min}(F)}{\partial F} = -\frac{\frac{\partial v(F,\gamma_{min}(F))}{\partial F}}{\frac{\partial v(F,\gamma_{min}(F))}{\partial \gamma}} < 0 \quad \text{for } F > F_{min}(\bar{\gamma})$$

where the inequality follows from Assumption 1(i), Assumption 1(ii), $F > F_{min}(\bar{\gamma}) > 0$, and $\gamma_{min}(F) < \bar{\gamma}$. □

The following lemma characterizes $F^*(\gamma)$.

Lemma 3. *For $\gamma \in (0,\bar{\gamma}]$, $F^*(\gamma)$ i) exists, ii) is positive, iii) is unique, and iv) $\frac{\partial F^*(\gamma)}{\partial \gamma} < 0$ for $\gamma \in (0,\bar{\gamma})$.*

Proof. i) Let $h(x) \equiv v(x,\gamma) + \tilde{V}_R - V_R(\gamma)$. Note that Assumption 3(iv) implies $\lim_{x\to\infty} h(x) > 0$. $h(0) < 0$ by Assumption 3(ii) ($V_R(0) > \tilde{V}_R$) and Assumption 1(iv) ($v(0,\gamma) < 0$). Additionally, $\frac{\partial h(x)}{\partial x} > 0$ for $x > 0$ by Assumption 1(ii) (the monotonicity of $v(F,\gamma)$ in F). The existence of $F^*(\gamma)$ follows by the intermediate value theorem.

ii) Suppose $F^*(\gamma) = 0$. Then, $v(0,\gamma) + \tilde{V}_R = V_R(\gamma)$ which contradicts Assumption 3(ii) ($V_R(0) > \tilde{V}_R$) and Assumption 1(iv) ($v(0,\gamma) < 0$).

iii) Uniqueness follows by the strict monotonicity of $h(x)$.

iv) Totally differentiating $v(F^*(\gamma),\gamma) + \tilde{V}_R = V_R(\gamma)$ with respect to γ yields

$$\frac{\partial v(F^*(\gamma),\gamma)}{\partial \gamma} + \frac{\partial v(F^*(\gamma),\gamma)}{\partial F}\frac{\partial F^*(\gamma)}{\partial \gamma} = \frac{\partial V_R(\gamma)}{\partial \gamma}$$

$$\implies \quad \frac{\partial F^*(\gamma)}{\partial \gamma} = \frac{\frac{\partial V_R(\gamma)}{\partial \gamma} - \frac{\partial v(F^*(\gamma),\gamma)}{\partial \gamma}}{\frac{\partial v(F^*(\gamma),\gamma)}{\partial F}} < 0 \quad \text{for } \gamma \in (0, \bar{\gamma})$$

where the inequality follows from $\frac{\partial v(F^*(\gamma),\gamma)}{\partial \gamma} > \frac{\partial V_R(\gamma)}{\partial \gamma}$ for $\gamma \in (0, \bar{\gamma})$ and $F^*(\gamma) > 0$ (Assumption 3(iii)), and $\frac{\partial v(F^*(\gamma),\gamma)}{\partial F} > 0$ (Assumption 1(ii)) as $\gamma \in (0, \bar{\gamma})$ and $F^*(\gamma) > 0$. □

The following Lemma characterizes $\gamma^*(F)$.

Lemma 4. *Suppose $F \geq F^*(\bar{\gamma})$. $\gamma^*(F)$ i) exists, ii) is positive, iii) is unique, and iv) $\frac{\partial \gamma^*(F)}{\partial F} < 0$ for $F > F^*(\bar{\gamma})$.*

Proof. i) Let $h(x) \equiv v(F, x) + \tilde{V}_R - V_R(x)$. Note that $h(\bar{\gamma}) \geq 0$ by $F \geq F^*(\bar{\gamma})$, and $h(0) < 0$ by Assumption 1(iii) ($v(F, 0) < 0$) and Assumption 3(ii) ($V_R(0) > \tilde{V}_R$). Additionally, $\frac{\partial h(x)}{\partial x} > 0$ by Assumption 3(iii). The existence of $\gamma^*(F)$ follows by the intermediate value theorem.

ii) Suppose $\gamma^*(F) = 0$. Then, $v(F, 0) = V_R(0) - \tilde{V}_R$ which contradicts Assumption 1(iii) ($v(F, 0) < 0$) and Assumption 3(ii) ($V_R(0) > \tilde{V}_R$)

iii) Uniqueness follows by the strict monotonicity of $h(x)$.

iv) First, I show that $\gamma^*(F) < \bar{\gamma}$ for $F > F^*(\bar{\gamma})$. Suppose $\gamma^*(F) = \bar{\gamma}$. Then, $\gamma^*(F) = \gamma^*(F^*(\bar{\gamma})) = \bar{\gamma}$ which implies $v(F, \bar{\gamma}) + \tilde{V}_R - V_R(\bar{\gamma}) = v(F^*(\bar{\gamma}), \bar{\gamma}) + \tilde{V}_R - V_R(\bar{\gamma}) = 0$. This implies $v(F, \bar{\gamma}) = v(F^*(\bar{\gamma}), \bar{\gamma})$ which contradicts Assumption 1(ii) as $F > F^*(\bar{\gamma}) > 0$.

Totally differentiating $v(F, \gamma^*(F)) + \tilde{V}_R = V_R(\gamma^*(F))$ with respect to F yields

$$\frac{\partial v(F, \gamma^*(F))}{\partial F} + \frac{\partial v(F, \gamma^*(F))}{\partial \gamma} \frac{\partial \gamma^*(F)}{\partial F} = \frac{\partial V_R(\gamma^*(F))}{\partial \gamma} \frac{\partial \gamma^*(F)}{\partial F}$$

$$\implies \quad \frac{\partial v(F, \gamma^*(F))}{\partial F} = \left(\frac{\partial V_R(\gamma^*(F))}{\partial \gamma} - \frac{\partial v(F, \gamma^*(F))}{\partial \gamma} \right) \frac{\partial \gamma^*(F)}{\partial F}$$

$$\implies \quad \frac{\partial \gamma^*(F)}{\partial F} = \frac{\frac{\partial v(F,\gamma^*(F))}{\partial F}}{\frac{\partial V_R(\gamma^*(F))}{\partial \gamma} - \frac{\partial v(F,\gamma^*(F))}{\partial \gamma}} < 0 \quad \text{for } F > F^*(\bar{\gamma})$$

where the inequality follows from $\frac{\partial v(F,\gamma^*(F))}{\partial \gamma} > \frac{\partial V_R(\gamma^*(F))}{\partial \gamma}$ for $\gamma \in (0, \bar{\gamma})$ and $F > 0$ (Assumption 3(iii)), $\frac{\partial v(F,\gamma^*(F))}{\partial F} > 0$ for $\gamma \in (0, \bar{\gamma}]$ and $F > 0$ (by Assumption 1(ii)), $F > F^*(\bar{\gamma}) > 0$, and $\gamma^*(F) < \bar{\gamma}$. □

This threshold γ_U exists and is unique by the following lemma.

Lemma 5. *There exists a unique $\gamma_U \in (0, \bar{\gamma})$ such that $\int_{\gamma_U}^{\bar{\gamma}} V_U(\gamma) g_1(\gamma; \gamma_U) d\gamma = \tilde{V}_U$.*

Proof. Let $h(x) \equiv \int_x^{\bar{\gamma}} V_U(\gamma) g_1(\gamma; x) d\gamma - \tilde{V}_U$. Note that $\lim_{x \to +\bar{\gamma}} h(x) < 0$ by Assumption 2(ii) and $h(0) > 0$ by Assumption 4. For $x \in [0, \bar{\gamma})$,

$$h(x) = \int_x^{\bar{\gamma}} V_U(\gamma) g_1(\gamma; x) d\gamma = \frac{1}{1 - P(x)} \int_x^{\bar{\gamma}} V_U(\gamma) p(\gamma) d\gamma$$

and

$$\begin{aligned}
\frac{\partial h(x)}{\partial x} &= \frac{p(x)}{[1 - P(x)]^2} \left(\int_x^{\bar{\gamma}} V_U(\gamma) p(\gamma) d\gamma \right) + \frac{1}{1 - P(x)} \left(-V_U(x) p(x) \right) \\
&= \frac{1}{[1 - P(x)]^2} \left(\int_x^{\bar{\gamma}} V_U(\gamma) p(\gamma) p(x) d\gamma \right) + \left(\frac{1}{1 - P(x)} \right) \left(-V_U(x) p(x) \right) \int_x^{\bar{\gamma}} \frac{p(\gamma)}{1 - P(x)} d\gamma \\
&= \frac{1}{[1 - P(x)]^2} \left(\int_x^{\bar{\gamma}} V_U(\gamma) p(\gamma) p(x) d\gamma \right) - \frac{1}{[1 - P(x)]^2} \int_x^{\bar{\gamma}} V_U(x) p(x) p(\gamma) d\gamma \\
&= \frac{1}{[1 - P(x)]^2} \left(\int_x^{\bar{\gamma}} \left(V_U(\gamma) - V_U(x) \right) p(\gamma) p(x) d\gamma \right) \\
&< 0
\end{aligned}$$

where the last inequality follows by Assumption 2(i) ($\frac{\partial V_U(\gamma)}{\partial \gamma} < 0$ for $\gamma \in (0, \bar{\gamma})$) and positivity of $p(\gamma)$. The existence of γ_U follows by Bolzano's theorem and uniqueness follows by the strict monotonicity of $h(x)$. □

A.3 Comparative Static Results

First, consider $\tilde{V}_R$. Recall that $\tilde{V}_R$ represents the discounted present value of retailer profit if the the retailer is refused the input in stage 2.

Lemma 6. *i)* $\frac{\partial F^*(\gamma)}{\partial \tilde{V}_R} < 0$ *for* $\gamma \in (0, \bar{\gamma}]$,
ii) $\frac{\partial \gamma^*(F)}{\partial \tilde{V}_R} < 0$ *for all* $F > F^*(\bar{\gamma})$

Proof. i) Totally differentiating $v(F^*(\gamma), \gamma) + \tilde{V}_R = V_R(\gamma)$ with respect to $\tilde{V}_R$ yields:

$$\frac{\partial v(F^*(\gamma), \gamma)}{\partial F} \frac{\partial F^*(\gamma)}{\partial \tilde{V}_R} + 1 = 0$$

$$\implies \quad \frac{\partial F^*(\gamma)}{\partial \tilde{V}_R} = -\frac{1}{\frac{\partial v(F^*(\gamma), \gamma)}{\partial F}} < 0 \quad \text{for } \gamma \in (0, \bar{\gamma}]$$

where the inequality follows from Assumption 1(ii) and $F^*(\gamma) > 0$ (by Lemma 3(ii)).

ii) Totally differentiating $v(F,\gamma^*(F)) + \tilde{V}_R = V_R(\gamma^*(F))$ with respect to $\tilde{V}_R$ yields:

$$\frac{\partial v(F,\gamma^*(F))}{\partial \gamma}\frac{\partial \gamma^*(F)}{\partial \tilde{V}_R} + 1 = \frac{\partial V_R(\gamma^*(F))}{\partial \gamma}\frac{\partial \gamma^*(F)}{\partial \tilde{V}_R}$$

$$\implies \quad \frac{\partial \gamma^*(F)}{\partial \tilde{V}_R} = -\frac{1}{\frac{\partial v(F,\gamma^*(F))}{\partial \gamma} - \frac{\partial V_R(\gamma^*(F))}{\partial \gamma}} < 0 \quad \text{for } F > F^*(\bar{\gamma})$$

where the inequality follows from Assumption 3(iii), $\gamma^*(F) < \bar{\gamma}$ (which follows fromfor $F > F^*(\bar{\gamma})$), $\gamma^*(F) > 0$ (by Lemma 4(ii)), and $F > F^*(\bar{\gamma}) > 0$. □

Next, consider $\tilde{V}_U$, the discounted present value of supplier payoff if they refuse the retailer the input in stage 2.

Lemma 7. $\frac{\partial \gamma_U}{\partial \tilde{V}_U} < 0$

Proof. Recall that $\gamma_U \in (0,\bar{\gamma})$ by Lemma 5 and γ_U satisfies

$$\int_{\gamma_U}^{\bar{\gamma}} V_U(\gamma) g_1(\gamma;\gamma_U) d\gamma = \tilde{V}_U$$

or

$$\frac{1}{[1-P(\gamma_U)]}\int_{\gamma_U}^{\bar{\gamma}} V_U(\gamma)p(\gamma)d\gamma = \tilde{V}_U.$$

Totally differentiating both sides with respect to $\tilde{V}_U$ yields

$$\begin{aligned}
1 &= \frac{\partial \gamma_U}{\partial \tilde{V}_U}\left[\frac{p(\gamma_U)}{[1-P(\gamma_U)]^2}\left(\int_{\gamma_U}^{\bar{\gamma}} V_U(\gamma)p(\gamma)d\gamma\right) + \frac{1}{1-P(\gamma_U)}\left(-V_U(\gamma_U)p(\gamma_U)\right)\right] \\
&= \frac{\partial \gamma_U}{\partial \tilde{V}_U}\left[\frac{1}{[1-P(\gamma_U)]^2}\left(\int_{\gamma_U}^{\bar{\gamma}} V_U(\gamma)p(\gamma)p(\gamma_U)d\gamma\right) + \left(\frac{1}{1-P(\gamma_U)}\right)\left(-V_U(\gamma_U)p(\gamma_U)\right)\int_{\gamma_U}^{\bar{\gamma}}\frac{p(\gamma)}{1-P(\gamma_U)}d\gamma\right] \\
&= \frac{\partial \gamma_U}{\partial \tilde{V}_U}\left[\frac{1}{[1-P(\gamma_U)]^2}\left(\int_{\gamma_U}^{\bar{\gamma}} V_U(\gamma)p(\gamma)p(\gamma_U)d\gamma\right) - \frac{1}{[1-P(\gamma_U)]^2}\int_{\gamma_U}^{\bar{\gamma}} V_U(\gamma_U)p(\gamma_U)p(\gamma)d\gamma\right] \\
&= \frac{\partial \gamma_U}{\partial \tilde{V}_U}\left[\frac{1}{[1-P(\gamma_U)]^2}\left(\int_{\gamma_U}^{\bar{\gamma}} \left(V_U(\gamma) - V_U(\gamma_U)\right)p(\gamma)p(\gamma_U)d\gamma\right)\right]
\end{aligned}$$

$$\implies \quad \frac{\partial \gamma_U}{\partial \tilde{V}_U} = \left[\frac{1}{[1-P(\gamma_U)]^2}\left(\int_{\gamma_U}^{\bar{\gamma}} \left(V_U(\gamma) - V_U(\gamma_U)\right)p(\gamma)p(\gamma_U)d\gamma\right)\right]^{-1} < 0$$

where the last inequality follows by Assumption 2(i) ($\frac{\partial V_U(\gamma)}{\partial \gamma} < 0$ for $\gamma \in (0,\bar{\gamma})$) and positivity of $p(\gamma)$. □