Technical Appendix for "Supplier Retaliation and the Illinois Brick Rule"

Douglas Turner

B Additional Analysis and Extensions

B.1 $v(F, \gamma)$ Examples

The source of differences in retailer litigiousness may be driven by a number of different factors. In this subsection, I present a number of underlying sources of differences in retailer litigiousness and examples of functions $v(F, \gamma)$ that satisfy Assumption 1.

Example 1 (Likelihood of a Successful Claim): In this example, differences in retailer litigiousness are driven by differences in retailers' beliefs regarding the likelihood of the damage claim being successful. Let $\gamma \in [0, 1]$ (thus, $\bar{\gamma} = 1$) denote a retailer's subjective beliefs regard regarding its likelihood of winning a particular case. F denotes the true damage award that the retailer receives if the suit is successful. Let $L > 0$ denote the retailer's time and legal costs. Let $u(\cdot)$ denote the retailer's strictly increasing utility function over money. Let $I > L$ denote the retailers initial endowment of money. The retailer's subjective valuation of its claim is[67]

$$v(F, \gamma) = \gamma u \left(I + F - L\right) + (1 - \gamma)u(I - L) - u(I). \tag{4}$$

It remains to show that $v(F, \gamma)$ in Equation (4) satisfies Assumption 1. First, consider Assumption 1(i). $\frac{\partial v(F,\gamma)}{\partial \gamma} = u\left(I + F - L\right) - u(I - L) > 0$ for $F > 0$. Next, consider Assumption 1(ii). $\frac{\partial v(F,\gamma)}{\partial F} = \omega u' \left(I + F - L\right) > 0$. Next, consider Assumption 1(iii). $v(F, 0) = u(I - L) - u(I) < 0$ holds by $L > 0$. Assumption 1(iv) holds by $v(0, \gamma) = u(I - L) - u(I) < 0$.

Example 2 (Estimates of the Size of the Claim): In this example, differences in retailer litigiousness are driven by differences in retailers' beliefs regarding the value of the claim. F denotes the true damage award that the retailer receives if the suit is successful (which is unobserved by the retailer). γF where $\gamma \in [0, \bar{\gamma}]$ denotes the retailer's estimate of its damage award if successful (e.g., if $\gamma > (<) 1$, then the retailer overestimates (underestimates) the value of its claim). Let $L > 0$ denote

[67] Equation (4) supposes that each party in a lawsuit pays its own legal fees. If the lawsuit is antitrust related, the Clayton Act permits injured parties to recover the cost of the suit. Thus, the retailer receives a payoff of $I + F$ instead of $I + F - L$ if the claim is successful. Note that if the losing party is required to pay the winning party's legal costs and the suit is unsuccessful, then the retailer receives a payoff of $I - L - L_U$ (where L_U denotes the supplier's legal costs), instead of $I - L$.

the retailer's time and legal costs. Let $u(\cdot)$ denote the retailer's strictly increasing utility function over money. ω denotes the likelihood of the damage claim being successful. Let $I > L$ denote the retailer's initial endowment of money. The retailer's subjective valuation of its claim is

$$v(F,\gamma) = \omega u\left(I + \gamma F - L\right) + (1-\omega)u(I-L) - u(I). \tag{5}$$

It remains to show that $v(F,\gamma)$ in Equation (5) satisfies Assumption 1. First, consider Assumption 1(i). $\frac{\partial v(F,\gamma)}{\partial \gamma} = \omega F u'\left(I + \gamma F - L\right) > 0$ for $F > 0$. Next, consider Assumption 1(ii). $\frac{\partial v(F,\gamma)}{\partial F} = \omega\gamma u'\left(I + \gamma F - L\right) > 0$. Next, consider Assumption 1(iii). $v(F,0) = u(I-L) - u(I) < 0$ holds for all $F > 0$ by $L > 0$. Assumption 1(iv) holds by $v(0,\gamma) = u(I-L) - u(I) < 0$.

Example 3 (Legal Costs): In this example, differences in retailer litigiousness are driven by differences in retailers' legal costs. Suppose $v(F,\gamma) = F - \frac{L}{\gamma}$ where $\gamma \in [0,\bar{\gamma}]$. $\frac{L}{\gamma}$ is understood to equal ∞ when $\gamma = 0$. $\frac{L}{\gamma}$ represents a retailer's legal costs. Higher values of γ correspond to lower legal costs and, as a result, a stronger propensity to sue. It remains to show that $v(F,\gamma)$ satisfies Assumption 1. First, consider Assumption 1(i). $\frac{\partial v(F,\gamma)}{\partial \gamma} = \frac{L}{\gamma^2} > 0$ for $F > 0$. Next, consider Assumption 1(ii). $\frac{\partial v(F,\gamma)}{\partial F} = 1 > 0$. Next, consider Assumption 1(iii). $v(F,0) = -\infty < 0$ holds for all $F > 0$. Assumption 1(iv) holds by $v(0,\gamma) = -\frac{L}{\gamma} < 0$.

Example 4 (Executive Compensation): In this example, differences in retailer litigiousness are driven by differences in retail managers' (or executives') compensation structures. For example, executives/managers at certain retailers may personally benefit from a damage award (through their compensation contracts) to greater extent than managers employed by other retailers. These differences may drive differences in the propensity to sue. To illustrate, suppose the retail manager's compensation consists of a base wage and a performance related bonus. The performance related bonus is larger when the firm receives an influx of cash from a successful damage claim. Formally, the manager's performance related bonus is γF if the claim is successful. If the claim is unsuccessful, the manager does not receive a performance related bonus and incurs a fixed penalty $M > 0$. M represents negative consequences from an unsuccessful damage claim such as a loss of goodwill with shareholders/higher level executives, reputational damage, or the possibility of termination. Thus, a manager values a damage claim according to

$$v(F,\gamma) = \omega\gamma F - (1-\omega)\,M \tag{6}$$

where $\omega \in (0,1)$ represents the manager's belief regarding the likelihood of a successful damage claim. It remains to show that $v(F,\gamma)$ in Equation (6) satisfies Assumption 1. First, consider Assumption

1(i). $\frac{\partial v(F,\gamma)}{\partial \gamma} = \omega F > 0$ for $F > 0$. Next, consider Assumption 1(ii). $\frac{\partial v(F,\gamma)}{\partial F} = \omega\gamma > 0$. Next, consider Assumption 1(iii). $v(F,0) = -(1-\omega)M < 0$ holds for all $F > 0$. Assumption 1(iv) holds by $v(0,\gamma) = -(1-\omega)M < 0$.

B.2 $V_R(\gamma)$ and $V_U(\gamma)$ Example

In this section, I provide examples of the functions $V_U(\gamma)$ and $V_R(\gamma)$ which satisfy Assumption 2, Assumption 3, and Assumption 4. Formally, suppose a third stage is added the model in the main text. In the third stage, retailers (if not refused the input in stage 2) have the opportunity to file a second lawsuit against the supplier. The timing of the expanded game is as follows. In the first stage, the retailer decides whether to file a claim or not file a claim. Any damage claim payments from the supplier to the retailer are made at the conclusion of stage 1.[68]In the second stage, the supplier observes the retailer's decision and decides whether to refuse to supply the input or not refuse to supply the input.

Stage 3 consists of three phases. In the first phase, retailers and suppliers receive profits from regular business operations (i.e., sales of their respective products not including profits or losses from litigation). If the supplier did not refuse to supply the retailer in stage 2, suppliers earn a profit of π_U from sales of the input, and retailers earn a profit of π_R from sales of the retail good. If the supplier refused to supply the retailer in stage 2, suppliers earn a profit of $\tilde{\pi}_U < \pi_U$, and retailers earn a profit of $\tilde{\pi}_R < \pi_R$.

In phase 2 of stage 3, after retailers and suppliers are awarded profits from regular business operations, the stochastic value of a second lawsuit/claim is realized. The second lawsuit may or may not be antitrust related. Let G denote the value of the claim. Both the supplier and the retailer's expectations regarding G are represented by the positive probability distribution function $m(G) : (0,\infty) \to (0,\infty)$. In phase 3 of stage 3, subsequent to the realization of G, retailers choose whether to pursue the second lawsuit or not pursue the second lawsuit. If a retailer is refused the input in stage 2, their business relationship with the supplier ceases and, therefore, additional opportunities to sue the supplier do not arise. A type γ retailer's subjective valuation of the claim is $v(G,\gamma)$.[69] As the game ends after stage 3, retailers cannot face retaliation after suing in stage 3. Thus, retailers sue if their subjective valuation of the stage 3 suit is positive (i.e., $v(G,\gamma) > 0$). Stage 3 profits, from both regular business operations and litigation, are discounted by a factor $\delta < 1$. Thus, $\delta\tilde{\pi}_R$ and $\delta\tilde{\pi}_U$ correspond to $\tilde{V}_R$ and

[68]Analogously, retailers incur any losses due to, for example, legal costs at the conclusion of stage 1. Thus, profits/losses from litigation in stage 1 are not discounted as are payoffs in stage 3.

[69]Thus, retailers evaluate the claim G according to the same function $v(\cdot,\gamma)$ as in stage 1. Thus, $G_{min}(\gamma) = F_{min}(\gamma)$ and satisfies the properties enumerated in Lemma 1.

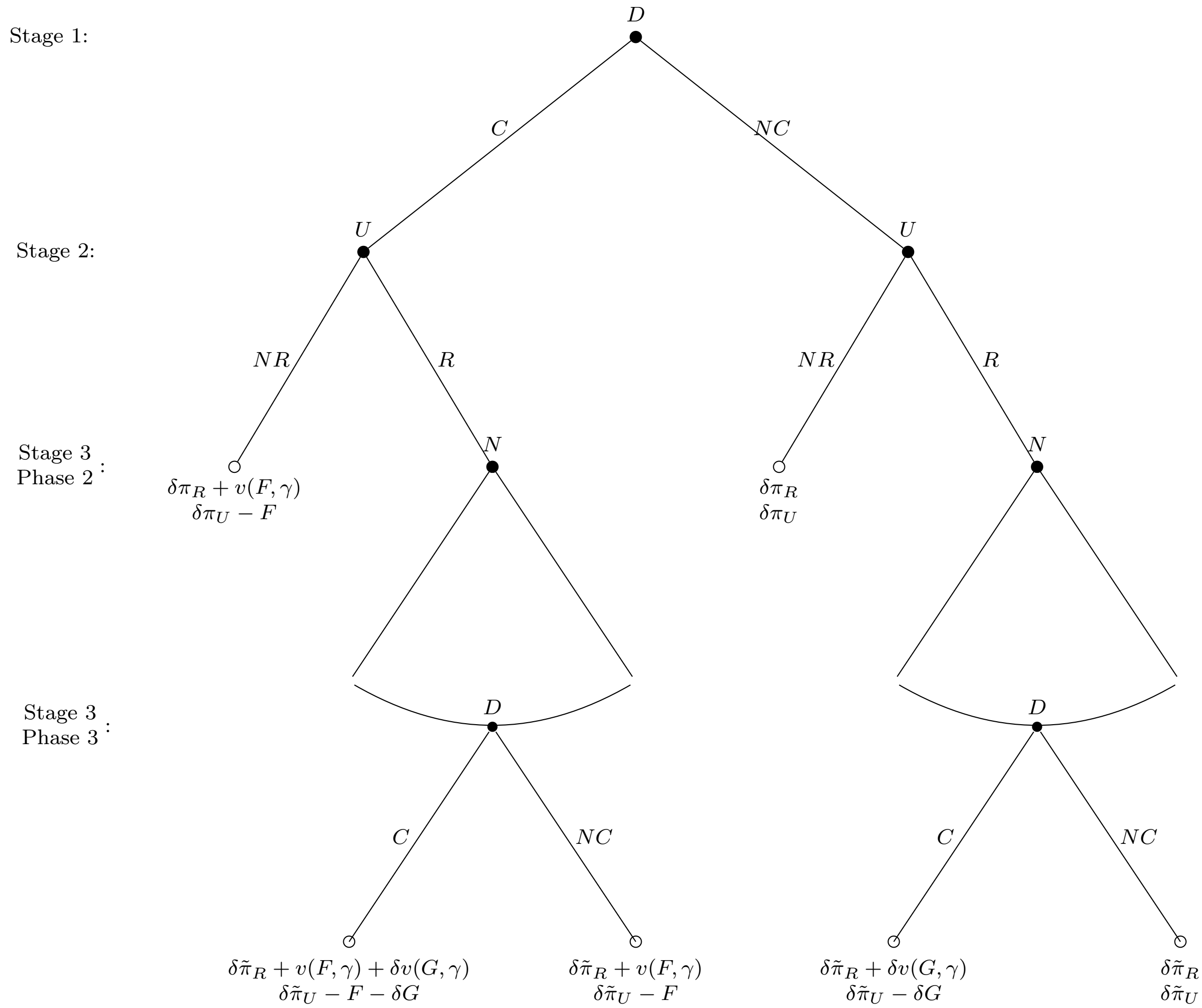

Figure 5: Expanded Game in Subsection B.2. N denotes Nature which determines G in Stage 3.

$\tilde{V}_U$, respectively, from the main text.

The extensive form of the game is illustrated in Figure 5. The (continuous) value of G is determined in phase 2 of stage 3 by player N (which denotes Nature). Phase 1 of stage 3 is not depicted as phase 1 does not involve a choice by any player. For expositional clarity, I set U's legal costs to zero and assume all claims (in both stages) are successful with probability 1. Thus, U's payment to D (i.e., U's loss in profit) if D chooses to file a claim is F (in stage 1) and G (in stage 3), as shown in Figure 5.[70]

$V_R(\gamma)$ represents the discounted present value of the retailer's payoff when the retailer is not refused

[70]This assumption is primarily for expositional clarify. U's legal costs could be accounted for in Equation (9) without qualitatively changing the results. Additionally, the possibility of an unsuccessful suit could be accounted for by adding an additional stage wherein nature determines if the claim was successful. Note that U's decision to retaliate or not retaliate in stage 2 is driven by what the decision to sue reveals about D's litigiousness γ. Thus, whether the claim was successful at trial does not impact U's likelihood of retaliation.

the input in stage 2.

$$V_R(\gamma) = \delta\left[\pi_R + E\left[\max\left\{v(G,\gamma),0\right\}\right]\right] = \begin{cases} \delta\left[\pi_R + \int_{G_{min}(\gamma)}^{\infty} v(G,\gamma)m(G)dG\right] & \text{if } \gamma > 0 \\ \delta\pi_R & \text{if } \gamma = 0 \end{cases} \tag{7}$$

where the expectation is over the size of the stage 3 claim (G). Note that a retailer with $\gamma = 0$ never files a claim in stage 3.

It remains to show that $V_R(\gamma)$ defined in Equation (7) satisfies Assumption 3.

Assumption 3(i): $\frac{\partial V_R(\gamma)}{\partial\gamma}$ is non-negative for $\gamma \in (0,\bar{\gamma})$ if, using Leibniz rule,[71]

$$\frac{\partial V_R(\gamma)}{\partial\gamma} = \delta\left(-v(G_{min}(\gamma),\gamma)m(G_{min}(\gamma))\frac{\partial G_{min}(\gamma)}{\partial\gamma} + \int_{G_{min}(\gamma)}^{\infty}\frac{\partial v(G,\gamma)}{\partial\gamma}m(G)dG\right) > 0 \tag{8}$$

where $\frac{\partial G_{min}(\gamma)}{\partial\gamma} < 0$ by Lemma 1(iv) and $\frac{\partial v(G,\gamma)}{\partial\gamma} > 0$ by Assumption 1(i).

Assumption 3(ii): $V_R(0) = \delta\pi_R > \delta\tilde{\pi}_R$ which holds by $\pi_R > \tilde{\pi}_R$.

Assumption 3(iii): $\frac{\partial v(F,\gamma)}{\partial\gamma} > \frac{\partial V_R(\gamma)}{\partial\gamma}$ for $\gamma \in (0,\bar{\gamma})$ and $F > 0$ if[72]

$$\frac{\partial V_R(\gamma)}{\partial\gamma} = \delta\left(-v(G_{min}(\gamma),\gamma)m(G_{min}(\gamma))\frac{\partial G_{min}(\gamma)}{\partial\gamma} + \int_{G_{min}(\gamma)}^{\infty}\frac{\partial v(G,\gamma)}{\partial\gamma}m(G)dG\right) < \frac{\partial v(F,\gamma)}{\partial\gamma}.$$

This inequality holds, for example, when the discount rate is sufficiently small.

Assumption 3(iv): $\lim_{F\to\infty} v(F,\gamma) + \tilde{V}_R - V_R(\gamma) > 0$ for $\gamma \in (0,\bar{\gamma}]$ holds if $\lim_{F\to\infty} v(F,\gamma)$ is sufficiently large. Assumption 3(iv) holds trivially for $v(F,\gamma) = \gamma F - L$ as $\lim_{F\to\infty} v(F,\gamma) = \infty$ for $\gamma > 0$. Additionally, this condition holds for all examples in subsection B.1 if $\lim_{x\to\infty} u(x) = \infty$.

$V_U(\gamma)$ represents the expected discounted present value of the supplier's payoff from continuing provide the input to the retailer.

$$V_U(\gamma) = \delta\left[\pi_U - E[X(G,\gamma)G]\right] = \begin{cases} \delta\left[\pi_U - \int_{G_{min}(\gamma)}^{\infty} Gm(G)dG\right] & \text{if } \gamma > 0 \\ \delta\pi_U & \text{if } \gamma = 0 \end{cases} \tag{9}$$

where $X(G,\gamma) = \begin{cases} 1 & \text{if } v(\gamma,G) \geq 0 \\ 0 & \text{if } v(\gamma,G) < 0 \end{cases}$ and the expectation is over the size of the stage 3 claim (G). Note that a retailer with $\gamma = 0$ never files a claim in stage 3.

[71] Leibniz rule can be applied to Equation (8) if the function $\frac{\partial v(G,\gamma)}{\partial\gamma}m(G)$ is suitably well behaved as G approaches ∞. Formally, the assumptions of the Lebesgue Dominated Convergence Theorem must be satisfied (see https://math.hawaii.edu/~rharron/teaching/MAT203/LeibnizRule.pdf).

[72] See footnote 71.

It remains to show that $V_R(\gamma)$ defined in Equation (9) satisfies Assumption 2 and Assumption 4.

Assumption 2(i): $\frac{\partial V_U(\gamma)}{\partial \gamma} < 0$ for $\gamma \in (0, \bar{\gamma})$ holds if, using the Fundamental Theorem of Calculus,

$$\frac{\partial V_U(\gamma)}{\partial \gamma} = -\delta\left(-G_{min}(\gamma)m(G_{min}(\gamma))\frac{\partial G_{min}(\gamma)}{\partial \gamma}\right) = \delta G_{min}(\gamma)m\left(G_{min}(\gamma)\right)\frac{\partial G_{min}(\gamma)}{\partial \gamma} < 0$$

where the inequality holds by $\frac{\partial G_{min}(\gamma)}{\partial \gamma} < 0$ (see Lemma 1(iv)).

Assumption 2(ii): $V_U(\bar{\gamma}) < \tilde{V}_U$ holds if $V_U(\bar{\gamma}) = \delta\left[\pi_U - E[X(G,\bar{\gamma})G]\right] = \delta\left[\pi_U - \int_{G_{min}(\bar{\gamma})}^{\infty} Gm(G)dG\right] < \delta\tilde{\pi}_U = \tilde{V}_U$ or

$$\int_{G_{min}(\bar{\gamma})}^{\infty} Gm(G)dG > \pi_U - \tilde{\pi}_U$$

which holds if the stage 3 claim G is sufficiently large in expectation or if sales to the retailer are relatively unimportant for the supplier (i.e., $\pi_U - \tilde{\pi}_U$ is small).

Assumption 2(iii): $\tilde{V}_U < V_U(0)$ holds by $V_U(0) = \delta\left[\pi_U - E[X(G,0)G]\right] = \delta\pi_U > \delta\tilde{\pi}_U = \tilde{V}_U$.

Lastly, consider Assumption 4. Assumption 4 states

$$\int_0^{\bar{\gamma}} V_U(\gamma)p(\gamma)d\gamma = \int_0^{\bar{\gamma}} \delta\left[\pi_U - E[X(G,\gamma)G]\right]p(\gamma)d\gamma > \delta\tilde{\pi}_U = \tilde{V}_U$$

and holds if the supplier believes the retailer is unlikely to be highly litigious (i.e., $p(\gamma)$ is small for large values of γ) prior to the initial stage.

B.3 Multiple Retailers

In this section, I consider a duopoly setting wherein two retailers purchase the input from the supplier and engage in downstream retail competition.[73] The presence of retail competition, all else equal, is beneficial for U but reduces the profits of the retailers.[74]

The timing of the game proceeds as follows. In stage 1, both retailers simultaneously decide whether to file a claim against the supplier. The size of each retailer's claim is F. As in the main text, $v(F,\gamma)$ denotes a type-γ retailer's subjective estimate/valuation of the payoff to be earned from pursuing a damage claim of size F. $v(F,\gamma)$ satisfies Assumption 1. Retailers are assumed to have perfect knowledge of their rival's litigiousness.[75] In the second stage, the supplier observes both retailers' decisions in

[73] If two retailers purchase the input from the supplier but operate in distinct markets (i.e., the retailers are not downstream competitors), the analysis of the main text holds independently for each retailer.

[74] This reflects, for example, additional retail competition reducing the impact of double marginalization.

[75] The accuracy of this assumption likely depends on the degree of past interaction between the two retailers. If the two retailers have both encountered opportunities to sue in the past and observed each other's litigation decisions, they may have acquired relatively strong knowledge of each other's propensity to sue. While this assumption is relatively

the first stage. Additionally, the supplier decides whether to continue to supply the input or refuse to supply the input to each retailer. Thus, there are four information sets in stage 2. Information set 1 is reached when both retailers file claims in stage 1. Information set 2 is reached when retailer 1 files a claim in stage 1, but retailer 2 does not. Correspondingly, information set 3 is reached when retailer 2 files a claim in stage 1, but retailer 1 does not. Finally, information set 4 is reached when neither retailer files a claim in stage 1.

Let $s_{D1}(\gamma_1, \gamma_2) \in \{C, NC\}$ denote the strategy of retailer 1 when retailer 1's litigiousness is γ_1 and retailer 2's litigiousness is γ_2. $s_{D2}(\gamma_1, \gamma_2) \in \{C, NC\}$ is defined analogously. U's strategy specifies its action at each information set. At each information set, U's strategy consists of an ordered pair $(x, y) \in \{R, NR\} \times \{R, NR\}$ where, for example, (R, NR) represents retaliation against retailer 1 and no retaliation against retailer 2. Thus, U's strategy is a 4-tuple $s_U = (i, j, k, m) \in \{\{R, NR\} \times \{R, NR\}\}^4$ where i denotes U's action at information set 1, j denotes U's action at information set 2, k denotes U's action at information set 3, and m denotes U's action at information set 4. After stage 1, U updates its beliefs regarding $D1$ and $D2$'s types according to Bayes' rule.

Let $V_U^M(\gamma)$ denote the discounted present value of U's payoff from continuing to supply the input to a single, monopoly retailer with litigiousness γ and refusing to supply the input to the other retailer. Let $V_U^D(\gamma_1, \gamma_2)$ denote the discounted present value of U's payoff from continuing to supply the input to both retailers (i..e, a downstream duopoly) when $D1$ has litigiousness γ_1 and $D2$ has litigiousness γ_2. As in the main text, $\tilde{V}_U$ denotes the supplier's discounted present value from refusing to supply both retailers.

Assumption 7. *$V_U^M(\gamma)$, $V_U^D(\gamma_1, \gamma_2)$ and $\tilde{V}_U$ satisfy*

i) $\frac{\partial V_U^M(\gamma)}{\partial \gamma} < 0$ *for* $\gamma \in (0, \bar{\gamma})$, $\frac{\partial V_U^D(\gamma_1,\gamma_2)}{\partial \gamma_1} < 0$ *for* $\gamma_1 \in (0, \bar{\gamma})$, $\frac{\partial V_U^D(\gamma_1,\gamma_2)}{\partial \gamma_2} < 0$ *for* $\gamma_2 \in (0, \bar{\gamma})$,

ii) $V_U^M(\bar{\gamma}) < \tilde{V}_U$, $V_U^D(\gamma_1, \bar{\gamma}) < V_U^M(\gamma_1)$, $V_U^D(\bar{\gamma}, \gamma_2) < V_U^M(\gamma_2)$, *and*

iii) $\tilde{V}_U < V_U^M(0) < V_U^D(0, 0)$.

Assumption 7 mirrors Assumption 2 from the main text. Note that Assumption 8(ii) ensures that the supplier prefers refusing to supply the input to any retailer with litigiousness $\bar{\gamma}$. Assumption 8(iii) ensures the supplier prefers to sell to both retailers when retailer's propensities to sue are zero.

Let $V_R^M(\gamma)$ denote the discounted present value of a type-γ retailer's payoff when it is not refused the input in stage 2 and its rival is refused the input. $V_R^M(\gamma)$ is equivalent to the function $V_R(\gamma)$ from the main text as the retailer's rival is refused the input and therefore is not a competitor in future periods. Let $V_R^D(\gamma)$ denote the discounted present value of a retailer's payoff when the retailer's

strong, it greatly simplifies the analysis. If retailers were uncertain of their rival's litigiousness, it would be necessary to specify beliefs for both retailers.

litigiousness is γ, and neither retailer is refused the input in stage 2. As in the main text, $\tilde{V}_R$ denotes the discounted present value of a retailer's payoff when it is refused the input in stage 2. In this section, I assume that alternative suppliers or inputs are unavailable to a retailer who is refused the input in stage 2. Thus, a retailer is a downstream monopolist if its rival is refused the input.[76]

Assumption 8. *$V_R^M(\gamma)$ and $V_R^D(\gamma)$ satisfy*

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

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

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

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

v) $V_R^M(\gamma) > V_R^D(\gamma)$ *for* $\gamma \in [0, \bar{\gamma}]$.

Assumptions 8(i)-(iv) mirror Assumption 3 from the main text. Assumption 8(v) implies that the discounted present value of a retailer's payoff is greater when the retailer is a monopolist than a duopolist. Suppose a retailer expects their rival to be refused the input in stage 2. Additionally, suppose the retailer expects a refusal to deal in stage 2 if they sue and does 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 $V_R^M(\gamma)$ if they do not sue. Let $F_M^*(\gamma)$ satisfy $v(F_M^*(\gamma), \gamma) + \tilde{V}_R = V_R^M(\gamma)$. $F_M^*(\gamma)$ is a a threshold claim value such that a retailer with litigiousness γ (that expects their rival to be refused the input) wishes to sue (despite retaliation) if $F > F_M^*(\gamma)$ and not sue if $F < F_M^*(\gamma)$. $F_M^*(\gamma)$ is equivalent to the function $F^*(\gamma)$ from the main text as the retailer's rival is refused the input and therefore is not a competitor in future periods. Lemma 3 establishes that $F_M^*(\gamma)$ i) exists, ii) is positive, iii) is unique, and iv) $\frac{\partial F_M^*(\gamma)}{\partial \gamma} < 0$ for $\gamma \in (0, \bar{\gamma})$. Analogously, let $\gamma_M^*(F)$ satisfy $v(F, \gamma_M^*(F)) + \tilde{V}_R = V_R^M(\gamma_M^*(F))$. $\gamma_M^*(F)$ is a threshold γ value such that any retailer with $\gamma > \gamma_M^*(F)$ wishes to sue (despite expecting a subsequent refusal to deal in stage 2) when the value of the damage claim is F and the retailer expects their rival to be refused the input in stage 2. Lemma 4 establishes that, when $F \geq F_M^*(\bar{\gamma})$, $\gamma_M^*(F)$ i) exists, ii) is positive, iii) is unique, and iv) $\frac{\partial \gamma_M^*(F)}{\partial F} < 0$ for $F > F_M^*(\bar{\gamma})$.

Next, suppose a retailer expects their rival to not be refused the input in stage 2. Let $F_D^*(\gamma)$ satisfy $v(F_D^*(\gamma), \gamma) + \tilde{V}_R = V_R^D(\gamma)$. $F_D^*(\gamma)$ is a a threshold claim value such that a retailer with litigiousness γ (that expects their rival to not be refused the input) wishes to sue (despite retaliation) if $F > F_D^*(\gamma)$ and not sue if $F < F_D^*(\gamma)$. Analogous derivations to those in the proof of Lemma 3 (with $V_R^D(\gamma)$ in place of $V_R(\gamma)$) establish that $F_D^*(\gamma)$ i) exists, ii) is positive, iii) is unique, and iv) $\frac{\partial F_D^*(\gamma)}{\partial \gamma} < 0$ for

[76] This assumption is made primarily for simplicity. If a retailer who is refused the input can acquire the input (or an alternative) from other suppliers and continue to produce the retail good, $\tilde{V}_R$ would depend on the number of retailers who are refused the input, which complicates the analysis considerably.

$\gamma \in (0, \bar{\gamma})$. Let $\gamma_D^*(F)$ satisfy $v(F, \gamma_D^*(F)) + \tilde{V}_R = V_R^D(\gamma_D^*(F))$. $\gamma_D^*(F)$ is a threshold γ value such that such that any retailer with $\gamma > \gamma_D^*(F)$ wishes to sue (despite expecting a subsequent refusal to deal in stage 2) when the value of the damage claim is F and the retailer expects their rival to not be refused the input in stage 2. Analogous derivations to those in the proof of Lemma 4 establishes that, when $F \geq F_D^*(\bar{\gamma})$, $\gamma_D^*(F)$ i) exists, ii) is positive, iii) is unique, and iv) $\frac{\partial \gamma_D^*(F)}{\partial F} < 0$ for $F > F_D^*(\bar{\gamma})$.

Lemma 8. *i) $F_D^*(\gamma) < F_M^*(\gamma)$ for all $\gamma \in (0, \bar{\gamma}]$, and*

ii) $\gamma_D^*(F) < \gamma_M^*(F)$ for $F \geq F_M^*(\bar{\gamma})$.

Proof. i) $v(F_M^*(\gamma), \gamma) = V_R^M(\gamma) - \tilde{V}_R$ and $v(F_D^*(\gamma), \gamma) = V_R^D(\gamma) - \tilde{V}_R$. Thus, the result follows from $V_R^M(\gamma) > V_R^D(\gamma)$ (by Assumption 8(v)) and $\frac{\partial v(F,\gamma)}{\partial F} > 0$ for $\gamma \in (0, \bar{\gamma}]$ (by Assumption 1(ii)).

ii) $F_M^*(\bar{\gamma}) \leq F$ implies $\gamma_M^*(F) \leq \bar{\gamma}$ and $\gamma_D^*(F) < \bar{\gamma}$ by part (i). Suppose $\gamma_M^*(F) \leq \gamma_D^*(F)$. Let $\gamma_M^*(F) \leq \gamma \leq \gamma_D^*(F)$. Thus, $v(F, \gamma) + \tilde{V}_R \leq V_R^D(\gamma)$ and $v(F, \gamma) + \tilde{V}_R \geq V_R^M(\gamma)$ which imply $V_R^M(\gamma) \leq V_R^D(\gamma)$ which violates Assumption 8(v), a contradiction. □

Lemma 8 establishes that retailers have weaker incentives to sue when they anticipate their rival being refused the input in the following stage. This is the case because the retailer earns monopoly retail profits (rather than duopoly profits) if they decline to sue their supplier, and thus maintain access to the input, when their rival is refused the input.

Prior to the initial stage of the game, the supplier is uncertain of the two retailers' propensity to sue. The supplier's initial beliefs regarding the retailers' types are captured by a joint positive probability density function $p(\gamma_1, \gamma_2) : [0, \bar{\gamma}] \times [0, \bar{\gamma}] \to (0, \infty)$ and corresponding joint CDF $P(\gamma_1, \gamma_2) : [0, \bar{\gamma}] \times [0, \bar{\gamma}] \to [0, 1]$. Let $p_1(\gamma) : [0, \bar{\gamma}] \to (0, \infty)$ denote the marginal distribution for γ_1 and let $p_2(\gamma) : [0, \bar{\gamma}] \to (0, \infty)$ denote the marginal distribution for γ_2. After observing the retailers' decisions in stage 1, the supplier updates their beliefs regarding the retailers' type according to Bayes' rule. The following assumption governs the supplier's initial (or prior) beliefs.

Assumption 9. *i) $p(\gamma) \equiv p_1(\gamma) = p_2(\gamma)$, and*

ii) $\int_0^{\bar{\gamma}} \int_0^{\bar{\gamma}} V_U^D(\gamma_1, \gamma_2) p(\gamma_1, \gamma_2) d\gamma_1 d\gamma_2 > \tilde{V}_U$.

Assumption 9(i) states that retailers are symmetric in the sense that the marginal distributions of γ_1 and γ_2 are the same. Assumption 9(ii) mirrors Assumption 4 from the main text and reflects the fact that the supplier chose to supply both retailers prior to the initial stage.

In this section, I restrict attention to the "Separating-PC" equilibrium wherein the supplier retaliates against all retailers that file claims in stage 1. The existence of a "Separating-PC" equilibrium (as shown

	Retailer 2: C	Retailer 2: NC
Retailer 1: C	$v(F,\gamma_1)+\tilde{V}_R,\ \ v(F,\gamma_2)+\tilde{V}_R$	$v(F,\gamma_1)+\tilde{V}_R,\ \ V_R^M(\gamma_2)$
Retailer 1: NC	$V_R^M(\gamma_1),\ \ v(F,\gamma_2)+\tilde{V}_R$	$V_R^D(\gamma_1),\ \ V_R^D(\gamma_2)$

Table 1: Retailers' Game in Stage 1 under a Retail Duopoly

below) illustrates that supplier retaliation can occur in equilibrium, and that the threat of supplier retaliation can deter retailers from filing claims.

Suppose retailers anticipate retaliation if they file a claim and expect to face no retaliation if they do not file a claim. In stage 1, both retailers will choose to sue the supplier if

$$v(F,\gamma_1)+\tilde{V}_R \geq V_R^M(\gamma_1) \quad \text{and} \quad v(F,\gamma_2)+\tilde{V}_R \geq V_R^M(\gamma_2)$$

or $\gamma_1 \geq \gamma_M^*(F)$ and $\gamma_2 \geq \gamma_M^*(F)$. Note that a retailer is rewarded with a monopoly retail position (and corresponding payoff $V_R^M(\gamma_2)$) if it declines to sue the supplier. Retailer 1 will file a claim and retailer 2 will not file a claim if

$$v(F,\gamma_1)+\tilde{V}_R \geq V_R^D(\gamma_1) \qquad v(F,\gamma_2)+\tilde{V}_R \leq V_R^M(\gamma_2) \tag{10}$$

or $\gamma_1 \geq \gamma_D^*(F)$ and $\gamma_2 \leq \gamma_M^*(F)$. Conversely, retailer 1 will not file a claim and retailer 2 will file a claim if

$$v(F,\gamma_1)+\tilde{V}_R \leq V_R^M(\gamma_1) \qquad v(F,\gamma_2)+\tilde{V}_R \geq V_R^D(\gamma_2) \tag{11}$$

or $\gamma_1 \leq \gamma_M^*(F)$ and $\gamma_2 \geq \gamma_D^*(F)$. Note that when $\gamma_D^*(F) \leq \gamma_1 \leq \gamma_M^*(F)$ and $\gamma_D^*(F) \leq \gamma_2 \leq \gamma_M^*(F)$, there are multiple equilibria (in the sub-game) as the inequalities in (10) and (11) are both satisfied. Thus, only one retailer sues in equilibrium when $\gamma_D^*(F) \leq \gamma_1 \leq \gamma_M^*(F)$ and $\gamma_D^*(F) \leq \gamma_2 \leq \gamma_M^*(F)$, however, the suing retailer could be either retailer 1 or retailer 2.

Neither retailer will file a claim if

$$v(F,\gamma_1)+\tilde{V}_R \leq V_R^D(\gamma_1) \qquad v(F,\gamma_2)+\tilde{V}_R \leq V_R^D(\gamma_2)$$

or $\gamma_1 \leq \gamma_D^*(F)$ and $\gamma_2 \leq \gamma_D^*(F)$. Retailers' game in stage 1 are represented in normal form in Table 1.

Next, consider the supplier's decision at information set 1. The supplier wishes to retaliate against both retailers if

$$\tilde{V}_U > \max\left\{\int_{\gamma_M^*(F)}^{\bar{\gamma}} V_U^M(\gamma) g_1(\gamma;\gamma_M^*(F))d\gamma, \int_{\gamma_M^*(F)}^{\bar{\gamma}}\int_{\gamma_M^*(F)}^{\bar{\gamma}} V_U^D(\gamma_1,\gamma_2) g_1^D(\gamma_1,\gamma_2;\gamma_M^*(F),\gamma_M^*(F))d\gamma_1 d\gamma_2\right\} \tag{12}$$

where[77]

$$g_1^D(\gamma_1,\gamma_2;\gamma_M^*(F),\gamma_M^*(F)) \equiv \frac{p(\gamma_1,\gamma_2)}{\int_{\gamma_M^*(F)}^{\bar{\gamma}}\int_{\gamma_M^*(F)}^{\bar{\gamma}} p(\gamma_1,\gamma_2)d\gamma_1 d\gamma_2}$$

and

$$g_1(\gamma;\gamma_M^*(F)) \equiv \frac{p(\gamma)}{1-P(\gamma_M^*(F))}$$

as in the main text.

When information set 2 is reached, the supplier can infer that $\gamma_1 \geq \gamma_D^*(F)$ and $\gamma_2 \leq \gamma_D^*(F)$. The supplier wishes to retaliate against the suing retailer (i.e., retailer 1) and not retaliate against the retailer that declined to sue (i.e., retailer 2) if

$$\int_0^{\gamma_M^*(F)} V_U^M(\gamma) g_2(\gamma;\gamma_M^*(F))d\gamma > \max\left\{\tilde{V}_U, \int_0^{\gamma_M^*(F)}\int_{\gamma_D^*(F)}^{\bar{\gamma}} V_U^D(\gamma_1,\gamma_2) g_2^D(\gamma_1,\gamma_2;\gamma_D^*(F),\gamma_M^*(F))d\gamma_1 d\gamma_2\right\} \tag{13}$$

where

$$g_2^D(\gamma_1,\gamma_2;\gamma_D^*(F),\gamma_M^*(F)) \equiv \frac{p(\gamma_1,\gamma_2)}{\int_0^{\gamma_M^*(F)}\int_{\gamma_D^*(F)}^{\bar{\gamma}} p(\gamma_1,\gamma_2)d\gamma_1 d\gamma_2}$$

and

$$g_2(\gamma;\gamma_M^*(F)) \equiv \frac{p(\gamma)}{P(\gamma_M^*(F))}$$

as in the main text. By symmetry, Equation (13) also ensures the supplier wishes to retaliate against retailer 2 and not retaliate against retailer 1 at information set 3.

Finally, consider the supplier's decision to retaliate or not retaliate in stage 2 at information set 4. At information set 4, neither retailer has filed a claim in stage 1. Thus, the supplier can infer that

[77] The superscript "D" indicates that g_1^D is relevant for the expected payoff of the supplier at information set 1 when both retailers continue to receive the input and, thus, the downstream market is a duopoly.

$\gamma_1 \leq \gamma_D^*(F)$ and $\gamma_2 \leq \gamma_D^*(F)$. The supplier does not wish to retaliate against either retailer if

$$\int_0^{\gamma_D^*(F)} \int_0^{\gamma_D^*(F)} V_U^D(\gamma_1, \gamma_2) g_4^D(\gamma_1, \gamma_2; \gamma_D^*(F), \gamma_D^*(F)) d\gamma_1 d\gamma_2 > \max \left\{ \tilde{V}_U, \int_0^{\gamma_D^*(F)} V_U^M(\gamma) g_2(\gamma; \gamma_D^*(F)) d\gamma \right\} \tag{14}$$

where

$$g_4(\gamma_1, \gamma_2; \gamma_D^*(F), \gamma_D^*(F)) \equiv \frac{p(\gamma_1, \gamma_2)}{P(\gamma_D^*(F), \gamma_D^*(F))}$$

and

$$g_2(\gamma; \gamma_D^*(F)) \equiv \frac{p(\gamma)}{P(\gamma_D^*(F))}$$

as in the main text.

$$\int_0^{\gamma_D^*(F)} \int_0^{\gamma_D^*(F)} V_U^D(\gamma_1, \gamma_2) g_4^D(\gamma_1, \gamma_2; \gamma_D^*(F), \gamma_D^*(F)) d\gamma_1 d\gamma_2 > \tilde{V}_U$$

follows from Assumption 9(ii). Thus, Equation (14) simplifies to

$$\int_0^{\gamma_D^*(F)} \int_0^{\gamma_D^*(F)} V_U^D(\gamma_1, \gamma_2) g_4^D(\gamma_1, \gamma_2; \gamma_D^*(F), \gamma_D^*(F)) d\gamma_1 d\gamma_2 > \int_0^{\gamma_D^*(F)} V_U^M(\gamma) g_2(\gamma; \gamma_D^*(F)) d\gamma. \tag{15}$$

The preceding arguments imply the following result.

Theorem 9. *Consider the following strategy profile:*

i) $s_{D1}(\gamma_1, \gamma_2) = C$ *and* $s_{D2}(\gamma_1, \gamma_2) = C$ *for all* $\gamma_1, \gamma_2 > \gamma_M^*(F)$*,*

ii) $s_{D1}(\gamma_1, \gamma_2) = C$ *and* $s_{D2}(\gamma_1, \gamma_2) = NC$ *for all* $\gamma_1 \geq \gamma_D^*(F)$ *and* $\gamma_2 < \gamma_D^*(F)$ *and all* $\gamma_1 > \gamma_M^*(F)$ *and* $\gamma_D^*(F) \leq \gamma_2 \leq \gamma_M^*(F)$*,*

iii) $s_{D1}(\gamma_1, \gamma_2) = NC$ *and* $s_{D2}(\gamma_1, \gamma_2) = C$ *for all* $\gamma_1 < \gamma_D^*(F)$ *and* $\gamma_2 \geq \gamma_D^*(F)$ *and all* $\gamma_D^*(F) \leq \gamma_1 \leq \gamma_M^*(F)$ *and* $\gamma_2 > \gamma_M^*(F)$*,*

iv) either $s_{D1}(\gamma_1, \gamma_2) = C$ *and* $s_{D2}(\gamma_1, \gamma_2) = NC$*, or* $s_{D1}(\gamma_1, \gamma_2) = NC$ *and* $s_{D2}(\gamma_1, \gamma_2) = C$ *if* $\gamma_D^*(F) \leq \gamma_1 \leq \gamma_M^*(F)$ *and* $\gamma_D^*(F) \leq \gamma_2 \leq \gamma_M^*(F)$*,*

v) $s_{D1}(\gamma_1, \gamma_2) = NC$ *and* $s_{D2}(\gamma_1, \gamma_2) = NC$ *for all* $\gamma_1, \gamma_2 < \gamma_D^*(F)$*, and*

vi) $s_U = ((R, R), (R, NR), (NR, R), (NR, NR))$

The above constitutes a perfect Bayesian equilibrium if i) (12), (13) and (15) hold, and ii) $F_M^*(\bar{\gamma}) < F$*.*

Theorem 9 characterizes an equilibrium (analogous to the "Separating-PC" equilibrium in the main text) wherein the supplier retaliates against any retailer that sues and retailers may be deterred from filing claims due to the threat of retaliation. This equilibrium occurs if (12), (13) and (15) hold and $F^*_M(\bar{\gamma}) < F$. Figure 6 depicts equilibrium retailer strategies in the first stage of the game in (γ_1, γ_2)-space. The light gray region depicts (γ_1, γ_2) values for which neither retailer sues. The blue shaded region shaded region depicts (γ_1, γ_2) values for which retailer 1 sues while retailer 2 does not sue. The red shaded region depicts (γ_1, γ_2) values for which retailer 2 sues while retailer 1 does not sue. The dark gray shaded region depicts (γ_1, γ_2) values for which both retailers sue. Note that (γ_1, γ_2) values that satisfy $\gamma^*_D(F) \leq \gamma_1 \leq \gamma^*_M(F)$ and $\gamma^*_D(F) \leq \gamma_2 \leq \gamma^*_M(F)$ are shaded both red and blue, indicating that both of these possibilities may occur due to multiple equilibria in the sub-game.

The impact of downstream competition on the likelihood of the threat of supplier retaliation deterring retailers from filing claims is unclear. On the one hand, full damage recovery (i.e., all retailers filing claims) will only occur in the above equilibrium under a downstream duopoly if $\gamma_1, \gamma_2 \geq \gamma^*_M(F)$. Conversely, a retail monopolist sues their supplier (under the "Separating-PC" equilibrium) when $\gamma > \gamma^*_M(F)$. Thus, both retailers must be sufficiently litigious to wish to pursue a damage claim (despite the threat of retaliation) under a retail duopoly. However, only one retailer (i.e., the monopoly retailer) need be sufficiently litigious under a retail monopoly. Additionally, each retailer may have a smaller claim under a retail duopoly than under a retail monopoly as a retail monopolist may purchase a larger amount of the input from the supplier. If this is the case, the damage claim is divided between two firms under a downstream retail duopoly rather than concentrated with only one potential claimant (as under a retail monopoly) which may weaken retailers incentives to sue and, potentially, risk retaliation.

On the other hand, partial recovery (i.e., one of two retailers filing claims) may occur when a monopoly retailer declines to sue. When, for example, retailer 1, is relatively unlitigiousness and therefore does not wish to sue the supplier and endure retaliation, retailer 2 may have a greater propensity to sue and therefore be willing to file a claim. Put differently, the presence of multiple retailers creates additional opportunities for sufficiently litigious claimants that are willing to sue. Downstream competition may also increase the likelihood of retailers filing claims for another reason. Suppose retailer 1 is relatively unlitigiousness and declines to sue the supplier. Retailer 2 would sue the supplier if

$$v(F, \gamma) + \tilde{V}_R \geq V^D_R(\gamma)$$

or $F \geq F^*_D(\gamma)$. Alternatively, if retailer 2 was a monopolist, then it would choose to sue the supplier if

$$v(F, \gamma) + \tilde{V}_R \geq V^M_R(\gamma)$$

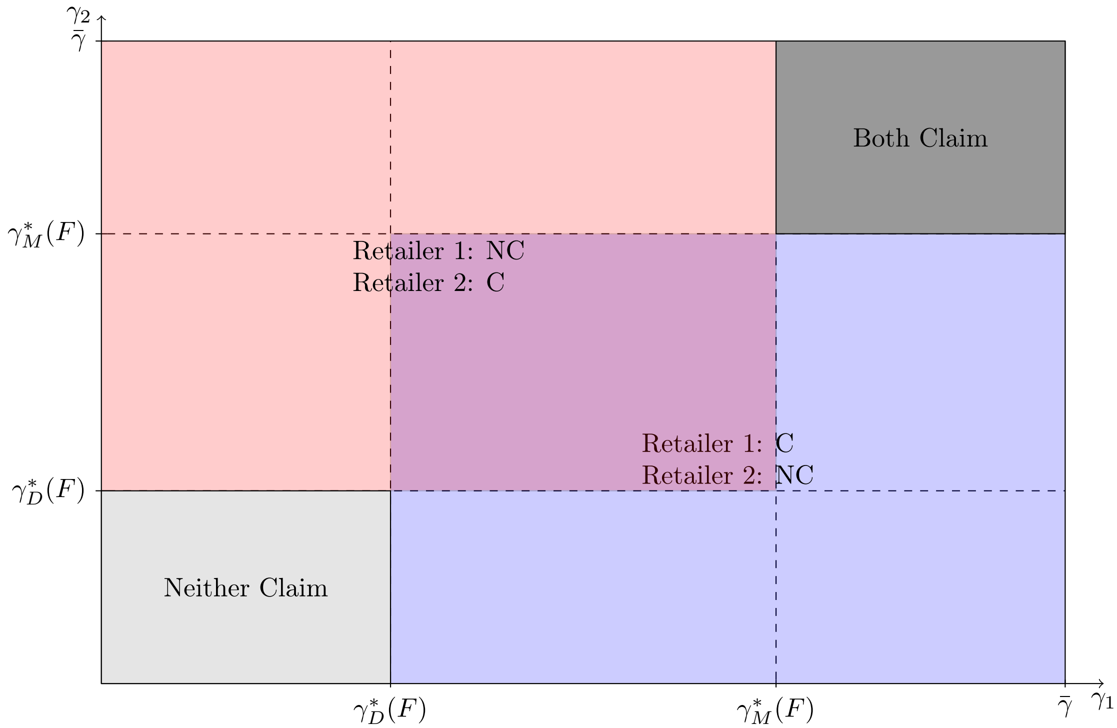

Figure 6: "Separating-PC" Equilibrium in (γ_1, γ_2) Space under a Retail Duopoly

or $F \geq F_M^*(\gamma)$. As $F_D^*(\gamma) < F_M^*(\gamma)$ (Lemma 8), the retailer chooses to sue its supplier under a wider range of claim sizes F under a downstream duopoly. This result occurs because refraining from filing a claim results in monopoly retail profits $V_R^M(\gamma)$ under a retail monopoly while refraining to file a claim results in duopoly retail profits (which are less than monopoly profits by Assumption 8(v)) under a retail duopoly. Intuitively, the temptation to decline to sue under a retail duopoly is weaker because profits from maintaining access to the input and continuing to sell the retail product are lower due to the presence of a downstream competitor.

In summary, the results of this section imply that supplier retaliation can also occur when two retailers purchase the input, compete downstream, and both have the opportunity to sue the supplier. The impact of additional downstream competition on the likelihood of retailers refraining from suing their suppliers due to the threat of retaliation is unclear.

B.4 Assumption 5(iii)

Assumption 5(iii) ensures that, absent retaliation, concentrating the entirety of the the right to sue with direct purchasers, rather than dividing the right to sue between direct and indirect purchasers, results in a larger amount of expected damages. Formally, Assumption 5(iii) requires $\beta_{NR}(F)$ and

$\alpha(F)$ satisfy $(1-\lambda)F\beta_{NR}((1-\lambda)F)+\lambda F\alpha(\lambda F)<F\beta_{NR}(F)$ for all $F>F_{min}(\bar{\gamma})$. In this section, I present examples satisfying this condition and discuss the robustness of results to this assumption.

Let $X_{NR}(F)\equiv\beta_{NR}(F)F$ denote expected direct purchaser damages absent the threat of retaliation when the value of the claim is F. First, note that $X_{NR}(F)$ is 0 for $F\leq F_{min}(\bar{\gamma})$ as $\beta_{NR}(F)=0$. Second, note that $X_{NR}(F)$ is strictly increasing in F for $F>F_{min}(\bar{\gamma})$ as

$$\frac{\partial X_{NR}(F)}{\partial F}=F\frac{\partial}{\partial F}\int_{\gamma_{min}(F)}^{\bar{\gamma}}f(\gamma)d\gamma+\beta_{NR}(F)=-Ff(\gamma_{min}(F))\frac{\partial\gamma_{min}(F)}{\partial F}+\beta_{NR}(F)>0$$

as $\frac{\partial\gamma_{min}(F)}{\partial F}<0$ for $F>F_{min}(\bar{\gamma})$ by Lemma 2. The following lemma establishes a sufficient condition for Assumption 5(iii) to hold.

Lemma 9. *Assumption 5(iii) holds when $X_{NR}(F)$ is convex.*

Proof. Suppose $X_{NR}(F)$ is convex. Recall that a function $f(x)$ is super-additive over positive real numbers[78] if $f(0)\leq 0$ and f is convex. $X_{NR}(0)=0$ which, together with the convexity of $X_{NR}(F)$, implies $X_{NR}(F)$ is super-additive over positive numbers. The super-additivity of $X_{NR}(F)$ over positive numbers implies

$$X_{NR}((1-\lambda)F)+X_{NR}(\lambda F)\leq X_{NR}(F)$$

for all $\lambda\in(0,1)$ and $F>0$. If $\lambda F>F_{min}(\bar{\gamma})$, then $\alpha(\lambda F)<\beta_{NR}(\lambda F)$ (and therefore $\alpha(\lambda F)\lambda F<X_{NR}(\lambda F)$) by Assumption 5(ii). Thus,

$$X_{NR}((1-\lambda)F)+\lambda F\alpha(\lambda F)<X_{NR}((1-\lambda)F)+X_{NR}(\lambda F)\leq X_{NR}(F)$$

and Assumption 5(iii) holds. If $\lambda F\leq F_{min}(\bar{\gamma})$, then $\alpha(\lambda F)=0$ and

$$X_{NR}((1-\lambda)F)+\lambda F\alpha(\lambda F)=X_{NR}((1-\lambda)F)<X_{NR}(F)$$

where the last inequality follows from $F>F_{min}(\bar{\gamma})$ (as assumed in Assumption 5(iii)) and the fact that $X_{NR}(F)$ is positive for $F>F_{min}(\bar{\gamma})$, non-decreasing for all $F>0$, and strictly increasing in F for $F>F_{min}(\bar{\gamma})$. □

The following lemma establishes an additional sufficient condition for Assumption 5(iii). Specifically, the following lemma shows that Assumption 5(iii) always holds when the pass through rate is sufficiently small. Intuitively, allocating a portion of the right to sue to indirect purchasers reduces

[78] A function f is super-additive over positive real numbers if $f(x+y)\geq f(x)+f(y)$ for all $x>0$ and $y>0$.

expected damages when the value of an indirect purchaser claim is sufficiently small that indirect purchasers do not sue.

Lemma 10. *Assumption 5(iii) holds when* $\lambda \leq \frac{F_{min}(\bar{\gamma})}{F}$.

Proof. $\lambda \leq \frac{F_{min}(\bar{\gamma})}{F}$ implies $\lambda F \leq F_{min}(\bar{\gamma})$. $\lambda F \leq F_{min}(\bar{\gamma})$ implies $\alpha(\lambda F) = 0$ and

$$X_{NR}((1-\lambda)F) + \alpha(\lambda F) = X_{NR}((1-\lambda)F) < X_{NR}(F)$$

where the last inequality follows from $F > F_{min}(\bar{\gamma})$ (as assumed in Assumption 5(iii)) and the fact that $X_{NR}(F)$ is positive for $F > F_{min}(\bar{\gamma})$, non-decreasing for all $F > 0$, and strictly increasing in F for $F > F_{min}(\bar{\gamma})$. $\square$

Next, I present a simple example satisfying Assumption 5(iii). Suppose $v(F, \gamma) = \gamma F - L$ and $f(\gamma) = \frac{1}{\bar{\gamma}}$ for $\gamma \in [0, \bar{\gamma}]$ and 0 otherwise (i.e., a uniform distribution). Thus, $\gamma_{min}(F) = \frac{L}{F}$ and $F_{min}(\bar{\gamma}) = \frac{L}{\bar{\gamma}}$. The probability of a direct purchaser suit (absent the threat of retaliation) is

$$\beta_{NR}(F) = \begin{cases} \int_{\gamma_{min}(F)}^{\bar{\gamma}} \frac{1}{\bar{\gamma}} d\gamma & \text{if } F > \frac{L}{\bar{\gamma}} \\ 0 & \text{if } F \leq \frac{L}{\bar{\gamma}} \end{cases}$$

or

$$\beta_{NR}(F) = \begin{cases} 1 - \frac{\gamma_{min}(F)}{\bar{\gamma}} = 1 - \frac{L}{F\bar{\gamma}} & \text{if } F > \frac{L}{\bar{\gamma}} \\ 0 & \text{if } F \leq \frac{L}{\bar{\gamma}} \end{cases}.$$

Expected direct purchaser damages absent retaliation (when the value of the claim is F) are

$$X_{NR}(F) = \begin{cases} F\left(1 - \frac{L}{F\bar{\gamma}}\right) = F - \frac{L}{\bar{\gamma}} & \text{if } F > \frac{L}{\bar{\gamma}} \\ 0 & \text{if } F \leq \frac{L}{\bar{\gamma}} \end{cases}.$$

$X_{NR}(F)$ is a convex function of F. Thus, Lemma 9 implies that Assumption 5(iii) holds.

Finally, I discuss the robustness of results to this assumption. Assumption 5(iii) is employed only in Theorem 5 which states that $X_I(F) > X_R(F)$ if $F > F^*(\gamma_U)$. This result can also hold if Assumption 5(iii) is violated (i.e., $(1-\lambda)F\beta_{NR}((1-\lambda)F) + \lambda F\alpha(\lambda F) \geq F\beta_{NR}(F)$). Note that $X_I(F) = F\beta_{NR}(F)$ as $F > F^*(\gamma_U)$. Thus, Theorem 5 holds if

$$X_R(F) = (1-\lambda)\, F\beta_D\left((1-\lambda)\, F\right) + \lambda F\alpha(\lambda F) < F\beta_{NR}(F) = X_I(F).$$

If $F^*(\bar{\gamma}) < (1-\lambda)F \leq F^*(\gamma_U)$, then the "Separating-PC" equilibrium occurs under the R regime and a fraction of direct purchasers are deterred from filing claims due to the threat of retaliation.[79] Thus,

$$X_R(F) = (1-\lambda)\,F\beta_S\left((1-\lambda)\,F\right) + \lambda F\alpha(\lambda F).$$

If $\beta_S\left((1-\lambda)\,F\right)$ is sufficiently small relative to $F\beta_{NR}(F)$, then $X_R(F) < X_I(F)$ (i.e., Theorem 5) may continue to hold. Next, suppose $(1-\lambda)F \leq F^*(\bar{\gamma})$. If $(1-\lambda)F \leq F^*(\bar{\gamma})$, then no retailer sues under a reversal of Illinois Brick as direct purchasers' claims are too small. Formally, the "Pooling-NC1" or "Pooling-NC2" equilibrium occurs under regime R.[80] Thus, $\beta_D((1-\lambda)\,F) = 0$ and

$$X_R(F) = \lambda F\alpha(\lambda F) \leq F\alpha(F) < F\beta_{NR}(F) = X_I(F)$$

where the first inequality follows from Assumption 5(i) and the second inequality follows from Assumption 5(ii) and $F > F_{min}(\bar{\gamma})$ (which follows from $F > F^*(\gamma_U)$).Lastly, $X_R(F) < X_I(F)$ (i.e., Theorem 5) is also likely to hold when the pass through rate λ is large. To see this, note that $\beta_D((1-\lambda)\,F) \to 0$ and $\lambda F\alpha(\lambda F) \to F\alpha(F)$ as $\lambda \to 1$. Therefore, $X_R(F) \to F\alpha(F) < F\beta_{NR}(F) = X_I(F)$ where the inequality follows from Assumption 5(ii) and $F > F_{min}(\bar{\gamma})$ (which follows from $F > F^*(\gamma_U)$).

In summary, Assumption 5(iii) impacts only Theorem 5. Moreover, Theorem 5 may continue to hold when Assumption 5(iii) is violated if the value of the direct purchasers' claims are sufficiently reduced (due to the pass-on defense) that some or all direct purchasers refrain from suing their suppliers (i.e., the "Separating-PC", "Pooling-NC1", or "Pooling-NC2" equilibrium occurs under regime R). This is likely to occur when F is sufficiently small that $(1-\lambda)F \leq F^*(\gamma_U) < F$ and/or the pass through rate λ is large.

B.5 Robustness: Assumption 6

In this section, I discuss the robustness of results to Assumption 6. Assumption 6 states that, when multiple equilibria occur, the equilibrium which involves the smallest expected damages occurs. For example, when the "Separating-PC" and "Separating-AC" equilibrium both occur, the "Separating-PC" is assumed to prevail. This assumption is primarily for concreteness and ease of exposition. In this subsection, I examine results under the opposite assumption that the equilibrium which involves the

[79] Recall Assumption 6 which states that, under multiple equilibria, the equilibrium involving the smallest expected damages occurs. Thus, the "Separating-PC" equilibrium (rather than the "Separating-AC" equilibrium) is selected when both equilibria occur.

[80] Recall Assumption 6 which states that, under multiple equilibria, the equilibrium involving the smallest expected damages occurs. Thus, the "Pooling-NC1" equilibrium (rather than the "Separating-AC" equilibrium) is selected when both equilibria occur.

largest expected damages occurs.

Assumption 10. *When there are multiple equilibria, the equilibrium involving the largest expected damages occurs.*

Results are qualitatively unchanged under Assumption 10. All else equal, expected damages are higher under both regimes. However, expected damages under Regime R may exceed expected damages under regime I (and vice-versa), as under Assumption 6 in the main text.

To illustrate, Figure 7 depicts expected damages under Assumption 10 for Case 1 (i.e., $F_{min}(\gamma_U) > F^*(\bar{\gamma})$).[81] Figure 7 closely resembles Figure 4 from the main text. The primary difference is that the threshold value of F determining the boundary between the "Separating-AC" equilibrium and the "Separating-PC" equilibrium is $F_{min}(\gamma_U)$ under Assumption 10 and $F^*(\gamma_U)$ under Assumption 6. Figure 8 depicts expected damages under Assumption 10 for Case 2 (i.e., $F_{min}(\gamma_U) < F^*(\bar{\gamma})$). Under Case 2, the "Separating-PC" equilibrium only exists when the "Separating-AC" equilibrium also exists. Thus, the "Separating-PC" equilibrium never prevails due to Assumption 10.

For both cases, note that expected damages under regime R can exceed expected damages under Regime I for moderately small claims. Additionally, expected damages under regime I can exceed expected damages under Regime R for relatively large claims, as in the main text.

B.6 Robustness: Claims that End Antitrust Violations

In the main text, I assume the supplier's antitrust violation (which harmed the retailer) occurred in the past.[82] In practice, retailers may sue their suppliers not only to obtain monetary compensation in the form of damages, but also in an attempt to force the supplier to terminate an ongoing antitrust violation. Bringing a damage suit against the supplier may bring an end to the antitrust violation for a number of reasons. First, the public filing of a damage suit may alert antitrust authorities to the possibility of a infringement and, as a result, instigate a government investigation and case against the supplier. Second, the filing of a damage claim may also motivate the supplier to terminate the antitrust violation to prevent further suits or antitrust scrutiny. Third, the filing of a damage claim may undermine the internal stability of a conspiracy (e.g., market allocation scheme or price-fixing scheme). For example, suppose a supplier is engage in illegal market allocation conspiracy with a rival supplier wherein each supplier serves their respective markets and does not compete in rival markets.

[81] An expositional advantage of employing Assumption 6 in the main text is that Assumption 6 eliminates the need to consider Case 1 and Case 2 separately as the thresholds between equilibria are the same under both cases.

[82] The model of the main text also applies when the retailer anticipates that purchasers in other markets (or the government, indirect purchasers or any other harmed party) are likely to pursue (or have already initiated) litigation against the supplier that will effectively end the antitrust violation. If this is the case, the retailer expects the violation to no longer occur in the future, regardless of whether it sues the supplier or not (as in the main text).

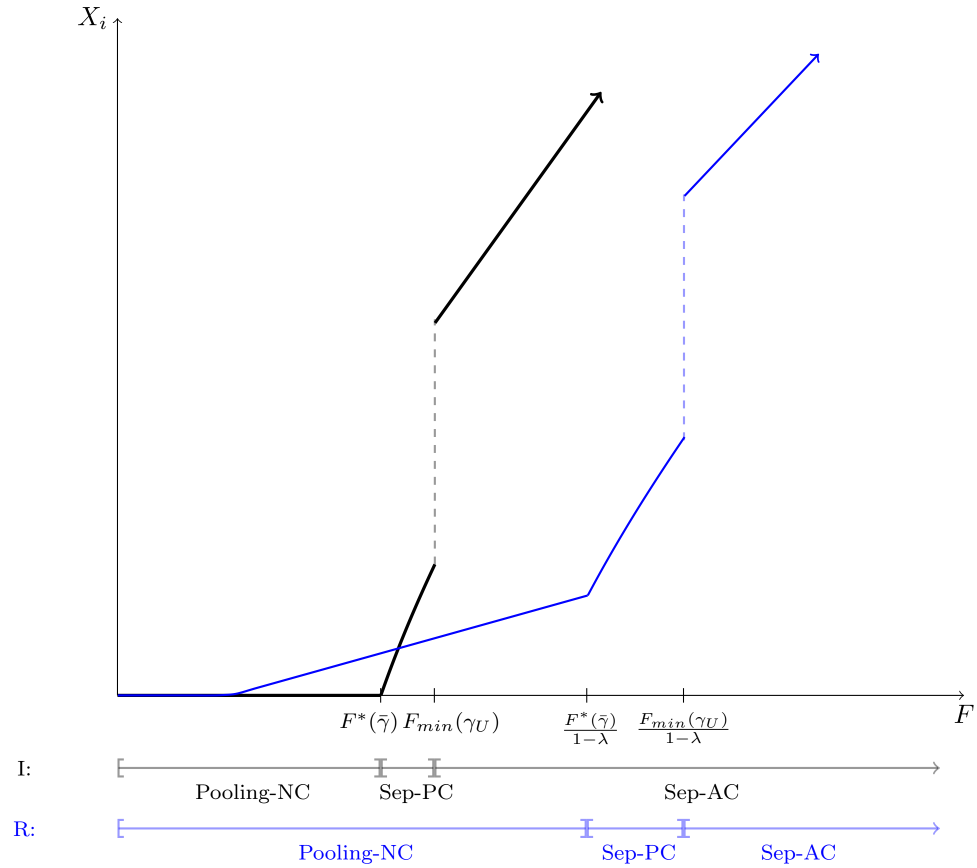

Figure 7: Expected Damage Amounts under Illinois Brick (Regime I, black) and Reversal (Regime R, blue) for Case 1 under Assumption 10

The filing of a damage claim may raise the likelihood of detection and penalization by an antitrust authority which could undermine the internal stability of the conspiracy, restoring competition to the market. Fourth, antitrust litigation may result in court injunctions or remedies that effectively prevent the supplier from continuing the activity in question. In this section, I consider an extension of the model in the main text wherein the filing of a damage claim ends an ongoing antitrust violation. Conversely, a supplier continues its antitrust violation if the retailer refrains from suing the supplier. Generally, retailers have stronger incentives to file damage claims when the filing of a claim ends an ongoing antitrust violation. This is the case because the retailer can prevent future harm due to the violation by filing a suit. However, supplier retaliation, as well as retailers refraining from suing their supplier due to the threat of retaliation, can also occur in this setting. To illustrate, I restrict attention to the “Separating-PC” equilibrium wherein suppliers retaliate against suing retailers and some retailers are deterring from filing a claim due to the threat of retaliation.

Let $V_U(\gamma)$ and $V_R(\gamma)$ denote the discounted present value of supplier and retailer payoffs, respec-

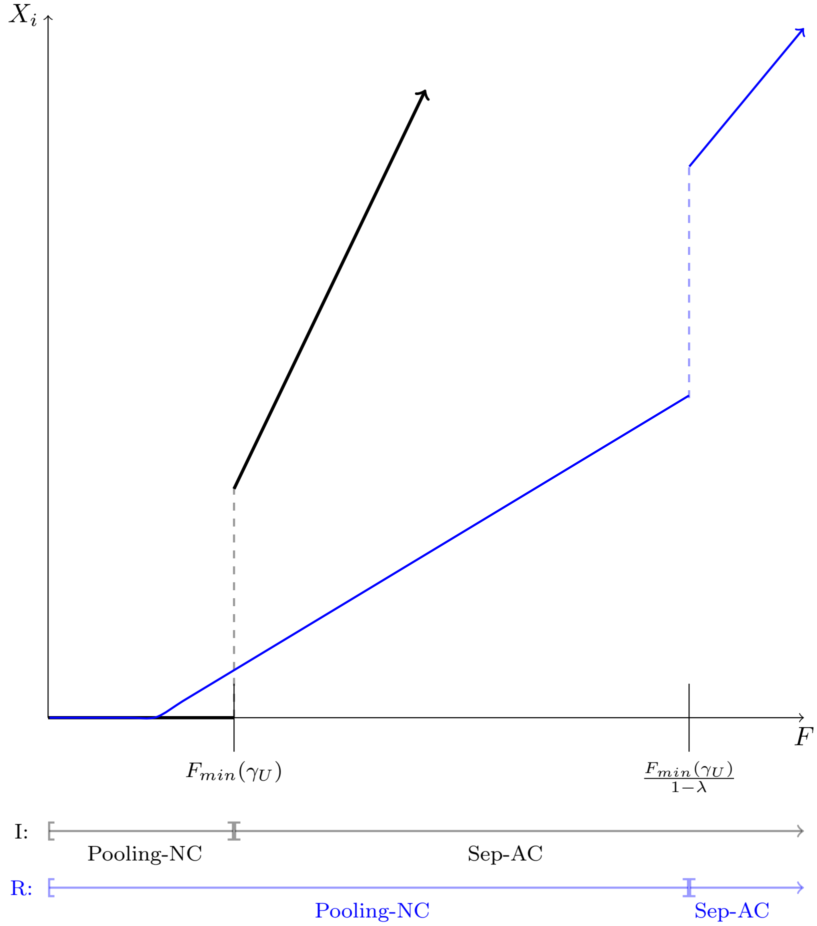

Figure 8: Expected Damage Amounts under Illinois Brick (Regime I, black) and Reversal (Regime R, blue) for Case 2 under Assumption 10

tively, when the antitrust violation has been terminated (as in the main text). Let $V_U^A(\gamma)$ and $V_R^A(\gamma)$ denote the discounted present value of supplier and retailer payoffs, respectively, when the antitrust violation is ongoing and expected to continue in future periods. The following assumption characterizes $V_U^A(\gamma)$ and is assumed to hold throughout this section (in addition to the assumptions in the main text).

Assumption 11. *$V_U^A(\gamma)$ satisfies*

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

ii) $V_U^A(\gamma) \geq V_U(\gamma)$ *for* $\gamma \in [0, \bar{\gamma}]$.

Assumption 11(i) mirrors Assumption 2(i) and ensures that the supplier's payoff is declining in the retailer's litigiousness. Assumption 11(ii) ensures that the supplier earns a smaller payoff if the antitrust infringement is terminated. The following assumption (which mirrors assumption 3 from the main text) governs $V_R^A(\gamma)$ and is assumed to hold throughout this section.

Assumption 12. $V_R^A(\gamma)$ *satisfies*

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

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

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

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

v) $V_R^A(\gamma) < V_R(\gamma)$ *for all* $\gamma \in [0, \bar{\gamma}]$*.*

Suppose a retailer anticipates being refused the input in stage 2 if they file a claim in stage 1. Let $F_A^*(\gamma)$ denote the threshold value of F such that a type-γ retailer wishes to sue their supplier in stage 1. $F_A^*(\gamma)$ satisfies $v(F_A^*(\gamma), \gamma) + \tilde{V}_R = V_R^A(\gamma)$. The following lemma establishes that $F_A^*(\gamma)$ exists, is positive, and is unique.

Lemma 11. *For* $\gamma \in (0, \bar{\gamma}]$*,* $F_A^*(\gamma)$ *i) exists, ii) is positive, and iii) is unique.*

Proof. i) Let $h(x) \equiv v(x, \gamma) + \tilde{V}_R - V_R^A(\gamma)$. Note that Assumption 12(iv) implies $\lim_{x \to \infty} h(x) > 0$. $h(0) < 0$ by Assumption 12(ii) ($V_R^A(0) > \tilde{V}_R$) 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 $F_A^*(\gamma)$ follows by the intermediate value theorem.

ii) Suppose $F_A^*(\gamma) = 0$. Then, $v(0, \gamma) + \tilde{V}_R = V_R^A(\gamma)$ which contradicts Assumption 12(ii) ($V_R^A(0) > \tilde{V}_R$) and Assumption 1(iv) ($v(0, \gamma) < 0$).

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

Let $\gamma_A^*(F)$ denote the threshold value of γ such that a retailer wishes pursue a claim of size F when the retailer expects retaliation in stage 2. $\gamma_A^*(F)$ satisfies $v(F, \gamma_A^*(F)) + \tilde{V}_R = V_R^A(\gamma_A^*(F))$. The following lemma establishes that $\gamma_A^*(F)$ exists, is positive, and is unique.

Lemma 12. *Suppose* $F \geq F_A^*(\bar{\gamma})$*.* $\gamma_A^*(F)$ *i) exists, ii) is positive, and iii) is unique.*

Proof. i) Let $h(x) \equiv v(F, x) + \tilde{V}_R - V_R^A(x)$. Note that $h(\bar{\gamma}) \geq 0$ by $F \geq F_A^*(\bar{\gamma})$, and $h(0) < 0$ by Assumption 1(iii) ($v(F, 0) < 0$) and Assumption 12(ii) ($V_R^A(0) > \tilde{V}_R$). Additionally, $\frac{\partial h(x)}{\partial x} > 0$ by Assumption 12(iii). The existence of $\gamma_A^*(F)$ follows by the intermediate value theorem.

ii) Suppose $\gamma_A^*(F) = 0$. Then, $v(F, 0) = V_R^A(0) - \tilde{V}_R$ which contradicts Assumption 1(iii) ($v(F, 0) < 0$) and Assumption 12(ii) ($V_R^A(0) > \tilde{V}_R$)

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

The following theorem, which mirrors Theorem 2, establishes when a "Separating-PC" equilibrium exists.

Theorem 10. *$s_D(\gamma) = C$ for all $\gamma \geq \gamma_A^*(F)$, $s_D(\gamma) = NC$ for all $\gamma < \gamma_A^*(F)$ and $s_U = (R, NR)$ is a perfect Bayesian equilibrium if $F_A^*(\bar{\gamma}) < F \leq F_A^*(\gamma_U)$.*

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

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

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

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

which holds by assumption 4, 2(i), and 11(ii). Next, consider stage 1. No retailer wishes to deviate in stage 1 by the definition of $\gamma_A^*(F)$. □

Theorem 10 establishes that supplier retaliation can also emerge in equilibrium when the filing of an damage claim ends an ongoing violation. Additionally, Theorem 10 implies that retailers may decline to file a claim against their suppliers, out of fear of retaliation, in this setting. Formally, this occurs for any γ such that $\gamma < \gamma_A^*(F)$ (i.e., the retailer does not file a claim in equilibrium) and $v(F, \gamma) + V_R(\gamma) > V_R^A(\gamma)$ (i.e., absent the threat of retaliation, the retailer would choose sue their supplier). However, the fraction of retailers that decline to sue (i.e., type-γ retailers where $\gamma < \gamma_A^*(F)$) is smaller in the present setting (where suing ends the violation) than in the main text. This is the case as declining to sue and maintaining access to the input (i.e., not facing a refusal to deal) is less profitable for the retailer due to the harm caused by the ongoing antitrust violation (i.e., $V_R^A(\gamma) < V_R(\gamma)$ by Assumption 12(v)). Formally, $\gamma_A^*(F) < \gamma^*(F)$. To see this, note that, by the definition of $\gamma_A^*(F)$ and $\gamma^*(F)$,

$$v(F, \gamma^*(F)) + \tilde{V}_R = V_R(\gamma) > V_R^A(\gamma) = v(F, \gamma_A^*(F)) + \tilde{V}_R$$

which implies $v(F, \gamma^*(F)) > v(F, \gamma_A^*(F))$ and (by the monotonicity of $v(F, \gamma)$ in γ from Assumption 1(ii)) $\gamma^*(F) > \gamma_A^*(F)$.

Retailers refraining from suing their suppliers is particularly concerning in the current setting because a retailer's decision to decline to sue their supplier not only results in the supplier avoiding any damage payments/penalties, but may also permit the supplier to continue the antitrust violation in future periods. Thus, while a smaller fraction of retailers decline to sue their suppliers when the filing of a suit ends the supplier's antitrust violation, the harm caused by a retailer's decision not to sue may be greater as the supplier's antitrust violation may continue unabated and undetected.