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ESMT Working Paper

VERTICAL COORDINATION THROUGH RENEGOTIATION

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Abstract

Vertical coordination through renegotiation⁺

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This paper analyzes the strategic use of bilateral supply contracts in sequential negotiations between one manufacturer and two differentiated retailers. Allowing for general contracts and retail bargaining power, I show that the first contracting parties have incentives to manipulate their contract to shift rent from the second contracting retailer and these incentives distort the industry profit away from the fully integrated monopoly outcome. To avoid such distortion, the first contracting parties may prefer to sign a contract which has no commitment power and can be renegotiated from scratch should the manufacturer fail in its subsequent negotiation with the second retailer. Renegotiation from scratch induces the first contracting parties to implement the monopoly prices and might enable them to capture the maximized industry profit. A slotting fee, an up-front fee paid by the manufacturer to the first retailer, and a menu of tariff-quantity pairs are sufficient contracts to implement the monopoly outcome. These results do not depend on the type of retail competition, the level of differentiation between the retailers, the order of sequential negotiations, the level of asymmetry between the retailers in terms of their bargaining power vis-à-vis the manufacturer or their profitability in exclusive dealing.

Keywords: vertical contracts, rent shifting, renegotiation, buyer power

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1 Introduction

This paper analyzes the strategic use of bilateral supply contracts in sequential negotiations between one manufacturer and two differentiated retailers. Allowing for general contracts and retail bargaining power, I show that the first contracting parties have incentives to manipulate their contract to shift rent from the second contracting retailer and these incentives distort the industry profit away from the fully integrated monopoly outcome. To avoid such distortion, they may prefer to sign a contract which has no commitment power and can be renegotiated from scratch should the manufacturer fail in its subsequent negotiation with the second retailer. A non-binding contract induces the first contracting parties to implement the monopoly prices and might enable them to capture the maximum industry profit.

It is well documented that vertically related firms cannot coordinate competing retailers' pricing decisions through their bilateral supply contracts.¹ Arms-length vertical contracting therefore results in competitive retail prices which are lower than the ones set by a fully integrated monopoly firm. My paper contributes to this literature by illustrating the role of supply contracts with no commitment power (that is, allowing for renegotiation from scratch) in internalizing contracting externalities and enabling the firms to implement the monopoly outcome, which I refer to as the "*efficient outcome*".

The focus of this paper is on rent shifting (that is, how the firstly negotiating parties should design their contract to extract as much surplus as possible from the second retailer). The previous literature on bilateral contracting seems to imply that a commitment not to renegotiate is key to extracting rent from the third parties.² In this paper, to the contrary, renegotiation from scratch may be desirable. The reason is that otherwise the first contracting retailer and manufacturer have an incentive to distort the outcome away from the industry profit maximizing outcome in order to shift more rent from the second contracting retailer. There is no deviation from the efficiency if the first retailer and manufacturer can commit to renegotiate from scratch in case the second retailer has no agreement with the manufacturer. Intuitively, such a renegotiation clause makes the manufacturer's outside option with the second retailer independent of the firstly signed contract and thereby induces the first contracting parties to set their contract terms in order to maximize the industry profit. As a result, the firms could achieve the monopoly outcome. If the renegotiation is not from scratch, but from status quo determined by the firstly signed contract, the commitment strategic effects of the first contract are still present and lead to the same inefficient

¹See e.g., Hart and Tirole (1990), O'Brien and Shaffer (1992), Segal (1999), de Fontenay and Gans (2007), Björnerstedt and Stennek (2007) among others.

²For instance, Aghion and Bolton (1987) consider two sellers (one incumbent and a more efficient potential entrant) contracting with one buyer, and show that when the incumbent could commit to punish the buyer in case it purchases from the entrant, the incumbent and the buyer shift some rent from the more efficient entrant. So commitment not to renegotiate ex-post is good for shifting rent from the third party.

equilibrium outcome as the game without renegotiation.

I model the sequential bilateral negotiations as a three-stage game assuming first an exogenous (fixed) order of negotiations.³ In stage 1, the manufacturer and the first retailer negotiate a contract. In stage 2, the manufacturer and the second retailer negotiate a contract. In stage 3, retailers with signed contracts compete in the product market. In addition, there are three key features of the model: (i) signed contract terms are observable to all parties at the start of the following stage, (ii) contracts include an up-front fee to be paid at the time the contract is signed and a tariff as a function of quantity purchased and to be paid when the trade takes place, and (iii) retailers have some bargaining power.

In this setup, I distinguish two factors leading to the firms' failure to maximize the industry profit. The first is the well-known opportunism problem of the monopoly manufacturer Hart and Tirole (1990), O'Brien and Shaffer (1992), McAfee and Schwartz (1994). After signing a contract with the first retailer, the manufacturer cannot commit to not giving a better deal and selling more to the second retailer. This opportunism problem can be solved by rich enough supply contracts Miklós-Thal et al. (2010).⁴ For instance, if the first retailer gets its equilibrium profit up-front by a slotting fee paid by the manufacturer and agrees to give all of its anticipated revenue (at monopoly prices) as a "*conditional tariff*" after observing its rival's quantity,⁵ the manufacturer would then sell exactly the monopoly quantity to the rival retailer, since if it sells more than that, the first retailer would not trade to avoid paying a tariff above its realized revenue.⁶

The second factor leading to the inefficient outcome is the commitment strategic effect of the first contract on the continuation of the game. It arises because the second contracting retailer has some bargaining power and the firstly contracting parties use their contract to manipulate the manufacturer's outside option in the second negotiation, and thereby to shift rent from the second retailer. I show that the general supply tariffs do not suffice to fix the second problem,⁷ and so the firms fail to achieve the efficient outcome. However, if the first

³I relax this assumption later by endogenizing the order.

⁴Two-part tariffs combined with retail price maintenance (RPM) would also solve the opportunism problem O'Brien and Shaffer (1992). However, RPM is forbidden in almost all OECD countries OECD (1997). Alternatively, supply contracts contingent on the rival retailers' contracts (or simply on their quantities) would also solve the problem, but these contracts are difficult to reinforce since they are mostly outlawed by anti-trust authorities.

⁵This role of conditional fees is first illustrated by de Fontenay and Gans (2005) where the retailers do not have any bargaining power, so slotting fees are not used to solve the opportunism problem. Marx and Shaffer (2007b) and Miklós-Thal et al. (2010) instead give all bargaining power to the retailers and show that conditional tariffs combined with slotting fees solve the opportunism problem.

⁶Conditional tariffs work in a similar way to *liquidated damages* studied by Aghion and Bolton (1987): If the manufacturer sells more to the second retailer, it is punished by the loss of a substantial revenue since by a high enough conditional tariff the first retailer commits to opting out in case its rival sells more than expected.

⁷Supply contracts contingent on the rival retailers' contracts or simply on its existence Mikls et al. (2010) would also solve the problem. But, again, these types of contingent contracts are under the scrutiny of anti-trust authorities since they are regarded as horizontal cooperative contracts.

bilateral contract is non-binding in the event of a breakdown of the second negotiation, the first contract has no effect on the manufacturer's outside option in the second negotiation and therefore the first contracting parties' bilateral incentives coincide with maximizing the industry profit.

The first retailer and manufacturer prefer their contract to have no commitment power if they could maximize their (ex-post) bilateral profits by committing (ex-ante) to renegotiate from scratch in the event that the second retailer has a disagreement with the manufacturer. This is shown to be the case when rent shifting incentives are very high, for example if the second retailer has very high bargaining power or if the first retailer is very profitable in exclusive dealing or if the retailers are sufficiently differentiated.

My contractual framework with no commitment power is the same as the non-binding contracts of Stole and Zwiebel (1996) and de Fontenay and Gans (2007),⁸ and is motivated in several ways. First, it captures a vertical environment where supply contracts have no commitment power and a pairwise renegotiation could be started by one of the two parties anytime before retail competition takes place.⁹ Second, in practice contracts are often renegotiated or no longer valid in the event of a *material change of circumstances*. Hence, it is reasonable to assume that a contract signed by one retailer has no commitment power should the conditions of the contracting change radically by the absence of a rival retailer. Moreover, I show that the first contracting parties prefer their contract to have no commitment power under a large set of parameter values.

These results are robust to different types of retail competition (e.g., price vs quantity competition) and to allowing renegotiation from scratch of the first agreement also in case the second negotiation succeeds. The order of the sequential negotiations, the level of asymmetry between the retailers in terms of their bargaining power vis-à-vis the manufacturer or their profitability in exclusive dealing, do not affect the equilibrium quantities, which are always at the monopoly level, and affects only the distribution of the monopoly profits. The manufacturer prefers to negotiate first with the less powerful retailer, with which it has the larger disagreement payoff¹⁰ since, by this way, it could use its first agreement as a tool to capture more rent from the more powerful retailer.¹¹

⁸The first paper models sequential intra-firm wage bargaining between the firm and its employees, and is interested in whether the firm's equilibrium choice for the number of employees or for the technology of production are efficient. The second paper models sequential bilateral bargaining of a quantity and tariff between many sellers and many buyers with asymmetric information (as contract terms are not observable to third parties) and passive beliefs. It shows that the equilibrium outcome is bilaterally efficient, but fails to maximize the total surplus of all players.

⁹As shown by Stole and Zwiebel (1996, Theorem 2).

¹⁰In this paper, the power of a retailer is captured by two parameters, the retailer's bargaining power and its profitability in exclusive dealing with the manufacturer.

¹¹This result is in line with Marx and Shaffer (2007a) who consider sequential bilateral negotiations between two sellers and one buyer and show that the buyer prefers to start negotiations with the weak seller to capture more rent from the strong seller.

My analyses have some testable implications. I show that the supplier of competing retailers prefers to start negotiations with the weak retailer, with which it earns a lower profit in exclusive dealing, that is the less efficient retailer and/or the one with a lower bargaining power. If the second contracting retailer has a very high bargaining power or the first retailer is very weak or the retailers are very differentiated, the manufacturer signs a contract without commitment power with the weak retailer.

Some evidence from the UK grocery market supports these findings. The interviews conducted with grocery suppliers in the UK illustrate that the supply contracts of the less powerful retailers (chain stores) are renegotiated much more frequently (sometimes on a daily basis), that is, they have much less commitment power than the supply contracts of more powerful retailers (four largest supermarkets) and “overall, the majority of suppliers claimed to be satisfied with the frequency of price and volume negotiations.”¹²

The next section describes the main framework. Section 3 compares the equilibrium outcomes of the three versions of my contracting setup; without renegotiation, with renegotiation from scratch, and with renegotiation but not from scratch, and analyzes the preferences of the first contracting parties over the commitment power of their contract. Section 4 discusses whether negative payments are necessary tools. Section 5 presents the extensions of the main framework. Finally, Section 6 concludes with policy implications. All formal proofs are in the Appendix, where I also characterize the equilibrium outcome of the game without renegotiation and describe conditions under which one retailer is excluded.

2 Framework

Consider a market where one manufacturer, U , negotiates bilateral supply contracts with two differentiated retailers, D_1 and D_2 , for the distribution of its product.¹³ Since the evolution of one negotiation with a retailer directly affects the payoff of the other retailer, that is, there are contracting externalities, not only the manufacturer but also the retailers are aware of strategic play of the manufacturer dealing with competing retailers. To take this fact into account in a tractable setup, I consider sequential (bilateral) negotiations and assume that the outcome of each negotiation is publicly observed before the subsequent negotiation starts.¹⁴ I assume that the manufacturer’s production takes place after contract negotiations

¹²See Competition Commission (2007), p. 32–41.

¹³I suppose that D_i does not hold any inventory and re-sells all quantity purchased from U .

¹⁴If I assumed secret contracts, I would have to make an assumption on out of equilibrium beliefs of retailers. The most widely used assumption (due to its tractability) is *passive beliefs* McAfee and Schwartz (1994), which means that when the retailers receive an unexpected offer from the manufacturer, they believe that the manufacturer keeps its offer with the rival retailer unchanged, i.e., the retailers believe that the manufacturer is not fully strategic. See de Fontenay and Gans (2007) for the analysis with passive beliefs.

and upon the retailers' order.¹⁵ The timing of negotiations is the following:

Stage 1: U and D_1 negotiate a supply tariff, T_1 .¹⁶

Stage 2: D_2 observes T_1 if it is signed, and then negotiates a supply tariff, T_2 , with U .

Stage 3: D_1 observes T_2 if it is signed. The retailers that have signed a contract compete in the downstream market and transfers are made according to the relevant contract(s).

I assume that the outcome of each bilateral bargaining is given by the generalized Nash bargaining solution. From the negotiation between U and D_i , D_i gets a share, $\lambda_i \in [0, 1]$, of the gains from trade¹⁷ plus its outside option, which is assumed to be 0, and U gets $1 - \lambda_i$ of the gains from trade plus its disagreement payoff with D_i , which corresponds to U 's payoff from trading only with D_i 's rival, D_{-i} .¹⁸ Parameter λ_i measures the exogenous source of retailer i 's bargaining power vis-à-vis the manufacturer and a higher λ_i means that the retailer gets more powerful in bargaining and so could capture a larger share of the gains from trade with the manufacturer. Binmore et al. (1986) show that this axiomatic solution emerges as the outcome of an alternating-offer extensive form game.¹⁹ To simplify the analysis, I assume that after a failure of a negotiation round with one retailer, the manufacturer does not negotiate again with that retailer before retail competition takes place.²⁰

The supply contract between U and D_i is a general contract

$$T_i(q) = S_i + t_i(q) \quad \text{for} \quad q \geq 0,$$

¹⁵This timing of production is a standard assumption of the vertical contracting with externalities literature. It captures the situation where the manufacturer has the lowest commitment capability. Since this paper illustrates a way to internalize all contracting externalities, relaxing this assumption would not change the qualitative conclusions. See the discussion in the extensions section.

¹⁶In Section 4.2, I show that the order of negotiations does not affect the equilibrium outcome, but changes the sharing of the equilibrium profits among the firms. There I characterize the manufacturer's preferred order (of negotiations) in equilibrium.

¹⁷The gains from trade is the difference between the bilateral profits if there is an agreement (contract) and the bilateral profits if they cannot agree on a contract, that is, if their negotiation fails.

¹⁸Throughout the paper, retailer i 's rival is denoted by $-i$.

¹⁹They present two models. In the first, players are impatient to reach an agreement and could differ in their impatience, and so in their relative bargaining power. In the second, there is a risk of failure after any rejection, players are risk-averse and could differ in their risk-aversion, and so in their relative bargaining power. Depending on the characteristics of the retailers (such as size, feasibility of being supplied by an alternative source or ease of integrating backwards (having private labels)), one of the two interpretations would be more appropriate. For instance, a small retailer is more likely to be risk-averse than a larger retailer and might not be able to find an alternative supplier easily, and so would be more patient in its negotiation with the manufacturer.

²⁰This assumption also captures the fact that each negotiation round costs time and effort for the parties, and the firms, in general, do not want to invest more effort and time to negotiate with the party with which they have had a failure, at least within some period of time.

where S_i is an up-front fee paid at the signature of the contract²¹ and $t_i(q)$ is a variable tariff as a function of quantity purchased.²² I focus on a contract space in which there exists an equilibrium in every subgame, for example, a finite number of menus including an up-front payment, a tariff and a quantity, $T_i = \{(S_i, t_i, q_i)_n \text{ for } n \geq 2\}$.²³ This contract space allows for more general contracts than those considered by the literature.²⁴

The manufacturer has a constant production cost, c , the retailers incur the costs of purchasing inputs from U and, for simplicity, I assume that they have no additional costs from their activity.²⁵ I do not specify the type of competition between the retailers; in particular, the results are valid both for quantity and price competition. Let $R_i(q_i, q_{-i})$ denote D_i 's revenue when it sells q_i units and its rival sells q_{-i} units. The profits of D_i , U , and the industry are denoted, respectively, by π_i , π_U , and Π :

$$\begin{aligned}\pi_i(q_i, q_{-i}) &= R_i(q_i, q_{-i}) - t_i(q_i) - S_i, \\ \pi_U(q_1, q_2) &= \sum_{i=1,2} [S_i + t_i(q_i) - cq_i], \\ \Pi(q_1, q_2) &= \sum_{i=1,2} [R_i(q_i, q_{-i}) - cq_i].\end{aligned}$$

I assume that each retailer's revenue is increasing in its own quantity and decreasing in its rival's quantity, respectively:²⁶

A1. (i) $\partial_{q_i} R_i(q_i, q_{-i}) > 0$, (ii) $\partial_{q_{-i}} R_i(q_i, q_{-i}) < 0$, for $i = 1, 2$, $q_i > 0$ and $q_{-i} \geq 0$.

Moreover, the following assumptions ensure the second-order conditions:

²¹I will show that in equilibrium S_1 is negative as long as D_1 has some bargaining power, so S_1 is indeed a slotting fee paid by U to D_1 .

²²Contract space is restricted in the sense that a retailer's contract cannot depend on its rival's contract. This assumption is motivated by the fact that contracts contingent on rivals' actions are difficult to enforce since they are regarded as horizontal cooperative agreements between competitors and therefore, are mostly outlawed by anti-trust authorities, at least in Europe and in the US. In the extension section, I will discuss how allowing contracts to be contingent on the market structure would change the results.

²³This technical assumption is necessary to outlaw contract spaces in which there exists no best-response quantity by a retailer to a given tariff and its rival's quantity. For instance, consider the subgame where the first negotiation fails. If the second negotiation signs contract $T_2 = \begin{cases} 0 & \text{for } q_2 \leq 1 \\ 1 & \text{for } q_2 > 1 \end{cases}$, retailer 2 wants to buy a quantity very close to 1, so there exists no best-response quantity to this contract. I thank Paul Heidheus for pointing this out.

²⁴For instance, more general than linear prices (a unit price per unit), quantity fixing contracts (one tariff for one quantity), two-part tariffs (a unit price per quantity and a fixed fee), three-part tariffs (an up-front fee to be paid at the signature of the contract and a two-part tariff to be paid when trade occurs).

²⁵The qualitative analysis would remain valid if I assumed that U had a convex cost function and/or the retailers incurred some additional retailing costs.

²⁶To simplify the expressions, I denote all partial derivatives by ∂ . For example, $\partial_X Y$ refers to the first-order derivative of variable Y with respect to variable X , and $\partial_{XZ}^2 Y$ refers to the second-order derivative of Y with respect to X and Z , and so on.

A2. (i) $\partial_{q_i}^2 R_i(q_i, q_{-i}) < 0$, (ii) $\left| \partial_{q_i q_{-i}}^2 R_i(q_i, q_{-i}) \right| < \left| \partial_{q_i}^2 R_i(q_i, q_{-i}) \right|$, for $i = 1, 2$, $q_i > 0$ and $q_{-i} \geq 0$.

Let (q_1^M, q_2^M) denote the “monopoly” quantities which maximize the industry profit and Π^M denote the maximum industry profit, which I refer to as “vertically integrated monopoly profit” or “monopoly profit”.²⁷ The monopoly quantities serve as a benchmark against which contracting outcomes are compared, and the firms’ failure to maximize their joint profit will be referred to as “inefficiency”.²⁸ If D_i is the unique active retailer, q_i^m denotes the quantity maximizing the industry profit and the maximized industry profit is denoted by Π_i^m . I allow the retailers to be asymmetric in their profitability when exclusive dealing, $\Pi_1^m \neq \Pi_2^m$, which I refer to as the retailers being different in their “efficiency”.²⁹

Assumption A1(ii), rules out an uninteresting case where two retail markets are independent³⁰ and implies that

$$\Pi_1^m + \Pi_2^m > \Pi^M.$$

Moreover, I assume that the maximum industry profit is higher when both retailers are active rather than when there is an exclusive deal with one retailer:

A3. Retailers are imperfect substitutes: $\Pi^M > \Pi_i^m$ for $i = 1, 2$.³¹

I use sequential negotiations mainly to study the role of renegotiation on internalizing contracting externalities. I consider three different scenarios regarding the commitment power of the firstly signed contract:

- *full commitment*, which refers to the original game (without renegotiation),
- *no commitment*, which refers to the game where the first contracting parties renegotiate their contract from scratch in the event of the second retailer having no agreement, that is, there is a renegotiation stage after Stage 2 before Stage 3,

²⁷Existence and uniqueness of (q_1^M, q_2^M) are guaranteed by A2. They are formally defined as

$$(q_1^M, q_2^M) = \arg \max_{q_1, q_2} \Pi(q_1, q_2).$$

and the industry profit at these quantities is denoted by $\Pi^M \equiv \Pi(q_1^M, q_2^M)$.

²⁸Regarding the total welfare or consumer welfare, this notion of efficiency does not have any normative meaning.

²⁹This might be, for example, because one retailer has a lower demand (or a higher cost in case we introduce positive distribution costs) than the other retailer.

³⁰In this case, there would be no externality between the retailers, and a two-part tariff contract with a wholesale price at the marginal cost of the manufacturer would be sufficient to implement the vertically integrated monopoly outcome.

³¹If the retailers were perfect substitutes, the manufacturer would prefer to deal exclusively with the most profitable retailer in equilibrium.

- *partial commitment*, which refers to the game with renegotiation of the first contract, but not from scratch, in the event of the second retailer having no agreement (after Stage 2 before Stage 3).

I look for a subgame perfect Nash equilibrium by solving the sequential game backwards for each commitment framework. At the end I compare the bilateral profits of the first retailer and manufacturer in equilibrium of the three commitment scenarios and illustrate their bilateral preference for the commitment power of their firstly signed contract.

3 Equilibrium analysis

For (sub-game) equilibrium contracts, quantities, prices and profits, I use superscript ^{**} if both retailers are active, and the superscript ^{*} when there is only one active retailer. Moreover, π_U^{*i} denotes U 's equilibrium profit from exclusive dealing with D_i . The sub-game equilibrium analyses of Stage 3 (retail equilibrium) and the case where the first retailer and manufacturer have no agreement (exclusive dealing with the second retailer), are the same for the three commitment frameworks, so I describe their analyses only once:

Retail Equilibrium Each downstream firm which has signed a supply contract with U , say D_i , sets its best-response quantity to its rival's quantity by maximizing its variable profit:

$$q_i^{BR}(q_{-i}) = \arg \max_{q_i} [R_i(q_i, q_{-i}) - t_i(q_i)]. \quad (1)$$

The contract space I consider ensures the existence of a unique best-response to given $q_{-i} \geq 0$. D_i finds it profitable to buy $q_i^{BR}(q_{-i})$ if and only if

$$R_i(q_i^{BR}(q_{-i}), q_{-i}) \geq t_i(q_i^{BR}(q_{-i})) \quad (2)$$

Depending on the signed supply contracts, there are two types of retail equilibrium: exclusive dealing and retail competition. If D_i is the only retailer that has signed a contract with U , D_i becomes the exclusive dealer and sells $q_i^* = q_i^{BR}(0)$. If both retailers have signed a supply contract with U , the solution to the retailers' best-response quantities determine the Nash equilibrium, $q_i^{**} = q_i^{BR}(q_{-i}^{BR}(q_i))$. Both retailers are active if and only if condition (2) holds for both $i = 1, 2$.

Exclusive Dealing with the Second Retailer In case of a disagreement between U and D_1 in the first stage, U and D_2 sign a contract as long as each of them earns non-negative profits, which is the case when the gains from trade are non-negative. Here, the gains from

trade are equal to the industry profit since D_2 's and U 's outside options are both zero.³² Since $T_2(q)$ allows U and D_2 to share the industry profit through a fixed transfer, they want to implement q_2^m to maximize the total share of the pie. This gives us the following result:

Lemma 1 *If U and D_1 have no agreement, in a sub-game equilibrium, D_2 sells q_2^m and the resulting profits of D_2 and U are, respectively,*

$$\pi_2^* = \lambda_2 \Pi_2^m, \quad \pi_U^{*2} = (1 - \lambda_2) \Pi_2^m.$$

One tariff-quantity pair (t_2^, q_2^*) such that $t_2^* = (1 - \lambda_2) \Pi_2^m + cq_2^m$ and $q_2^* = q_2^m$, is sufficient to implement this outcome.*

Observe that whether the tariff is paid upfront, before the actual trade, or ex-post, when the trade takes place, is not important to implement this outcome, since its unique role is to share profits.

3.1 Full commitment benchmark: contracts without renegotiation

In the benchmark, I consider the sequential contracting game without renegotiation. When renegotiation is not allowed, the contract signed by U and D_1 in Stage 1, T_1 , is implemented even in the event of D_2 having no agreement with U . Hence, U 's disagreement payoff with D_2 depends on the first contract signed with D_1 and is equal to the profit of U (under T_1) when dealing exclusively with D_1 , which is

$$\pi_U^{*1}(T_1) = S_1 + t_1(q_1^*) - cq_1^*,$$

where q_1^* refers to the sub-game equilibrium quantity purchased by D_1 and characterized by the retail equilibrium condition, (1), for $i = 1$ and $q_2 = 0$.

If U and D_2 sign a contract, their bilateral profit would be

$$\begin{aligned} \pi_U(q_1, q_2) + \pi_2(q_2, q_1) &= \Pi(q_1, q_2) - \pi_1(q_1, q_2) \\ &= R_2(q_2, q_1) - cq_2 + S_1 + t_1(q_1) - cq_1 \end{aligned} \quad (3)$$

They agree on a contract if there are some gains from trade, that is, the maximum value of the bilateral profits from trading is higher than the manufacturer's outside option:

$$\max_{q_2} [R_2(q_2, q_1) - cq_2 + t_1(q_1) - cq_1] \geq t_1(q_1^*) - cq_1^*. \quad (4)$$

In this case, through a fixed fee, U and D_2 share the gains from trade with respect to their

³²Recall that U cannot negotiate with D_1 another time once there is a disagreement between them.

relative bargaining power:³³

$$\begin{aligned}\pi_2 &= \lambda_2 \{R_2(q_2, q_1) - cq_2 + t_1(q_1) - cq_1 - [t_1(q_1^*) - cq_1^*]\}, \\ \pi_U &= (1 - \lambda_2) \{R_2(q_2, q_1) - cq_2 + t_1(q_1) - cq_1 - [t_1(q_1^*) - cq_1^*]\} \\ &\quad + S_1 + t_1(q_1^*) - cq_1^*,\end{aligned}\tag{5}$$

and set $t_2(\cdot)$ to implement the quantity maximizing their bilateral profit (3).

Anticipating the equilibrium of the second stage contracting, if U and D_1 sign a contract, their bilateral profit would be (replacing π_2 by its equilibrium value from (5))

$$\begin{aligned}\pi_U + \pi_1 &= \Pi(q_1, q_2) - \pi_2 \\ &= \Pi(q_1, q_2) - \lambda_2 \{R_2(q_2, q_1) - cq_2 + t_1(q_1) - cq_1 - t_1(q_1^*) + cq_1^*\}.\end{aligned}\tag{6}$$

They agree on a contract if their maximum bilateral profit from this trade is higher than what the manufacturer would get if they had no agreement (see Lemma 1):

$$\max_{t_1(\cdot)} \{\Pi(q_1, q_2) - \lambda_2 (R_2(q_2, q_1) - cq_2 + t_1(q_1) - cq_1 - t_1(q_1^*) + cq_1^*)\} \geq \pi_U^{*2} = (1 - \lambda_2) \Pi_2^m. \tag{7}$$

If this is the case, through a fixed fee, U and D_1 share the gains from trade with respect to their relative bargaining power:

$$\begin{aligned}\pi_1 &= \lambda_1 \{ \Pi(q_1, q_2) - \lambda_2 [R_2(q_2, q_1) - cq_2 + t_1(q_1) - cq_1 - (t_1(q_1^*) - cq_1^*)] - \pi_U^{*2} \} \\ \pi_U &= (1 - \lambda_1) \{ \Pi(q_1, q_2) - \lambda_2 [R_2(q_2, q_1) - cq_2 + t_1(q_1) - cq_1 - (t_1(q_1^*) - cq_1^*)] - \pi_U^{*2} \} + \pi_U^{*2}\end{aligned}$$

and set $t_1(\cdot)$ to maximize their bilateral profit (6).

When choosing an optimal tariff, U and D_1 face a trade-off. On one hand, they want to induce the efficient outcome, (q_1^M, q_2^M) , to maximize the total industry profit, $\Pi(q_1, q_2)$. To do so, they need to set $t_1(q_1^M) = R_1(q_1^M, q_2^M)$, since otherwise U and D_2 would trade a quantity greater than q_2^M (by using equation (3)):

$$\partial_{q_2} [\pi_U(q_1^M, q_2^M) + \pi_2(q_1^M, q_2^M)] = -\partial_{q_2} \pi_1(q_1^M, q_2^M) = -\partial_{q_2} R_1(q_1^M, q_2^M) > 0 \tag{8}$$

However, if D_1 agrees to give all of its anticipated revenue as a conditional fee after observing its rival's quantity, the manufacturer and the second retailer do not have an incentive to trade a quantity greater than q_1^M , since otherwise the first retailer would not buy a positive quantity to avoid paying a tariff higher than its revenue. In other words, setting the first retailer's conditional tariff at its anticipated revenue protects it against the opportunistic

³³Hereafter, I drop the arguments of the profit functions, π_1, π_2 and π_U , unless I refer to their specific values.

behavior of the second contracting parties.³⁴ The first retailer wants to give all of its revenue as a conditional fee only if there is another tool through which the retailer could get its share over the gains from trade. An up-front payment made by the manufacturer to the first retailer, $S_1 < 0$, would serve as such a tool.³⁵

On the other hand, when the second retailer has some bargaining power, $\lambda_2 > 0$, U and D_1 want to minimize the rent of D_2 by maximizing U 's outside option with D_2 , $t_1(q_1^*) - cq_1^*$, and the latter is maximized at $t_1(q_1^*) = R_1(q_1^*, 0)$ and $q_1^* = q_1^m$.

Suppose that U and D_1 set their contract to induce the efficient outcome: $t_1(q_1^M) = R_1(q_1^M, q_2^M)$. In the case of D_2 having no agreement with U , D_1 should sell q_1^* (by definition of q_1^*), so as to earn at least as much as selling q_1^M :

$$R_1(q_1^*, 0) - t_1(q_1^*) \geq R_1(q_1^M, 0) - t_1(q_1^M) = R_1(q_1^M, 0) - R_1(q_1^M, q_2^M) > 0,$$

which imposes an upper bound on the exclusive dealing tariff:

$$t_1(q_1^*) \leq R_1(q_1^*, 0) + \int_0^{q_2^M} \partial_{q_2} R_1(q_1^M, q_2) dq_2.$$

Since the bilateral profit of U and D_1 , (6), increases in $t_1(q_1^*)$, the latter constraint should be binding in equilibrium. Their bilateral profit then increases in the exclusive dealing industry profit, $\Pi(q_1^*, 0)$, so, should D_2 have no agreement, U and D_1 should set $q_1^* = q_1^m$ and

$$t_1(q_1^m) = R_1(q_1^m, 0) + \int_0^{q_2^M} \partial_{q_2} R_1(q_1^M, q_2) dq_2.$$

Their bilateral profit at the efficient outcome would therefore be

$$\pi_U^M + \pi_1^M = (1 - \lambda_2)\Pi(q_1^M, q_2^M) + \lambda_2 \left[\Pi_1^m + \int_0^{q_2^M} \partial_{q_2} R_1(q_1^M, q_2) dq_2 \right]. \quad (9)$$

This shows that starting from (q_1^M, q_2^M) , U and D_1 have a profitable deviation if and only if

$$\partial_{q_1} (\pi_U^M + \pi_1^M) = \lambda_2 \int_0^{q_2^M} \partial_{q_1 q_2}^2 R_1(q_1^M, q_2) dq_2 \neq 0,$$

which is the case whenever the second retailer has some bargaining power, $\lambda_2 > 0$, since the retailers are competing and their marginal revenue is affected by the rival's sales: $\partial_{q_i q_{-i}}^2 R_i(q_i, q_{-i}) \neq 0$. If the marginal revenue of one retailer is increasing in the quantity of its rival, that is, if $\partial_{q_i q_{-i}}^2 R_i(q_i, q_{-i}) > 0$, the quantities are strategic complements, and therefore U and D_1

³⁴This role of conditional tariffs is first illustrated by de Fontenay and Gans (2005) in a specific framework where the manufacturer has all the bargaining power and supply contracts are two-part tariffs.

³⁵Like in Marx and Shaffer (2007b) and Miklós-Thal et al. (2010).

prefer to trade more than q_1^M to increase U 's outside option with D_2 . But then U and D_2 would also trade more than q_2^M to maximize their bilateral profit, (3). Otherwise, that is, if $\partial_{q_i q_{-i}}^2 R_i(q_i, q_{-i}) < 0$, the quantities are strategic substitutes and the retailers sell less than q_1^M and q_2^M , respectively. The proposition summarizes these results:

Proposition 1 *When the second contracting retailer has some bargaining power, $\lambda_2 > 0$, in equilibrium of the game without renegotiation, the firms fail to implement the vertically integrated monopoly quantities. The equilibrium quantities are above their monopoly level, $q_i^{**} > q_i^M$, if the retailers' quantities are strategic complements, that is, if $\partial_{q_i q_{-i}}^2 R_i(q_i, q_{-i}) > 0$. Otherwise, we have $q_i^{**} < q_i^M$ for both $i = 1, 2$.*

The proposition shows that protecting the first retailer against the opportunism of the manufacturer is not enough to achieve the efficient outcome, since U and D_1 have incentives to use their variable tariff as a tool to shift rent from D_2 by increasing U 's outside option in the second negotiation. In other words, they deviate from the monopoly quantities in order to get a larger share of a smaller pie. More generally speaking, Proposition 1 is the result of uninternalized contracting externalities in the negotiation between the manufacturer and the first retailer. This result is in parallel to the literature on vertical contracting with externalities.³⁶ Different from this literature, by focusing on sequential bilateral negotiations, I am able to distinguish the well-known opportunism problem of the monopolist manufacturer (against the first contracting retailer) from the first contracting parties' incentives to distort their contract to shift more rent from the second retailer. Following the literature, I show that rich enough supply contracts fix the first problem (for example, a high enough conditional tariff and a negative up-front fee in the first contract). However, a new finding is that, even with the general contracts, they cannot correct the latter externality, which arises due to the commitment strategic effects of the first contract on the manufacturer's outside option with the second retailer.³⁷

The failure to achieve the efficient outcome might lead to the exclusion of the second retailer or a disagreement between U and D_1 . The first contracting parties prefer to exclude the second retailer if and only if from exclusive dealing they earn more than their joint profit if retailer 2 is also active and more than their disagreement joint payoff (given by Lemma 1),

³⁶See, for example, Hart and Tirole (1990), O'Brien and Shaffer (1992), McAfee and Schwartz (1994), Segal (1999), Segal and Whinston (2003), Martimort and Stole (2003), Marx and Shaffer (2007b).

³⁷This externality would be internalized and the efficient outcome would be implemented if it was the manufacturer who determined the quantity (or price) of the first retailer (such as retail price maintenance) after signing the contract. For instance, recent work by Rey and Whinston (2011) show the existence of the monopoly outcome in a setup where the retailers have all the bargaining power and offer simultaneously menus of contracts to the manufacturer, which in turn picks one contract within the offer of each retailer or none.

respectively,

$$\begin{aligned}\Pi_1^m &\geq (1 - \lambda_2)\Pi(q_1^{**}, q_2^{**}) + \lambda_2 \left(\Pi_1^m + \int_0^{q_2^{**}} \partial_{q_2} R_1(q_1^{**}, q_2) dq_2 \right) \\ \Pi_1^m &\geq (1 - \lambda_2)\Pi_2^m\end{aligned}\tag{10}$$

For instance, when the second retailer's bargaining power is very high, at the limit when λ_2 goes to 1, the first contracting parties prefer to exclude the second retailer, since $\partial_{q_2} R_1(q_1, q_2) < 0$. On the other hand, when the second retailer has nearly no bargaining power, when λ_2 goes to 0, the equilibrium quantities approach to their efficient levels (as shown by Proposition 1), in which case U and D_1 prefer that the second retailer is active. Within the parameter space where D_2 is not excluded, U and D_1 sign a contract if there are some gains from trade (condition (7) holds at equilibrium contracts) and fails to reach an agreement otherwise, in which case the second retailer would become the exclusive dealer. I present the detailed analysis of these exclusion possibilities in the Appendix and show that sequential bilateral negotiations lead to the exclusion of the second contracting retailer when it has significant buyer power, even if the industry would benefit from the activity of both retailers. The occurrence of this exclusion does not depend on the relative profitability (or efficiency) of the retailers. These results are different from Marx and Shaffer (2007a)³⁸, who show that simultaneous and non-renegotiable offers by retailers always lead to the exclusion of the less efficient retailer, which is the less profitable in exclusive dealing. The main reasons of this difference are that, in my setup, the retailers could be asymmetric in their bargaining power vis-à-vis the manufacturer and in sequential negotiations the manufacturer could capture more rent when the second retailer has lower bargaining power and/or is more efficient in exclusive dealing. The manufacturer would therefore prefer to exclude the second retailer when the latter has too high bargaining power (even if it is more efficient than the first retailer), otherwise the manufacturer would be strictly better off from dealing with both retailers in equilibrium.

3.2 No commitment: contracts with renegotiation from scratch

In case of a disagreement between U and D_2 , previously signed T_1 becomes null, and U renegotiates from scratch another contract with D_1 . As demonstrated by Stole and Zwiebel (1996, Theorem 2), the game with renegotiation from scratch captures the setup where any retailer or the manufacturer starts pairwise contract renegotiations any time before retail competition takes place. This means that supply contracts are not binding if one party

³⁸The authors consider a specific type of contracts: three-part tariff contracts including an up-front fee, which is paid at the signature of the contract, and a conditional two-part tariff, which is paid upon actual trade.

wants to renegotiate.³⁹ The disagreement payoff of U with D_2 is now determined by the renegotiation stage:

Exclusive Dealing with the First Retailer In case the negotiation between U and D_2 fails in Stage 2, the contract signed in Stage 1 becomes null, U and D_1 then renegotiate from scratch. The solution of this renegotiation is symmetric to the case of exclusive dealing with the second retailer. Hence, we get the symmetric result to Lemma 1.

Lemma 2 *If U and D_2 have no agreement, in a sub-game equilibrium of the game with renegotiation from scratch, D_1 sells q_1^m and the resulting profits of D_1 and U are, respectively,*

$$\pi_1^* = \lambda_1 \Pi_1^m, \quad \pi_U^{*1} = (1 - \lambda_1) \Pi_1^m.$$

One tariff-quantity pair (t_1^, q_1^*) such that $t_1^* = (1 - \lambda_1) \Pi_1^m + cq_1^m$ and $q_1^* = q_1^m$, is sufficient to implement this outcome.*

The lemma shows that U 's disagreement payoff with D_2 is now equal to

$$\pi_U^{*1} = (1 - \lambda_1) \Pi_1^m,$$

which does not depend on the first contract signed with D_1 . Different from the benchmark, here the first contract cannot be used as a way to influence U 's outside option in the second negotiation since in the event of a disagreement between U and D_2 , the first contract becomes null; U and D_1 renegotiate from scratch, as a result of which the manufacturer gets $(1 - \lambda_1) \Pi_1^m$. To take into account this difference in the solution of the game, it is enough to replace $[t_1(q_1^*) - cq_1^*]$ by $[(1 - \lambda_1) \Pi_1^m - S_1]$ in the analysis of the benchmark analysis. This affects the success of Stage 2 negotiation between U and D_2 , (4), and changes their equilibrium payoffs, given in (5). This in turn affects the success of Stage 1 negotiation between U and D_1 , (7), and changes the equilibrium profits of U and D_1 , given in (6). Now, the bilateral profit of U and D_1 is

$$\pi_U + \pi_1 = \Pi(q_1, q_2) - \lambda_2 [R_2(q_2, q_1) - cq_2 + t_1(q_1) - cq_1] + \lambda_2 [(1 - \lambda_1) \Pi_1^m - S_1] \quad (11)$$

If U and D_1 set $t_1(q_1) = R_1(q_1, q_2)$, by adjusting S_1 appropriately, they always internalize a fixed share, $(1 - \lambda_2)$, of any increase in the industry profit that will eventually be generated.

³⁹A *stable profit profile** of the latter setup is obtained as the Subgame Perfect Nash Equilibrium of no commitment framework, since allowing for renegotiation from scratch of the first agreement with D_1 in case of a failure of negotiation with D_2 constitutes a sufficient amount of renegotiations. *A *stable profit profile* is a set of profit pairs $\{\pi_U, \pi_i\}$ such that D_i cannot improve its payoff in a pairwise renegotiation with U without lowering U 's payoff and U cannot improve its payoff in a pairwise renegotiation with D_i without lowering D_i 's payoff.

As a result, the bilateral incentives of U and D_1 coincide with maximizing the total industry profit.

When the firstly signed contract has no commitment power, U and D_1 do not have any incentives to distort the efficient outcome, since they cannot shift rent from the second retailer by manipulating their first contract. Given that U and D_1 set their variable tariff inducing the monopoly price, $t_1(q_1^M) = R_1(q_1^M, q_2^M)$, U and D_2 prefer to induce the monopoly price, too, since their bilateral profit is increasing in the industry profit (from (3)). This gives us the following proposition:

Proposition 2 *In any candidate equilibrium of the game with renegotiation from scratch, if both retailers sign a contract, the first contracting parties set $t_1(q_1^M) = R_1(q_1^M, q_2^M)$, and thereby induce the quantities maximizing the industry profit, (q_1^M, q_2^M) .*

Now the question is whether the contracting parties would deviate from this candidate equilibrium to any exclusive dealing outcome. To answer this question, we need to characterize the candidate equilibrium payoffs and check whether any party might want to break its deal to get its corresponding outside option. The following condition is crucial in determining the equilibrium payoffs:

$$(P1) : \Pi^M > \frac{(1 - \lambda_2 + \lambda_1 \lambda_2)}{1 - \lambda_2} \Pi_1^m - \frac{\lambda_1}{1 - \lambda_1} \Pi_2^m.$$

Condition (P1) holds if and only if the second retailer has sufficiently low bargaining power:

$$\lambda_2 < \frac{1}{1 + \frac{\lambda_1 \Pi_1^m}{\Pi^M - \Pi_1^m + \frac{\lambda_1}{1 - \lambda_1} \Pi_2^m}} \equiv \widehat{\lambda_2}, \quad (12)$$

in which case I show that in equilibrium the gains from trade between U and D_2 is positive, and thus D_2 earns positive profits as long as it has some bargaining power, $\lambda_2 > 0$. Otherwise, that is, if $\lambda_2 > \widehat{\lambda_2}$, D_2 has very high bargaining power, but it gets zero, since then D_1 and U shift all rent from D_2 .

Lemma 3 *If $(1 - \lambda_2)\Pi_2^m > (1 - \lambda_1)\Pi_1^m$, condition (P1) holds.*

Intuitively, if U finds dealing exclusively with D_2 (and thus getting $(1 - \lambda_2)\Pi_2^m$) more profitable than dealing exclusively with D_1 (and getting $(1 - \lambda_1)\Pi_1^m$), (P1) holds and D_2 earns positive profits given that $\lambda_2 > 0$. The next result characterizes the equilibrium profits:

Proposition 3 *In equilibrium, both retailers are active and a negative up-front fee in the first contract and a fixed fee in the second contract are used to share the monopoly profit.*

- If (P1) holds, i.e., $\lambda_2 < \widehat{\lambda}_2$,

$$\begin{aligned}
S_1^{**} &= -\lambda_1 \left[\Pi^M + \frac{\lambda_2(1-\lambda_1)}{1-\lambda_2} \Pi_1^m - \Pi_2^m \right], \\
t_2^{**}(q_2^M) + S_2^{**} &= R_2(q_2^M, q_1^M) - \lambda_2 \left[(1-\lambda_1)\Pi^M + \lambda_1\Pi_2^m - \frac{(1-\lambda_1)(1-\lambda_2+\lambda_1\lambda_2)}{1-\lambda_2} \Pi_1^m \right], \\
t_2^{**}(q_2^M) &\leq R_2(q_2^M, q_1^M)
\end{aligned}$$

which lead to

$$\begin{aligned}
\pi_1^{**} &= \lambda_1 \left[\Pi^M + \frac{\lambda_2(1-\lambda_1)}{1-\lambda_2} \Pi_1^m - \Pi_2^m \right], \\
\pi_2^{**} &= \lambda_2 \left[(1-\lambda_1)\Pi^M + \lambda_1\Pi_2^m - \frac{(1-\lambda_1)(1-\lambda_2+\lambda_1\lambda_2)}{1-\lambda_2} \Pi_1^m \right], \\
\pi_U^{**} &= (1-\lambda_2) \left[(1-\lambda_1)\Pi^M + \lambda_1\Pi_2^m - \frac{(1-\lambda_1)(1-\lambda_2+\lambda_1\lambda_2)}{1-\lambda_2} \Pi_1^m \right] + (1-\lambda_1)\Pi_1^m.
\end{aligned}$$

- If (P1) does not hold, i.e., $\lambda_2 \geq \widehat{\lambda}_2$, $S_1^{**} = -[\Pi^M - (1-\lambda_1)\Pi_1^m]$, $t_2^{**}(q_2^M) + S_2^{**} = R_2(q_2^M, q_1^M)$ such that $t_2^{**}(q_2^M) \leq R_2(q_2^M, q_1^M)$. Hence,

$$\pi_1^{**} = \Pi^M - (1-\lambda_1)\Pi_1^m, \quad \pi_2^{**} = 0, \quad \pi_U^{**} = (1-\lambda_1)\Pi_1^m.$$

Observe that a negative up-front payment, that is, a slotting fee paid by U to D_1 , at the signature of the first contract is a means to achieve the vertically integrated monopoly outcome as long as D_1 has some bargaining power: Negative S_1^{**} allows U and D_1 to share their bilateral profit once they set $t_1^{**}(q_1^M) = R_1(q_1^M, q_2^M)$.

In the second contract, it does not make a difference whether there is a conditional and/or an up-front fee since the first contract has been agreed upon when the second contract is negotiated, so there is no need to protect the second retailer against any opportunism. Hence, the sum of fees $t_2^{**}(q_2^M) + S_2^{**}$ are used to share the bilateral profits between U and D_2 .

To sum up, I show that the commitment strategic effects are avoided by renegotiation from scratch of the first agreement in the event of the second retailer leaving the game. To illustrate further the role of the first contract's commitment power, I next consider the partial commitment scenario.

3.3 Partial commitment: contracts with renegotiation, but not from scratch

Consider the framework where the first contracting parties could renegotiate their contract in the event of the second retailer being out of the game. Different from the no commitment

case, here I assume that renegotiation is from the status quo which is given by the payoffs under the firstly signed contract, T_1 :

$$\begin{aligned}\pi_U^{*1}(T_1) &= S_1 + t_1(q_1^*) - cq_1^*, \\ \pi_1^*(T_1) &= R_1(q_1^*, 0) - S_1 - t_1(q_1^*).\end{aligned}\tag{13}$$

Hence, these payoffs determine the respective outside options of U and D_1 in renegotiation. They would like to renegotiate a new contract as long as they could improve their bilateral profit. When $q_1^* \neq q_1^m$, they renegotiate a new contract, say T_1^m , inducing q_1^m and thereby leading to the maximum bilateral profit, Π_1^m . Their payoffs from renegotiation would then be

$$\begin{aligned}\pi_U^{*1}(T_1^m) &= (1 - \lambda_1) [\Pi_1^m - (R_1(q_1^*, 0) - cq_1^*)] + \pi_U^{*1}(T_1) \\ \pi_1^*(T_1^m) &= \lambda_1 [\Pi_1^m - (R_1(q_1^*, 0) - cq_1^*)] + \pi_1^*(T_1)\end{aligned}\tag{14}$$

To take into account this difference in the solution of the game, it is enough to replace $[t_1(q_1^*) - cq_1^*]$ by $[\pi_U^{*1}(T_1^m) - S_1]$ in the analysis of the benchmark analysis. Now, the bilateral profit of U and D_1 is

$$\pi_U + \pi_1 = \Pi(q_1, q_2) - \lambda_2 \{R_2(q_2, q_1) - cq_2 + t_1(q_1) - cq_1 - [\pi_U^{*1}(T_1^m) - S_1]\}$$

which can be re-written (by replacing the value of $\pi_U^{*1}(T_1^m)$ from (14) and (13)) as

$$\begin{aligned}\pi_U + \pi_1 &= \Pi(q_1, q_2) - \lambda_2 \{R_2(q_2, q_1) - cq_2 + t_1(q_1) - cq_1 - [t_1(q_1^*) - cq_1^*]\} \\ &\quad + \lambda_2 (1 - \lambda_1) [\Pi_1^m - (R_1(q_1^*, 0) - cq_1^*)]\end{aligned}$$

which illustrates that U and D_1 face exactly the same trade-off as in the benchmark. On one hand, they want to induce (q_1^M, q_2^M) to maximize the industry profit. This requires setting $t_1(q_1^M) = R_1(q_1^M, q_2^M)$. On the other hand, when the second retailer has some bargaining power, $\lambda_2 > 0$, they want to minimize the rent of the second retailer by setting $q_1^* = q_1^m$ and $t_1(q_1^*) = R_1(q_1^*, 0)$.

This proves that the equilibrium with partial commitment is the same as the equilibrium with full commitment. The next question is whether the first contracting firms prefer signing vertical contracts which have no commitment power (until retail competition takes place) to the contracts with full commitment.

3.4 Preferences over the commitment power of the first contract

Recall that the game without renegotiation could attain three different equilibrium outcomes:

1. Exclusive dealing with the second retailer, in which case the bilateral profit of U and D_1 would be $(1 - \lambda_2)\Pi_2^m$.

2. Both retailers are active, in which case the bilateral profit of U and D_1 would be (from 9)

$$\pi_1^{**} + \pi_U^{**} = (1 - \lambda_2)\Pi(q_1^{**}, q_2^{**}) + \lambda_2 \left(\Pi_1^m + \int_0^{q_2} \partial_{q_2} R_1(q_1^{**}, q_2^{**}) dq_2 \right).$$

3. Exclusive dealing with the first retailer, in which case the bilateral profit of U and D_1 would be Π_1^m .

However, if U and D_1 write in their contract that it is going to be null and renegotiated from scratch if the second retailer is out of the game, their bilateral profit is given by Proposition 3. To analyze whether they want to have such a renegotiation clause in their contract, I compare their ex-post bilateral profits under the three frameworks: no commitment, partial commitment, and full commitment.

Proposition 4 *The first contracting parties are indifferent between contracting with renegotiation (but not from scratch) and without renegotiation, but they prefer contracting with renegotiation from scratch to the others if the second retailer has sufficiently high bargaining power:*

$$\lambda_2 \geq \frac{1}{1 + \frac{(1-\lambda_1)\Pi_1^m}{\Pi_1^m + \Pi_2^m - \Pi^M}}.$$

When D_2 has sufficiently high bargaining power (for high enough λ_2) and/or D_1 is sufficiently profitable in exclusive dealing (for high enough $(1 - \lambda_1)\Pi_1^m$) and/or when the retailers are sufficiently differentiated (when $\Pi_1^m + \Pi_2^m - \Pi^M$ is very small), the sufficient condition holds, and so the first retailer and manufacturer prefer the outcome of the game with renegotiation from scratch (no commitment) to the game without renegotiation (full commitment). Intuitively, in those cases, incentives to shift rent from D_2 are very high, so the first contracting parties prefer their contract to have no commitment power in case D_2 has no agreement.

3.5 Are slotting fees necessary?

Miklós-Thal et al. (2010) show that negative payments, that is, slotting fees, are not necessary to achieve the fully integrated monopoly outcome when the retailers make simultaneous offers to the manufacturer and these offers could be contingent on the market structure, exclusive dealing vs common agency. In their framework, retailer i gets at most its contribution to the efficient outcome, $\Pi^M - \Pi_{-i}^m$, and this profit could be ensured if the manufacturer sells

a limited quantity at cost to the retailer. They prove that, under some conditions,⁴⁰ this quantity level lies below the monopoly quantity, and thereby a slotting fee could be replaced by selling a limited volume at cost to leave each retailer its contribution.

In equilibrium of my setup, the first contracting retailer gets (see Proposition 3):

$$\pi_1^{**} = \lambda_1 \left[\Pi^M + \frac{\lambda_2(1 - \lambda_1)}{1 - \lambda_2} \Pi_1^m - \Pi_2^m \right],$$

which could be more than its contribution to the industry outcome, $\Pi^M - \Pi_2^m$, if the second retailer has sufficiently high bargaining power:

$$\lambda_2 > \frac{1}{1 + \frac{\lambda_1 \Pi_1^m}{\Pi^M - \Pi_2^m}}$$

in which case the manufacturer has to sell a greater quantity at cost, which might not be below the monopoly quantity. Intuitively, when the second retailer has very high bargaining power, the first contracting parties could shift a significant amount of rent from the second retailer. To share their bilateral profit, the manufacturer would need to sell at cost a volume greater than the monopoly quantity, but then this contract could not implement the monopoly outcome. Therefore, the slotting fee of the first contract cannot be replaced by a limited volume at cost. Hence, when the second retailer has sufficiently high bargaining power, a slotting fee in the first contract becomes a necessary tool to share the profits and thereby to implement the monopoly outcome. In this case, banning slotting fees would lead to the opportunism problem of the monopoly manufacturer and thereby result in some competitive prices or exclusion of the second retailer (if it has very high bargaining power). Hence, the welfare implications of slotting fees are unclear; they might prevent the monopoly prices, but at the same time, they might lead to the exclusion of one retailer.

On the other hand, when the second contracting retailer does not have so much bargaining power, a slotting fee is sufficient but not necessary to share the profits and can be replaced by a limited volume at cost, like in Miklós-Thal et al. (2010). In this case, banning slotting fees would not affect the final outcome.

⁴⁰More precisely, each retailer's contribution to the industry profit should decrease in its rival's quantity, $\partial_{q_{-i}} R_i < 0$, which is the case by A1 in my paper, and the retailers' quantities should be strategic substitutes.

4 Extensions

4.1 Renegotiation from scratch in case of a success or failure of the second negotiation:

Now, suppose that U and D_1 are allowed to renegotiate from scratch the first agreement should the second negotiation succeed (that is, they renegotiate from scratch if and only if they mutually agree to do so, otherwise the first contract is in force). In this case, D_2 should also be protected against any opportunism when U possibly renegotiates afterwards with D_1 . A high enough conditional fee paid by D_2 , that is $t_2(q_2^M) = R_2(q_2^M, q_1^M)$, prevents such an opportunistic behavior. Given $q_1 = q_1^M$ and $t_1(q_1^M) = R_1(q_1^M, q_2^M)$, U and D_2 prefer to achieve the maximum industry profit (by the same arguments as in the proof of Proposition 2). To do so, in addition to $q_2 = q_2^M$, they also need to set $t_2(q_2^M) = R_2(q_2^M, q_1^M)$ to protect D_2 against the opportunism of U . But then, U and D_1 will not have any incentive to trade a quantity different than q_1^M . Moreover, the equilibrium fee S_1^{**} is ex-post optimal since it implements the optimal sharing rule between U and D_1 expecting the fully-integrated monopoly profit. Hence, U and D_1 do not mutually agree to renegotiate equilibrium contract T_1^{**} if the second negotiation succeeds.

4.2 The order of sequential negotiations

I analyze how the results would change if U negotiated first with D_2 and then with D_1 . In this case, the solution of the game is symmetric to that of the original framework (where D_1 negotiates first with U). I obtain results symmetric to those of Propositions 2 and 3 (exchanging the roles between D_1 and D_2). Symmetric to (P1), the following condition will be crucial in determining equilibrium payoffs:

$$(P2) : \Pi^M > \frac{(1 - \lambda_1 + \lambda_1 \lambda_2)}{1 - \lambda_1} \Pi_2^m - \frac{\lambda_2}{1 - \lambda_2} \Pi_1^m.$$

Proposition 5 *If U negotiates first with D_2 , in equilibrium with renegotiation from scratch, both retailers are active and implement the fully integrated monopoly outcome. The equilibrium payoffs can be of two types: If (P2) holds, all parties get some positive profits as long as they have some bargaining power. Otherwise, D_1 gets 0 whereas D_2 gets the fully integrated monopoly profit after leaving U its outside option.*

The order of the sequential negotiations does not affect the equilibrium quantities, which are always at the monopoly level, and only affects the distribution of the monopoly profit.

Now I add one stage at the beginning of the game, in which U decides with which retailer to negotiate first. Comparing U 's payoff when D_1 is the first negotiating retailer with U 's payoff when D_2 is the first negotiating retailer, gives us the following result:

Proposition 6 *In the game with renegotiation from scratch, U prefers to negotiate first with the retailer with which it gets the smaller payoff when there is exclusive dealing, that is, if $(1 - \lambda_2)\Pi_2^m > (1 - \lambda_1)\Pi_1^m$, U strictly prefers to negotiate first with D_1 ; otherwise, U prefers to negotiate first with D_2 .*

Intuitively, U wants to take advantage of a greater outside option in the first negotiation. This is similar to the finding of Marx and Shaffer (2007a) in an inverse industry structure where a common agent retailer prefers to negotiate first with the weaker supplier to improve its bargaining position at the first stage.⁴¹

Comparing the profit of D_1 when it is the first negotiator (given in Proposition 3) and when it is the second (given in the proof of Proposition 6), one can show that D_1 always prefers to be the first in negotiations (and, by symmetry, the same is true for D_2). When (P1) does not hold, D_1 gets the maximum industry profit if it is the first contracting retailer, so, in this case, it is straightforward that D_1 prefers to be the first. However, in this case, we have $(1 - \lambda_2)\Pi_2^m \leq (1 - \lambda_1)\Pi_1^m$ (by Lemma 3), which implies that the manufacturer prefers to start its negotiation with the second retailer (by Proposition 6). This comparison is not straightforward if (P1) holds. Figure 1⁴² illustrates the comparison between the gains from being the first contracting retailer and the manufacturer's preferred order of negotiations. The red and blue curves represent, respectively, the gains of D_1 and D_2 , from being the first negotiator. The black curve shows the gains/losses of the manufacturer from starting its negotiations with D_1 . The green line is the difference between the exclusive dealing profits of the manufacturer, $(1 - \lambda_2)\Pi_2^m - (1 - \lambda_1)\Pi_1^m$. The manufacturer prefers to negotiate first with D_1 if and only if the green line is above zero (as proven in Proposition 6). In this case, the bilateral profits of the manufacturer and D_1 (the sum of the values of the black and red curves) might be below the gains of D_2 from being the first in negotiations.

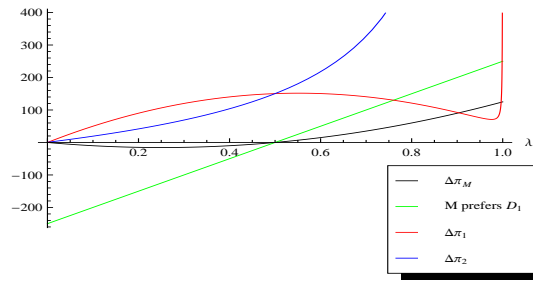


Fig. 1: Comparison of the preference on the order of negotiations

⁴¹ Another difference from my setup is that the authors consider supply contracts contingent on the structure of the industry: exclusive dealing vs up-stream competition.

⁴² I draw Figure 1 for parameter values $\Pi^M = 600$, $\Pi_1^m = \Pi_2^m = 500$ and $\lambda_2 = 0.5$. In the Appendix, Figures 2 and 3 illustrate the same graph, respectively, for $\lambda_2 = 0.1$ and $\lambda_2 = 0.9$.

4.3 Timing of the manufacturer's production

I assume that the manufacturer produces after the contract negotiations terminate. If the manufacturer produced before contract negotiations and its production is observable to the retailers, it would use its investment in the capacity of a tool to commit to selling the vertically integrated monopoly quantity after selling the half monopoly quantity to the first retailer, that is, the manufacturer could commit to not being opportunistic against the first retailer. The fact that production takes place before contracting would not change the commitment strategic effects of the first contract on the manufacturer's outside option in the second negotiation. Ex-ante investment in capacity by the manufacturer would lead to retail competition in quantities. Hence, without renegotiation, the first contracting parties would want to trade less than the monopoly quantity distorting the industry profit to shift rent from the second retailer (the result of Proposition 1 when the quantities are strategic substitutes). Different from the original setup, here there is an additional commitment effect due to the investment in capacity and this effect would not be removed by a renegotiation clause. Even if the first contract is renegotiated from scratch in the event of the second retailer has no agreement, the industry outcome would be inefficient due to the capacity constraint. However, if one allows for production *also* after the first contract negotiation, renegotiation of the first contract from scratch would lead to extra production should the second retailer leaves the game. This means that the first contract's quantity would not affect the manufacturer's outside option in the second negotiation and therefore the first contracting parties would want to trade the efficient quantity.

To account for the positive marginal cost of production, I assume that the manufacturer's production occurs after the retailers order their quantities. This assumption is not critical to my results. Relaxing it and assuming that the manufacturer produces before the retailers' orders would make the manufacturer's marginal cost sunk when it sells to the retailers, but would not change my results qualitatively. Instead, this would correspond to a special case of my framework where the manufacturer's marginal cost is zero.

4.4 Contingent contracts

If the contracts were allowed to be contingent on the rival's contract, or simply on its existence, like in Miklós-Thal et al. (2010), the firms would achieve the efficient outcome without renegotiation. By setting the following contract:

$$S_1^{**} = -\lambda_1 [\Pi^M - (1 - \lambda_2)\Pi_2^m],$$

$$t_1(q) = \begin{cases} R_1(q_1^M, q_2^M) & \text{if } q = q_1^M \text{ and } D_2 \text{ has a contract} \\ \Pi^M + cq_1^m & \text{if } q = q_1^m \text{ and } D_2 \text{ has no contract} \\ \infty & \text{otherwise} \end{cases},$$

the first contracting parties would maximize their joint profit, (6), through implementing the monopoly outcome and capturing all rent of the second retailer simultaneously. This contract claims to charge the first retailer more than the industry profit in case D_2 has no agreement, that is, $\Pi^M + cq_1^m > \Pi_1^m$. If this is not possible, for example, due to limited liability, the first contracting parties could not shift all the rent of D_2 , but would still be able to implement the monopoly quantities by setting $t_1(q_1^m) = R_1(q_1^m, 0)$ in case D_2 has no contract. Intuitively, when the first contract could be contingent on common agency (where both retailers are active) vs exclusivity (where D_2 has no contract), the contingency eliminates the commitment strategic effects of the common agency tariff, since it allows the first contracting parties to control the rent of the second retailer through the exclusive dealing tariff.

5 Policy implications and concluding remarks

Policy makers have increasingly been concerned about how retailers' bargaining strength vis-à-vis suppliers affects less powerful retailers and final prices.⁴³ The exercise of retailers' buyer power has given rise to many (complex) forms of payments made by suppliers to retailers, e.g., "slotting fees" to place products on the retailers' shelves, many "types of variable promotional support and any overrides that are linked to volume of sales, including growth targets."⁴⁴ Retailers get variable volume discounts at realized quantities of sales, whereas slotting fees are paid before the good is actually purchased and "do not commit the store operator to any particular level of purchases."⁴⁵ In other words, after receiving a slotting fee from a producer, the retailer could choose not to buy the product.

My analysis of supply contracts with full commitment shows that when competing retailers have some bargaining power vis-à-vis a common manufacturer, sequential bilateral negotiations of contracts would result in competitive prices or an exclusion of one retailer due to contracting externalities, even if contracts are general enough to solve the opportunism problem of the manufacturer. Different from Marx and Shaffer (2007b), who show that non-renegotiable simultaneous offers by retailers lead to the exclusion of the less "profitable" retailer, I show that one retailer might be excluded in equilibrium, but the occurrence of exclusion does not necessarily depend on the relative profitability of the retailers. For instance, the second contracting retailer is excluded if it has sufficiently high bargaining power. Moreover, I show that a simple renegotiation clause in bilateral contracts (that is, contracts with no commitment) would enable the firms to internalize all contracting externalities and

⁴³See the European Commission's report (1999), Dobson and Waterson (2001), Inderst and Wey (2007) for evidence and consequences of growing buyer power of retailers in Europe and in the US.

⁴⁴The UK Competition Commission's reports (2000, 2008).

⁴⁵See the Federal Trade Commission (FTC)'s report (2001), p.11.

implement the fully integrated monopoly prices, where both retailers are active.

Regarding the welfare implications of slotting fees, I show that a slotting fee in the first contract might be necessary to implement the monopoly outcome, since it cannot be replaced by non-negative tariffs, like sales at cost, to share the bilateral profits between the first contracting parties if the second retailer has a very high bargaining power. This result is different from Miklós-Thal et al. (2010), who show that slotting fees are sufficient, but not necessary tools to implement the monopoly outcome.

Instead of giving all bargaining power to one side, I assume more realistic bilateral negotiations where bargaining power is shared between the two sides. This allows me to analyze exclusive dealing incentives in the game without renegotiation and illustrate differences from Marx and Shaffer (2007b) when the retailers have asymmetric bargaining power. This also alleviates some problems that might otherwise arise when two competitors make take-it-or-leave-it offers to the same partner. In equilibrium, the side with no bargaining power gets zero, so the competitors could always find a profitable deviation from any candidate equilibrium by offering a slightly positive payoff to the common agent.⁴⁶ Allowing for more balanced bargaining power is likely to ensure that all parties strictly prefer to deal with all partners and thus simplify the existence and the characterization of equilibria.

An interesting research agenda is to extend this analysis to account for implications of upstream competition. Intuitively, all the commitment strategic effects of early signed supply contracts could be eliminated if the firms are assumed to renegotiate from scratch in case one bilateral negotiation ends with a disagreement. A full-fledged analysis is required to prove this intuitive argument.

⁴⁶For instance, Rey and Vergé (2004) show that when two competing manufacturers simultaneously make take-it-or-leave-it two-part tariff offers to two imperfectly competitive retailers, in equilibrium, the manufacturers *push* the retailers to the limit where they will be indifferent between dealing with (either) one or both manufacturers (and always get zero payoff); this in turn makes it tempting for a manufacturer, by *slightly* deviating, to convince a retailer to cut its rival. As a consequence, many types of deviations, leading to different market structures, must be considered, and the characterization of equilibria is quite cumbersome. A similar problem would appear if the retailers were instead assumed to have all bargaining power – in equilibrium, the manufacturers would be indifferent between dealing with one or both retailers (and always get zero payoff), which would encourage retailers to deviate in various ways, and so on.

Appendix

Proof of Lemma 1 An equilibrium tariff $T_2(q)$ is a maximizer of the generalized Nash product of the negotiation between D_2 and U :

$$\max_{T_2(\cdot)} [R_2(q_2, 0) - T_2(q_2)]^{\lambda_2} [T_2(q_2) - cq_2]^{(1-\lambda_2)}.$$

If the parties set

$$T_2^*(q) = \begin{cases} (1 - \lambda_2)\Pi_2^m + cq_2^m & \text{if } q = q_2^m \\ \infty & \text{otherwise,} \end{cases}$$

they induce the quantity maximizing their bilateral profit, q_2^m . The fixed fee, $(1 - \lambda_2)\Pi_2^m + cq_2^m$, then enables D_2 and U to share the maximized industry profit, Π_2^m , with respect to their respective bargaining power:

$$\pi_2^* = \lambda_2 \Pi_2^m, \quad \pi_U^{*2} = (1 - \lambda_2) \Pi_2^m.$$

Exclusive dealing equilibrium without renegotiation Consider the equilibrium of the game without renegotiation. The first contracting parties prefer to exclude the second retailer if and only if they earn more from exclusive dealing and more than their joint profits in case of a disagreement, that is, conditions in (10) both hold.

Suppose that the industry profit when both retailers are active is at least as high as the exclusive dealing profits, $\Pi(q_1^{**}, q_2^{**}) \geq \max\{\Pi_1^m, \Pi_2^m\}$. Indeed, when the retailers are highly differentiated and are not very asymmetric in their profitability, this inequality should hold. Let $\bar{\lambda}_2$ denote the minimum threshold at which both conditions in (10) hold, so U and D_1 are indifferent between excluding D_2 or not:

$$\bar{\lambda}_2 = \max \left\{ \frac{1}{1 - \frac{\int_0^{q_2^{**}} \partial_{q_2} R_1(q_1^{**}, q_2) dq_2}{\Pi(q_1^{**}, q_2^{**}) - \Pi_1^m}}, 1 - \frac{\Pi_1^m}{\Pi_2^m} \right\}$$

For $\lambda_2 > \bar{\lambda}_2$, conditions in (10) strictly hold and D_2 is excluded. Otherwise, $\lambda_2 < \bar{\lambda}_2$, D_2 will be active, in which case U and D_1 sign a contract if there are some gains from trade

(condition (7) holds at equilibrium contracts⁴⁷):

$$\Pi(q_1^{**}, q_2^{**}) - \Pi_2^m \geq \lambda_2 \left[\Pi(q_1^{**}, q_2^{**}) - \Pi_2^m - \Pi_1^m - \int_0^{q_2^{**}} \partial_{q_2} R_1(q_1^{**}, q_2) dq_2 \right]. \quad (15)$$

Observe that (15) always holds since the sum of the last two terms in the brackets (on the right-hand side) sum up to the manufacturer's exclusive dealing profit with D_1 , which is non-negative:

$$\Pi_1^m + \int_0^{q_2^{**}} \partial_{q_2} R_1(q_1^{**}, q_2) dq_2 = \pi_U^{*1} \geq 0,$$

This proves the following result:

Proposition 7 *In equilibrium of the game without renegotiation, if the industry profit is higher than the exclusive dealing profits, $\Pi(q_1^{**}, q_2^{**}) \geq \max\{\Pi_1^m, \Pi_2^m\}$,*

- (i) *There is inefficient exclusion of the second retailer if and only if it has sufficiently high bargaining power, that is, $\lambda_2 \geq \bar{\lambda}_2$.*
- (ii) *Otherwise, both retailers would be active.*

Proof of Proposition 2 Consider a candidate equilibrium, (T_1^c, T_2^c) , where both retailers sign a contract and the industry profit, Π^c , is lower than the vertically integrated monopoly profit, Π^M . Let the payoffs of D_1 , D_2 and U be respectively π_1^c , π_2^c , and π_U^c . (T_1^c, T_2^c) could be the equilibrium contracts only if each retailer gets non-negative profits, $\pi_1^c, \pi_2^c \geq 0$, and U gets at least what it would get by failing one negotiation and focusing on the other retailer. If the negotiation with D_1 fails, U deals only with D_2 and gets $(1 - \lambda_2)\Pi_2^m$ (from Lemma (1)). If the negotiation with D_2 fails, the first contract with D_1 becomes null, U and D_1 renegotiate from scratch, and thus U gets $(1 - \lambda_1)\Pi_1^m$ (from (2)). The equilibrium profit of U should be at least as much as its outside options, $\pi_U^c \geq (1 - \lambda_2)\Pi_2^m$ and $\pi_U^c \geq (1 - \lambda_1)\Pi_1^m$.

At (T_1^c, T_2^c) , the gains from trade between U and D_2 , that is, their bilateral profit, $\Pi^c - \pi_1^c$, minus the disagreement payoff of U , $(1 - \lambda_1)\Pi_1^m$, must be non-negative:

$$\Pi^c - \pi_1^c - (1 - \lambda_1)\Pi_1^m \geq 0$$

since otherwise there would be no contract between them. In Stage 2, U and D_2 share the

⁴⁷Following the same lines as of page 12, one could show that in equilibrium we have

$$\begin{aligned} t_1(q_1^*) &= R_1(q_1^*, 0) + \int_0^{q_2^{**}} \partial_{q_2} R_1(q_1^*, q_2) dq_2, \\ q_1^* &= q_1^m. \end{aligned}$$

gains from trade with respect to their bargaining power:

$$\begin{aligned}\pi_2^c &= \lambda_2 (\Pi^c - \pi_1^c - (1 - \lambda_1)\Pi_1^m), \\ \pi_U^c &= (1 - \lambda_2) (\Pi^c - \pi_1^c - (1 - \lambda_1)\Pi_1^m) + (1 - \lambda_1)\Pi_1^m.\end{aligned}$$

Let ε be a positive number satisfying $\varepsilon < \Pi^M - \Pi^c$. Instead of T_1^c , suppose that U and D_1 negotiated T_1^d to induce q_1^M such that

$$S_1^d = -(\pi_1^c + \varepsilon), \quad t_1^d(q) = \begin{cases} R_1(q_1^M, q_2^M) & \text{if } q_1 = q_1^M \\ \infty & \text{if } q_1 \neq q_1^M \end{cases}.$$

Once T_1^d is signed, if U and D_2 trade something different than q_2^M , the industry profit will be lower than Π^M . If $q_2 > q_2^M$, D_1 's profit is $\pi_1^c + \varepsilon$ and D_1 is inactive, since otherwise it would pay fee $t_1^d(q_1^M)$, which is greater than its revenue $R_1(q_1^M, q_2)$, since $\partial_{q_2} R_1 < 0$ (by A1). If $q_2 < q_2^M$, D_1 is active and its profit is strictly greater than $\pi_1^c + \varepsilon$. Since the payoffs of U and D_2 are both increasing in the industry profit and decreasing in D_1 's profit, they prefer to negotiate T_2^d , which induces q_2^M , to achieve the industry profit of Π^M and to leave the minimum to D_1 , which is $\pi_1^d = \pi_1^c + \varepsilon$. Under (T_1^d, T_2^d) both retailers would be active, and the three firms obtain (replacing Π^c with Π^M , and π_1^c with $\pi_1^d = \pi_1^c + \varepsilon$ in the above payoff expressions):

$$\begin{aligned}\pi_1^d &= \pi_1^c + \varepsilon, & \pi_2^d &= \lambda_2 (\Pi^M - \pi_1^c - \varepsilon - (1 - \lambda_1)\Pi_1^m), \\ \pi_U^d &= (1 - \lambda_2) (\Pi^M - \pi_1^c - \varepsilon - (1 - \lambda_1)\Pi_1^m) + (1 - \lambda_1)\Pi_1^m.\end{aligned}$$

Since $0 < \varepsilon < \Pi^M - \Pi^c$, I get $\pi_1^d > \pi_1^c$, $\pi_2^d > \pi_2^c$ and $\pi_U^d > \pi_U^c$. By assumption, U and D_2 had no incentives to fail their negotiation initially (that is, they negotiate T_2^c once T_1^c is signed). Since they both get more under (T_1^d, T_2^d) than under (T_1^c, T_2^c) , they do not fail their negotiation once T_1^d is signed, either. But then, U and D_1 prefer (T_1^d, T_2^d) to (T_1^c, T_2^c) since they both get strictly higher profits under (T_1^d, T_2^d) , that is, (T_1^c, T_2^c) cannot be an equilibrium. Therefore, in any candidate equilibrium where both retailers sign a contract with U , it must be the case that both retailers are active and achieve the monopoly outcome: $q_i = q_i^M$.

Proof of Lemma 3 Suppose that (P1) does not hold and that $(1 - \lambda_2)\Pi_2^m > (1 - \lambda_1)\Pi_1^m$, these inequalities are consistent if $\Pi^M < (1 - \lambda_1)\Pi_1^m$ which can never be satisfied since $\Pi^M > \Pi_1^m$.

Proof of Proposition 3 Proposition 2 shows that in any candidate equilibrium where both retailers sign a contract, D_1 and D_2 sell, respectively, (q_1^M, q_2^M) . We then have $t_1(q_1^M) = R_1(q_1^M, q_2^M)$ (since otherwise U and D_2 would trade $q_2 > q_2^M$, see (8)). Suppose, wlog, that

$t_2(q_2^M) = R_2(q_2^M, q_1^M)$ since what matters for U and D_2 is the sum of the fees, $t_2(q_2^M) + S_2$, rather than the individual values of $t_2(q_2^M)$ and S_2 . Given these, I simplify the analysis by assuming that: (i) Each contract consists only of an up-front payment, (ii) each retailer decides whether to sign a contract or not, and (iii) if both retailers have a contract, they sell the monopoly quantities, (q_1^M, q_2^M) . The payoffs are then

$$\pi_i = -S_i \quad \text{for } i = 1, 2, \quad \pi_U = \Pi^M + S_1 + S_2. \quad (16)$$

Consider the negotiation between U and D_2 with the new value of D_2 's disagreement profit with U , that is, replace $[t_1(q_1^*) - cq_1^*]$ by $[(1 - \lambda_1)\Pi_1^m - S_1]$ in (5). Given T_1 is signed, U and D_2 choose between two possibilities: either they fail their negotiation, in which case their bilateral profit is $(1 - \lambda_1)\Pi_1^m$ (from (2)), or they negotiate a contract, in which case their bilateral profit is $\Pi^M + S_1$. I define Condition 1 as follows:

$$\text{Condition 1 : } \Pi^M + S_1 - (1 - \lambda_1)\Pi_1^m \geq 0.$$

If Condition 1 holds, U and D_2 prefer to reach an agreement and set S_2 by

$$\max_{S_2} [\Pi^M + S_1 + S_2 - (1 - \lambda_1)\Pi_1^m]^{1-\lambda_2} [-S_2]^{\lambda_2}.$$

The first-order condition then characterizes S_2 as a function of S_1 :

$$S_2^{**}(S_1) = -\lambda_2 [\Pi^M + S_1 - (1 - \lambda_1)\Pi_1^m], \quad (17)$$

which yields the payoffs

$$\begin{aligned} \pi_1^{**}(S_1) &= -S_1, \quad \pi_2^{**}(S_1) = \lambda_2 [\Pi^M + S_1 - (1 - \lambda_1)\Pi_1^m], \\ \pi_U^{**}(S_1) &= (1 - \lambda_2) [\Pi^M + S_1 - (1 - \lambda_1)\Pi_1^m] + (1 - \lambda_1)\Pi_1^m. \end{aligned}$$

If Condition 1 does not hold, the negotiation between U and D_2 breaks down, in which case the payoffs are (from (2))

$$\pi_1^* = \lambda_1 \Pi_1^m, \pi_2 = 0, \quad \text{and} \quad \pi_U^{*1} = (1 - \lambda_1)\Pi_1^m.$$

In Stage 1, U and D_1 choose among three options:

Option 1: They fail their negotiation, in which case the payoffs are (from (1)):

$$\pi_1 = 0, \quad \pi_U^{*2} = (1 - \lambda_2)\Pi_2^m.$$

Option 2: They negotiate a contract, in which case they have two options:

(a) If they set S_1 such that Condition 1 does not hold, the second negotiation breaks down and their payoffs are

$$\pi_1^* = \lambda_1 \Pi_1^m, \quad \pi_U^{*1} = (1 - \lambda_1) \Pi_1^m.$$

(b) If they set S_1 satisfying Condition 1, the second negotiation succeeds and their payoffs are eventually given by:

$$\pi_1^{**}(S_1) = -S_1, \quad \pi_U^{**}(S_1) = (1 - \lambda_2) [\Pi^M + S_1 - (1 - \lambda_1) \Pi_1^m] + (1 - \lambda_1) \Pi_1^m.$$

Observe that, in *Option 2b*, if U and D_1 set $S_1 = (1 - \lambda_1) \Pi_1^m - \Pi^M$, U gets the same payoff as in *Option 2a* and D_1 gets $\Pi^M - \pi_U$ instead of $\Pi_1^m - \pi_U$. In other words, in *Option 2b*, U and D_1 can set an up-front payment which enables them to do better than in *Option 2a*. Therefore, they prefer *Option 2b* to *Option 2a*. Similarly, they prefer *Option 2b* to *Option 1* since setting $S_1 = 0$ in *Option 2b* gives D_1 zero payoff as in *Option 1* and gives U the payoff of $(1 - \lambda_2) \Pi^M + \lambda_2 (1 - \lambda_1) \Pi_1^m$, which is superior to its payoff in *Option 1*. Hence, U and D_1 prefer *Option 2b* and set $S_1 \geq (1 - \lambda_1) \Pi_1^m - \Pi^M$. At optimum, S_1 is chosen by

$$\max_{S_1} \left\{ (1 - \lambda_2) [\Pi^M + S_1 - (1 - \lambda_1) \Pi_1^m] + (1 - \lambda_1) \Pi_1^m - (1 - \lambda_2) \Pi_2^m \right\}^{(1-\lambda_1)} \{-S_1\}^{\lambda_1} \quad (18)$$

$$s.t. S_1 \geq (1 - \lambda_1) \Pi_1^m - \Pi^M$$

The constraint requires that the gains from trade between U and D_2 are non-negative (that is, Condition 1 is satisfied) so that the negotiation with D_2 does not fail once T_1 is signed.

If the constraint is not binding, the first-order condition characterizes the equilibrium up-front fee:

$$S_1^{**} = -\lambda_1 \left[\Pi^M - \Pi_2^m + \frac{\lambda_2 (1 - \lambda_1)}{1 - \lambda_2} \Pi_1^m \right], \quad (19)$$

which satisfies the constraint if (and only if) (P1) holds.

- If (P1) holds, the constraint is not binding and S_1^{**} is given by (19). By using (17), S_2^{**} is then calculated as

$$S_2^{**} = -\lambda_2 \left[(1 - \lambda_1) \Pi^M + \lambda_1 \Pi_2^m - \frac{(1 - \lambda_1)(1 - \lambda_2 + \lambda_1 \lambda_2)}{1 - \lambda_2} \Pi_1^m \right].$$

Replacing S_1^{**} and S_2^{**} into the profit equations (16), we obtain

$$\begin{aligned}\pi_1^{**} &= \lambda_1 \left[\Pi^M + \frac{\lambda_2(1-\lambda_1)}{1-\lambda_2} \Pi_1^m - \Pi_2^m \right], \\ \pi_2^{**} &= \lambda_2 \left[(1-\lambda_1)\Pi^M + \lambda_1\Pi_2^m - \frac{(1-\lambda_1)(1-\lambda_2+\lambda_1\lambda_2)}{1-\lambda_2} \Pi_1^m \right], \\ \pi_U^{**} &= (1-\lambda_2) \left[(1-\lambda_1)\Pi^M + \lambda_1\Pi_2^m - \frac{(1-\lambda_1)(1-\lambda_2+\lambda_1\lambda_2)}{1-\lambda_2} \Pi_1^m \right] + (1-\lambda_1)\Pi_1^m.\end{aligned}$$

- If (P1) does not hold, the constraint must be binding, that is, $S_1^{**} = (1-\lambda_1)\Pi_1^m - \Pi^M$, which leads to $S_2^{**} = 0$ and

$$\pi_1^{**} = \Pi^M - (1-\lambda_1)\Pi_1^m; \pi_2^{**} = 0; \pi_U^{**} = (1-\lambda_1)\Pi_1^m.$$

If (P1) holds, U gets at least its disagreement payoff with D_2 , $(1-\lambda_1)\Pi_1^m$, and at least its disagreement payoff with D_1 , $(1-\lambda_2)\Pi_2^m$, by the definition of the Generalized Nash Bargaining solution. If (P1) does not hold, U gets exactly its disagreement payoff with D_2 . By Lemma (3), we have $(1-\lambda_1)\Pi_1^m \geq (1-\lambda_2)\Pi_2^m$, so U also gets at least its disagreement payoff with D_1 . Hence, U has no incentive to fail its negotiation with D_1 , and once T_1^{**} is signed, it has no incentive to fail its negotiation with D_2 , either. Similarly, as both retailers get non-negative payoffs under contracts (T_1^{**}, T_2^{**}) , none of them has an incentive to fail its negotiation with U . Hence, in equilibrium both retailers are active and implement the fully integrated monopoly outcome, and the equilibrium payoffs of two types depending on condition (P1).

Proof of Proposition 4 The game with renegotiation from scratch could have two different equilibrium distributions (from Proposition 3):

- The bilateral profit of U and D_1 would be the maximum industry profit, Π^M , if (P1) does not hold. This is the case if and only if (from (12))

$$\lambda_2 \geq \frac{1}{1 + \frac{\lambda_1 \Pi_1^m}{\Pi^M - \Pi_1^m + \frac{\lambda_1}{1-\lambda_1} \Pi_2^m}} \equiv \widehat{\lambda}_2$$

In this case U and D_1 prefer renegotiation from scratch to any outcome of the game without renegotiation.

- If $\lambda_2 < \widehat{\lambda}_2$, (P1) holds and the bilateral profit of U and D_1 would be

$$(\pi_1^{**} + \pi_U^{**})^R = (1-\lambda_2) \Pi^M + \lambda_2(1-\lambda_1)\Pi_1^m + \lambda_2\lambda_1 \left[\Pi^M + \frac{\lambda_2(1-\lambda_1)}{1-\lambda_2} \Pi_1^m - \Pi_2^m \right]. \quad (20)$$

In this case, U and D_1 prefer renegotiation from scratch to the exclusive dealing outcomes (see the proof of Proposition 3):

$$\begin{aligned}(\pi_1^{**} + \pi_U^{**})^R &\geq (1 - \lambda_2)\Pi_2^m \\ (\pi_1^{**} + \pi_U^{**})^R &\geq \Pi_1^m\end{aligned}$$

Consider the outcome of the game without renegotiation where both retailers are active:

$$(\pi_1^{**} + \pi_U^{**})^{NR} = (1 - \lambda_2)\Pi(q_1^{**}, q_2^{**}) + \lambda_2 \left(\Pi_1^m + \int_0^{q_2} \partial_{q_2} R_1(q_1^{**}, q_2^{**}) dq_2 \right). \quad (21)$$

This could be an equilibrium if and only if it dominates the exclusive dealing outcomes:

$$\begin{aligned}(\pi_1^{**} + \pi_U^{**})^{NR} &\geq (1 - \lambda_2)\Pi_2^m \\ (\pi_1^{**} + \pi_U^{**})^{NR} &\geq \Pi_1^m\end{aligned}$$

Suppose that this is the case (since otherwise U and D_1 would prefer renegotiation from scratch to the game without renegotiation). First observe that the bilateral profit in the game with renegotiation is bounded above:

$$(\pi_1^{**} + \pi_U^{**})^{NR} < (1 - \lambda_2)\Pi^M + \lambda_2\Pi_1^m \quad (22)$$

since $\Pi(q_1^{**}, q_2^{**}) < \Pi^M$ and $\partial_{q_2} R_1(q_1^{**}, q_2^{**}) < 0$. Comparing (20) with (21) and using (22), I derive a sufficient condition under which U and D_1 prefer the contracting with renegotiation from scratch to without renegotiation:

$$\Pi^M + \frac{\lambda_2(1 - \lambda_1)}{1 - \lambda_2}\Pi_1^m - \Pi_2^m - \Pi_1^m \geq 0 \quad (23)$$

which is equivalent to

$$\lambda_2 \geq \frac{1}{1 + \frac{(1 - \lambda_1)\Pi_1^m}{\Pi_1^m + \Pi_2^m - \Pi^M}}.$$

Hence, when (P1) holds, U and D_1 prefer renegotiation from scratch to any outcome of the game without renegotiation if

$$\widehat{\lambda}_2 > \lambda_2 \geq \frac{1}{1 + \frac{(1 - \lambda_1)\Pi_1^m}{\Pi_1^m + \Pi_2^m - \Pi^M}}.$$

It is straightforward to show that this range is non-empty, that is,

$$\widehat{\lambda}_2 = \frac{1}{1 + \frac{\lambda_1 \Pi_1^m}{\Pi^M - \Pi_1^m + \frac{\lambda_1}{1 - \lambda_1} \Pi_2^m}} > \frac{1}{1 + \frac{(1 - \lambda_1) \Pi_1^m}{\Pi_1^m + \Pi_2^m - \Pi^M}},$$

because

$$\frac{\lambda_1 \Pi_1^m}{\Pi^M - \Pi_1^m + \frac{\lambda_1}{1 - \lambda_1} \Pi_2^m} < \frac{(1 - \lambda_1) \Pi_1^m}{\Pi_1^m + \Pi_2^m - \Pi^M},$$

given that $\Pi^M > \Pi_1^m > 0$.

Proof of Proposition 6 Suppose that $(1 - \lambda_2) \Pi_2^m > (1 - \lambda_1) \Pi_1^m$,

i. If U negotiates first with D_1 , by Lemma 3, (P1) holds and U gets

$$\pi_U^{**} = (1 - \lambda_2) \left[(1 - \lambda_1) \Pi^M + \lambda_1 \Pi_2^m - \frac{(1 - \lambda_1)(1 - \lambda_2 + \lambda_1 \lambda_2)}{1 - \lambda_2} \Pi_1^m \right] + (1 - \lambda_1) \Pi_1^m.$$

ii. If U negotiates first with D_2 :

– When (P2) holds, U gets

$$\pi_U^{**} = (1 - \lambda_1) \left[(1 - \lambda_2) \Pi^M + \lambda_2 \Pi_1^m - \frac{(1 - \lambda_2)(1 - \lambda_1 + \lambda_1 \lambda_2)}{1 - \lambda_1} \Pi_2^m \right] + (1 - \lambda_2) \Pi_2^m.$$

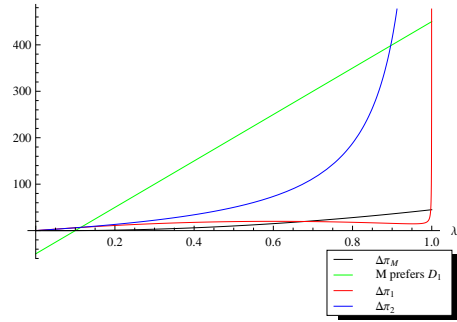
U strictly prefers (i) to (ii) since $(1 - \lambda_2) \Pi_2^m > (1 - \lambda_1) \Pi_1^m$.

– When (P2) does not hold, U gets $\pi_U^{**} = (1 - \lambda_2) \Pi_2^m$. U strictly prefers (i) to (ii) if

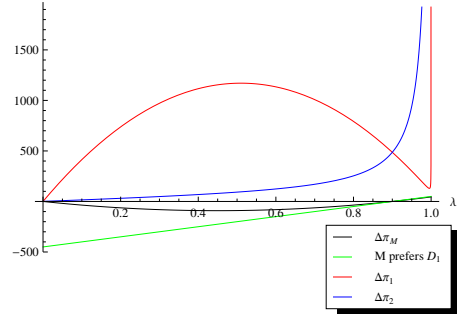
$$\Pi^M > \Pi_2^m - \frac{\lambda_2(1 - \lambda_1) \Pi_1^m}{1 - \lambda_2} \text{ which is always the case as } \Pi^M > \Pi_2^m \text{ and } \lambda_i \in [0, 1].$$

Symmetrically, if $(1 - \lambda_2) \Pi_2^m \leq (1 - \lambda_1) \Pi_1^m$, U prefers (ii) to (i).

Comparison of the gains from being the first contracting retailer and the manufacturer's preferred order of negotiations: Figures 2 and 3 are drawn for parameter values $\Pi^M = 600$, $\Pi_1^m = \Pi_2^m = 500$, $\lambda_2 = 0.1$ and $\lambda_2 = 0.9$, respectively:



(a) Fig.2



(b) Fig.3

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