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Hendrik Döpper
Geza Sapi
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Prof. Dr. Hans-Theo Normann
Düsseldorf Institute for Competition Economics (DICE)
Tel +49 (0) 211-81-15125, E-Mail normann@dice.hhu.de

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A Bargaining Perspective on Vertical Integration*

Hendrik Döpper[1], Geza Sapi[1,2], and Christian Wey[1]

[1]Düsseldorf Institute for Competition Economics (DICE), Heinrich Heine University Düsseldorf, Universitätsstr. 1, 40225 Düsseldorf, Germany

[2]European Commission DG COMP - Chief Economist Team

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Abstract

This paper analyzes vertical integration incentives in a bilaterally duopolistic industry where input market outcomes are determined by bargaining. Vertical integration incentives are a combination of horizontal integration incentives up- and downstream and depend on the strength of substitutability or complementarity and the shape of the unit cost function. In contrast to the widely prevailing view in competition policy, vertical integration can under particular circumstances convey more bargaining power to the merged entity than a horizontal merger to monopoly. In a bidding game for an exogenously determined target firm, a vertical merger can dominate a horizontal one, while pre-emption does not occur.

Keywords: Bargaining; Vertical Mergers; Shapley Value
JEL: L13; L22; L42

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Email: doepper@dice.hhu.de (Döpper), sapi@dice.hhu.de (Sapi), wey@dice.hhu.de (Wey)

1 Introduction

Competition policy traditionally looks at vertical and horizontal mergers from different perspectives. While horizontal mergers are often regarded to be motivated by the intent to reduce competition, vertical integration is more frequently argued to be driven by efficiencies, for example by eliminating double markups, reducing transaction costs or solving some variant of the holdup problem. This is explicitly stated in paragraph 11 of the EC non-horizontal merger guidelines, recognizing that *"[n]on-horizontal mergers are generally less likely to significantly impede effective competition than horizontal mergers"* (European Union, 2008). A similar view emerges in the Vertical Merger Guidelines of the US Department of Justice and the Federal Trade Commission, noting that *"[v]ertical mergers [...]also raise distinct considerations [than horizontal mergers][...]. For example, vertical mergers often benefit consumers through the elimination of double marginalization, which tends to lessen the risks of competitive harm."*[1]

At least some of this sharp distinction between horizontal and vertical mergers may lie in the tradition of economic analysis to ignore the ability of downstream firms to influence upstream markets. Yet in perhaps most vertically related industries, supply conditions are determined through bilateral bargaining, where downstream firms may have the ability to actively negotiate contracts with suppliers. Much research has been devoted to how horizontal integration can tip bargaining in favor of the merging parties. This research also gave rise to the recent heated debate on buyer-power in the antitrust arena. The question of how vertical integration can affect bargaining outcomes has however remained significantly less studied.

This article intends to make a step towards closing this gap. We investigate the driving forces behind vertical integration, its effects and social desirability while taking into account that transactions between businesses in input markets arise as a result of bilateral bargaining. To focus on the shift in bargaining power from vertical integration, we apply a model that abstracts away from product market effects such as changes in price.[2]

We provide conditions for vertical mergers to take place regarding the strength of substitutability or complementarity between products and the shape of the unit cost function. We are also able to compare vertical to horizontal integration incentives, and find that vertical

[1] See Section 1 of the Vertical Merger Guidelines (U.S. Department of Justice & The Federal Trade Commission, 2020).

[2] Isolating shifts in bargaining power from price effects is useful for reasons of tractability. We can also show that adding downstream competition leaves our qualitative results intact. Details are provided in Appendix B.

merger incentives are a combination of horizontal merger incentives up- and downstream, so that both types of mergers are closely related from a pure bargaining perspective.

We also analyze strategic incentives of firms to merge in order to pre-empt a potentially harmful merger by a competitor. To investigate this question, we propose a bidding game in which an exogenously determined target firm is up for sale for the highest bidder, either to a horizontally or a vertically related firm. In this framework, we show that vertical merger incentives can be stronger than horizontal ones. Consequently, and in contrast to conventional wisdom, a horizontal merger to monopoly may convey less bargaining power to the merged entity than vertical integration. In addition, we find that vertical mergers are never motivated by pre-emptive bargaining power considerations.

A lot of examples show the increasingly important role of bargaining power considerations in the decisions of antitrust authorities, both in vertical as well as horizontal mergers.

In a horizontal merger of the two major record labels EMI and Universal in 2012, the European Commission acknowledged no competitive overlap between Universal and EMI's song titles at the consumer level.[3] Nonetheless, it concluded that the merger would have likely increased the bargaining power of Universal towards digital music platforms at the downstream level, such as Apple iTunes and Spotify. The case is an example of antitrust concerns related to an increase in bargaining power in an upstream merger against downstream customers.

The merger of the two German discounter supermarket chains Netto and Plus is an example of the role of bargaining power in a horizontal downstream merger.[4] The supermarket chain EDEKA, which operated Netto, acquired a majority share in a new joint venture with its competitor Tengelmann, which operated Plus. The aim of the joint venture was to integrate the activities of their discounter chains Netto and Plus. Tengelmann would have received a minority share and the agreement would have allowed for the possibility of the supermarket chains negotiating jointly with upstream manufacturers. The German Federal Cartel Office imposed remedies on the merger with the aim of sustaining competition in both the up- and downstream markets. In particular, the authority pointed to the increased bargaining power that would have resulted from joint negotiations and prohibit such a cooperation.

Although EDEKA and Tengelmann were not allowed to cooperate, the merger discussions gave rise to new competitive concerns: EDEKA obtained key insights into Plus' (pre-merger) wholesale terms with suppliers. EDEKA used these insights to renegotiate contracts where its own terms with suppliers were worse than those of Plus. The German Federal Cartel

[3]See Case COMP/M. 6458 Universal Music Group/EMI Music.

[4]See Case B2-333/07.

Office found that EDEKA had considerable bargaining power over the manufacturers and therefore prohibited this practice.[5]

Bargaining power in vertical mergers was a key consideration in the U.S. merger wave between downstream pay-TV operators and their upstream content providers. The merger series includes, among others, the famous media mergers of News Corp/DirecTV, Comcast/NBCU, and AT&T/Time Warner. As discussed in a comment by Rogerson (2020a, pp. 1-4) on a draft of the latest US vertical merger guidelines[6], the merger investigations and the corresponding debates have over time led to a stronger integration of bargaining considerations into decisions. In particular, the traditional paradigms of raising rivals' costs and input foreclosure have been successively challenged by a competing theory, called bargaining leverage over rivals. While the theory of raising rivals' costs arises from setup where bargaining power only exists on the upstream market side, so that upstream firms can make take-it-or-leave-it offers, the competing theory arises from a bargaining framework in which both sides can have (some) bargaining power.

2 Literature Review

Our article contributes to the literature on vertical integration incentives. Given that up- and downstream firms have (at least some) market power, vertical integration can be privately and socially desirable because of its potential to reduce the double mark-up problem which arises under linear wholesale prices. However, the opposite (i.e., vertical disintegration) can also occur, when there are competing vertical chains (Bonanno and Vickers (1988)). Recent economic theories emphasize the anti-competitive effects of vertical mergers by referring to foreclosure and raising rivals' costs effects. Salinger (1988), Ordover et al. (1990), and Inderst and Valletti (2011) derive conditions such that an upstream firm has an incentive to integrate vertically in order to limit supply to downstream rivals.

Hart et al. (1990) were among the first to analyze vertical integration incentives when input market transactions are the result of bilateral and secret contracting.[7] Under such conditions, an upstream monopolist selling its goods via (competing) retailers to final consumers faces a commitment problem which prevents it from reaping the full monopoly profit. Thus, the upstream monopolist is its own worst competitor and, without a suitable com-

[5] See Case B2-58/09. The decision was later broadly confirmed by the German Federal Court of Justice, see File Number KVR 3/17.

[6] See Rogerson (2020b, pp. 408-412) for the journal version.

[7] Typically, quantity forcing or two-part tariff contracts are considered. A direct consequence of this assumption is that there is no vertical merger incentive to overcome the double mark-up problem.

mitment device at hand, is not able to implement the monopoly solution (a problem closely related to the durable good monopoly problem of Coase (1972)). Given such a setting, Hart et al. (1990) show that vertical integration can help a dominant supplier to implement the monopoly solution. Consequently, vertical integration serves to foreclose downstream rivals and reduces output, which harms welfare.[8]

It has been recognized in industrial organization theory and in competition policy that, if delivery conditions between sellers and buyers are determined by bargaining, the resulting outcomes may be markedly different from usual ones (Horn and Wolinsky, 1988; Campbell, 2007). Our modeling approach explicitly takes bargaining into account to examine the incentives for vertical mergers. We follow the standard merger literature and consider a merger as combining two otherwise independently bargaining units into a single firm. Whereas under non-integration each supplier and retailer bargains separately, under integration the negotiations of the merged entity are controlled by one common agent. Regarding the way bargaining is modeled, this article has several predecessors. We follow, among others, Hart and Moore (1990); Stole and Zwiebel (1996); Rajan and Zingales (1998); Inderst and Wey (2003); Segal (2003); De Fontenay and Gans (2005b); Montez (2007) and Kranton and Minehart (2000), and use the Shapley value to capture the outcome of bargaining between various actors.[9]

The two articles closest to ours are Inderst and Wey (2003) and De Fontenay and Gans (2005b). Both articles focus on an industry with two upstream and two downstream firms and use the Shapley value to capture bargaining outcomes.[10] Under the assumption that downstream markets are independent, Inderst and Wey (2003) analyze horizontal merger incentives upstream and downstream, as well as the choice of a manufacturer between two technologies influencing production costs.

In turn, De Fontenay and Gans (2005b) focus on vertical merger incentives in a similar bargaining framework and compare outcomes under upstream competition and monopoly.[11]

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[8]The approach of Hart et al. (1990) has been extended to analyze the effects of vertical integration on investment incentives. See Bolton and Whinston (1993), Stole and Zwiebel (1996), Baake et al. (2004) and Choi and Yi (2000) for examples.

[9]While it is an axiomatic solution concept, the theoretical literature has proposed a number of justifications for the Shapley value as an equilibrium outcome of a non-cooperative bargaining processes. See for example Gul (1989), Stole and Zwiebel (1996), Inderst and Wey (2003), De Fontenay and Gans (2005a), De Fontenay and Gans (2005b) and Winter (2002) for a survey.

[10]These articles derive the Shapley value as the outcome of different bargaining procedures.

[11]In the basic model of De Fontenay and Gans (2005b), downstream firms do not exert competitive externalities on each other. This setup is identical to the one in Inderst and Wey (2003) and it is what we

The key modeling difference between Inderst and Wey (2003) and De Fontenay and Gans (2005b) is the way mergers are regarded. In Inderst and Wey (2003), with a merger between two firms the integrated entity bargains with other firms as a single party and, hence, the number of firms decreases. This is not the case in De Fontenay and Gans (2005b), who distinguish between the owner and the manager of a firm[12]. After a merger takes place, the manager of a purchased entity remains indispensable in further negotiations and acts as an independently negotiating party.

Our article can be regarded as an extension of Inderst and Wey (2003) and De Fontenay and Gans (2005b). We consider both vertical and horizontal merger incentives in a single framework, modeling mergers as a process that combines the control of firms' resources with a single entity. We extend the analysis of De Fontenay and Gans (2005b) to complementary products and decreasing unit costs. Doing so yields markedly different results for vertical merger incentives, two of which stand out.

First, in the baseline model of De Fontenay and Gans (2005b) (with no downstream competitive externalities) and given upstream competition, vertical integration is always preferred to non-integration. Our analysis confirms this result for the particular case of substitute goods and increasing unit cost. However, we obtain different and opposite results by considering also complementary goods and/or decreasing unit costs. Second, De Fontenay and Gans (2005b) show that vertical integration incentives are larger under upstream competition than under upstream monopoly. In contrast, we show that the impact of upstream competition on vertical integration incentives can go either way. We find a simple condition which implies that the vertical integration incentives can be higher under upstream monopoly whenever unit costs are strongly increasing while goods are relatively weak substitutes.

Finally, our paper provides a novel perspective on Segal (2003), who discusses various contracts among substitute and complementary firms in the context of cooperative games with random-order values. A contract can implement exclusion, whereby one firm bans another from a resource it cannot use itself. The contract can lead to inclusion, if a firm can use another's resource, without banning the other from it. The third type of contract in Segal (2003) is labeled "collusion", where resources are merged in one hand. In our framework, inclusion and exclusion play no role, and mergers correspond to what Segal (2003) refers to as collusion. Segal shows that a merger between substitutes likely hurts non-indispensable outsiders, while a merger between complements benefits them.

apply in this article. De Fontenay and Gans (2005b) introduce downstream competition in Section 4 of their article.

[12] This approach follows the property rights literature (see Grossman and Hart, 1986; Hart and Moore, 1990).

Our model generates additional insights by assigning control of different resources to different firms. While in Segal (2003) firms only differ in terms of the value they generate to the industry as a whole, in our model these differences are systematic for upstream and downstream firms. Upstream firms control the costs of production. Downstream firms in turn are gatekeepers to consumers, and hence control demand, which determines the extent products are substitutes or complements. The shape of costs and demand arbitrate the value these firms create in various bargaining coalitions. This gives rise to different incentives for horizontal and vertical mergers depending on the shape of average costs and demand.

The article proceeds as follows: Section 3 introduces the model. In Section 4, we apply the framework to analyze vertical merger incentives. Section 5 compares horizontal and vertical merger incentives in more detail and derives conditions determining which of these incentives are strongest. In doing so, we first conduct a simple comparison of merger gains and then apply an auction model in which firms take each other as bidders into account. Finally, Section 6 concludes.

3 The Model

Our main modeling setup follows Inderst and Wey (2003), and extends that analysis to vertical mergers. Consider an industry in which two upstream suppliers $s \in S^0 = \{A, B\}$ produce inputs which are turned into final goods by two downstream retailers $r \in R^0 = \{a, b\}$. The inputs are differentiated, with each supplier controlling the production of one input. The demand at the retailers is independent, hence, there are no competitive externalities downstream.[13] We relax the assumption of independent downstream markets in Appendix B and show that our main finding remains intact if we allow downstream externalities.

The indirect demand function for the good of supplier s at retailer r is denoted by $p_{sr}(q_{sr}, q_{s'r})$, where s' stands for the alternative supplier (similarly, r' will denote the alternative retailer) and q_{sr} denotes the quantity of input s supplied to retailer r. The total costs of supplier s for providing input quantities q_{sr} and $q_{sr'}$ to the retailers are given by $C_s(q_{sr} + q_{sr'})$. We will denote the average unit cost of supplier s for providing quantity q of the product as $\overline{C}_s(q) = C_s(q)/q$. The retailers incur no other costs than the costs of buying the goods from the suppliers.

Supply contracts between upstream and downstream firms are determined by bargaining, and involve lump sum transfers that do not impact product market outcomes. We follow

[13]We can think for example of retailers operating in different geographic markets, or of ones turning inputs into strongly differentiated final goods.

other authors studying the effects of integration in a bargaining framework and adopt the Shapley value as solution concept of the bargaining game.[14]

As there are no competitive externalities between retailers, changes in the industry structure affect only the distribution of rents, but not the supplied quantities, prices or the total surplus generated. This is an important simplification: while it abstracts away from short run price effects, which are typically a key concern in antitrust analysis, doing so also allows us to isolate the pure bargaining effects of various vertical and horizontal mergers. In a way, our analysis focuses on how mergers can shift bargaining power to harm *competitors*. An effect on competitors is an interim step towards harm to consumers. While direct consumer harm is assumed away in our model (final prices do not change as total industry surplus is constant), indirect harm to consumer is easily derived from bargaining outcomes.[15]

Apart from isolating strategic bargaining incentives from the desire to monopolize a product market, our framework is also useful to compare pre-merger and post-merger outcomes taking into account merger remedies. This is a rarely analyzed and relevant comparison, as economic models focusing on the harmful effects of vertical integration typically compare the pre-merger situation with the unremedied post-merger outcome.[16] In industries such as retailing, merger remedies such as divestitures or behavioral commitments can be used to fix the competitive structure and outcomes at the pre-merger level. Consequently, taking into account such remedies (and assuming they work well), even if a merger may have no harmful effect on product market outcomes, it can affect the bargaining process in the industry.

The Shapley value allocates to each independently negotiating party its expected marginal contribution to coalitions, where the expectation is taken over all coalitions in which the party may belong, with all coalitions assumed to occur with equal probability. Formally, let Ψ denote the set of independently negotiating parties and $|\Psi|$ the cardinality of this set. The payoff of firm $\psi \in \Psi$ is given by

$$U_{\psi}^{\Psi} = \sum_{\widetilde{\Psi} \subseteq \Psi \,|\, \psi \in \widetilde{\Psi}} \frac{\left(\left|\widetilde{\Psi}\right| - 1\right)! \left(|\Psi| - \left|\widetilde{\Psi}\right|\right)!}{|\Psi|!} \left[W_{\widetilde{\Psi}} - W_{\widetilde{\Psi} \setminus \psi}\right],$$

[14]The literature review in Section 2 contains a long list of references to articles relying on the Shapley value in a bargaining framework, which we do not repeat here.

[15]In the simplest of all setups, lower bargaining rents today can be assumed to lead to a marginalization of the firm in the future, to the harm of consumers.

[16]Dertwinkel-Kalt and Wey (2016) provide a recent review of the literature on merger remedies in oligopoly models.

where $\widetilde{\Psi} \subseteq \Psi \,|\, \psi \in \widetilde{\Psi}$ represents a set $\widetilde{\Psi} \subseteq \Psi$, such that ψ is a member of coalition $\widetilde{\Psi}$, and $W_{\widetilde{\Psi}}$ denotes the maximum surplus achieved by the firms in coalition $\widetilde{\Psi}$. For simplicity, we write $\widetilde{\Psi}\backslash\psi$ for $\widetilde{\Psi}\backslash\{\psi\}$. We furthermore denote the set of all firms by $\Omega = \{A, B, a, b\}$ and define W_Ω as the maximum industry profit which is given by

$$W_\Omega(\{q_{sr}\}_{sr\in S^0\times R^0}) = \sum_{r\in R^0} [p_{Ar}(q_{Ar}, q_{Br})q_{Ar} + p_{Br}(q_{Br}, q_{Ar})q_{Br}] - \sum_{s\in S^0} C_s(q_{sa} + q_{sb}).$$

The maximum surplus of a coalition follows from the total industry profit by only considering the links between members of the coalition. For example, the coalition $\Omega\backslash A$ does not include supplier A and, hence, the links between A and the two retailers are missing. This means that supplier A cannot provide the retailers with inputs ($q_{Aa} = q_{Ab} = 0$). Analogously, the coalition $\Omega\backslash a$ has no links with retailer a and, hence, this retailer has no access to inputs, i.e., $q_{Aa} = q_{Ba} = 0$.

In the terminology of cooperative game theory $W(\cdot)$ is often referred to as the *characteristic function*. $W_{\Omega'}$ is assumed to be continuous and strictly quasi-concave for all $\Omega' \subseteq \Omega$. Importantly, since at least one supplier and retailer is necessary for production, $W_{\widetilde{\Psi}} = 0$ if $\widetilde{\Psi}$ does not contain at least one firm of each market side. Before proceeding with the analysis, we need some additional definitions and assumptions.

Definition 1 *The cost function $C_s(\cdot)$ is said to exhibit strictly increasing (decreasing) unit costs if the unit cost function $\overline{C}_s(q)$ is strictly increasing (decreasing) on $q > 0$.*

Definition 2 *Take any $s, s' \in S^0$ with $s \neq s'$ and $r \in R^0$. The two goods are said to be strict substitutes if $q''_{s'r} > q'_{s'r}$ and $p_{sr}(q_{sr}, q''_{s'r}) > 0$ imply $p_{sr}(q_{sr}, q'_{s'r}) > p_{sr}(q_{sr}, q''_{s'r})$. They are strict complements if $q''_{s'r} > q'_{s'r}$ and $p_{sr}(q_{sr}, q''_{s'r}) > 0$ imply $p_{sr}(q_{sr}, q'_{s'r}) < p_{sr}(q_{sr}, q''_{s'r})$.*

Definition 3 *Let $\Delta_C^{\Omega'} := \overline{C}_s(2q_{sr}^{\Omega'}) - \overline{C}_s(q_{sr}^{\Omega'})$ and $\Delta_p^{\Omega'} := p_{sr}(q_{sr}^{\Omega'}, q_{s'r}^{\Omega'}) - p_{sr}(q_{sr}^{\Omega'}, 0)$, with $\Omega' \subseteq \Omega$. From Definition 1 unit costs are strictly increasing (decreasing) if $\Delta_C^{\Omega'} > 0$ ($\Delta_C^{\Omega'} < 0$). From Definition 2 products are strict complements (substitutes) if $\Delta_p^{\Omega'} > 0$ ($\Delta_p^{\Omega'} < 0$).*

Assumption 1 (Superadditivity) *$W_{(\cdot)}$ is superadditive: $W_{\Omega'} \geq W_{\Omega''}$ for every Ω' and Ω'' with $\Omega'' \subset \Omega' \subseteq \Omega$.*

Assumption 2 (Symmetry) *Suppliers and retailers are symmetric: $C_s(\cdot) = C_{s'}(\cdot) = C(\cdot)$, $q_{sr} = q_{\widetilde{s}\widetilde{r}}$ and $p_{sr}(\cdot) = p_{\widetilde{s}\widetilde{r}}(\cdot)$ for any $s, \widetilde{s} \in S^0$ and any $r, \widetilde{r} \in R^0$.*

Definitions 1 and 2 are borrowed from Inderst and Wey (2003). While Assumption 1 is put forward throughout this article, Assumption 2 is not necessary for all results and will be invoked at various segments of the text explicitly.

4 Vertical Merger Incentives

Throughout this paper, we refer to a merger as a transaction combining the merging firms into one bargaining unit. Therefore, a merger leads to a reduction in the number of firms. This is a realistic way to think about mergers in which the merged firms are united under a common management, which conducts negotiations with other entities. It would happen, for example, if the key executives of the acquired company were replaced by the new owner.

We can now calculate equilibrium payoffs under different market structures. We use the notation $\{s, s', r, r'\}$ to denote a market structure, where the commas separate non-merged and therefore individually negotiating entities. For example, $\{AB, a, b\}$ stands for the market structure with an upstream monopoly facing a duopoly of retailers. Similarly, $\{Aa, B, b\}$ denotes the market structure consisting of supplier A being vertically integrated with retailer a, and supplier B as well as retailer b negotiating independently. We focus on the following market structures: $\{A, B, a, b\}$ (*full separation*), $\{AB, a, b\}$ (*upstream monopoly*), $\{A, B, ab\}$ (*downstream monopoly*), $\{ABa, b\}$ (*vertically integrated upstream monopoly*), $\{Aab, B\}$ (*vertically integrated downstream monopoly*), $\{ABab\}$ (*full integration*), $\{Aa, B, b\}$ (*single vertical integration*), $\{Aa, Bb\}$ (*double vertical integration*).

Lemma 1 *Under the different market structures the payoffs of the firms are as stated in Table 2 in Appendix A.*

Proof. The payoffs follow directly from applying the Shapley value to the different market structures.

Before proceeding with the analysis of vertical merger incentives, we provide a brief interpretation of the payoffs generated by the Shapley value in Table 2 in Appendix A.

The Shapley value corresponds to the idea that in bargaining, a party should reap her marginal contribution to an existing agreement between other parties. However, the marginal contribution of a firm depends on the agreements between other firms already in place. In a well-known interpretation of the Shapley value, players are randomly ordered in a sequence.[17] Since several random orderings are possible, each of them is assumed to be equally likely. Each player gets as payoff its marginal contribution to the coalition formed by the preceding players in the sequence. The Shapley value is the expected payoff taken over all possible orderings.

[17] See Gul (1989), Stole and Zwiebel (1996), Inderst and Wey (2003), De Fontenay and Gans (2005a,b) and Winter (2002) for specific bargaining processes that result in an allocation of surplus according to the Shapley value.

Take for example the industry structure of an upstream monopoly, with $\Psi = \{AB, a, b\}$. In this case six orderings are possible, those displayed in Table 1. We focus on the payoff of supplier AB.

		Marginal contribution		
	Ordering	AB	a	b
1	AB, a, b	0	$W_{\Omega\backslash b}$	$W_\Omega - W_{\Omega\backslash b}$
2	AB, b, a	0	$W_\Omega - W_{\Omega\backslash a}$	$W_{\Omega\backslash a}$
3	a, AB, b	$W_{\Omega\backslash b}$	0	$W_\Omega - W_{\Omega\backslash b}$
4	b, AB, a	$W_{\Omega\backslash a}$	$W_\Omega - W_{\Omega\backslash a}$	0
5	a, b, AB	W_Ω	0	0
6	b, a, AB	W_Ω	0	0

Table 1: Marginal contributions in various orderings

In orderings 1 and 2, supplier AB comes first. Its marginal contribution is zero, because without a retailer preceding it, the supplier cannot bring her product to the market. Supplier AB comes second in orderings 3 and 4. In ordering 3, supplier AB's contribution is to enable production with retailer a, together creating $W_{\Omega\backslash b}$ of surplus. This is the surplus that can be created without retailer b. Similarly, in ordering 4, supplier AB enables production with retailer b and therefore generates $W_{\Omega\backslash a}$ of surplus.

In orderings 5 and 6, supplier AB comes last. Since the retailers preceding have no product to sell absent a supplier, firm AB's marginal contribution corresponds to the full industry surplus W_Ω in these orderings. Taking expectations about the orderings with equal probabilities, the Shapley value yields as payoff for the supplier

$$U_{AB} = \frac{1}{6}\left[0 + 0 + W_{\Omega\backslash b} + W_{\Omega\backslash a} + W_\Omega + W_\Omega\right] = \frac{1}{6}\left[W_{\Omega\backslash b} + W_{\Omega\backslash a} + 2W_\Omega\right].$$

The payoffs of the retailers can be determined in a similar manner.

By comparing pre- to post-merger payoffs, we can now compare vertical integration incentives for various pre-merger market structures.

Proposition 1 *Whether a vertical merger between supplier $s \in S^0$ and retailer $r \in R^0$ increases their joint payoff depends on the pre-merger market structure in the following way:*

(i) If suppliers are integrated and retailers are separated ($\Psi = \{AB, a, b\}$), the joint profit of supplier AB and retailer r weakly increases by vertically merging if $W_{\Omega\backslash r} + W_{\Omega\backslash r'} \geq W_\Omega$, whereas it decreases if the opposite holds.

(ii) If suppliers are separated and retailers are integrated ($\Psi = \{A, B, ab\}$), the joint profit of supplier s and retailer ab weakly increases by vertically merging if $W_{\Omega\backslash s} + W_{\Omega\backslash s'} \geq W_{\Omega}$, whereas it decreases if the opposite holds.

(iii) If suppliers and retailers are nonintegrated ($\Psi = \{A, B, a, b\}$), the joint profit of supplier s and retailer r weakly increases by vertically merging if

$$\left(W_{\Omega\backslash s'r'} - W_{\Omega\backslash sr}\right) + W_{\Omega\backslash s} + W_{\Omega\backslash r} \geq W_{\Omega}, \tag{1}$$

whereas it decreases if the opposite holds.

Proof. See Appendix A.

In order to give an economic interpretation for Proposition 1, the following corollary connects the conditions stated in Proposition 1 with the economic fundamentals.

Corollary 1 *Vertical merger incentives depend on the initial market structure, the degree of substitutability or complementarity between the products and the shape of the unit cost function in the following way:*

(i) With suppliers integrated and retailers separated ($\Psi = \{AB, a, b\}$), a vertical merger between supplier AB and retailer r takes place (does not take place) if both suppliers have strictly increasing (decreasing) units costs.

(ii) With suppliers separated and retailers integrated ($\Psi = \{A, B, ab\}$), a vertical merger between supplier s and retailer ab takes place (does not take place) if the products are strict substitutes (complements).

(iii) Invoke Assumption 2 (symmetry) and take the scenario with all firms separated ($\Psi = \{A, B, a, b\}$). Supplier s and retailer r merge (stay separated) if for all $\Omega' \subseteq \Omega$ we have $\Delta_p^{\Omega'} < \Delta_C^{\Omega'}$ ($\Delta_p^{\Omega'} > 0$ and $\Delta_C^{\Omega'} < 0$).

Proof. See Appendix A.

We now provide some intuition on vertical merger incentives. Take first the pre-merger case of a monopolist retailer (downstrean) facing separated suppliers upstream. In this situation, vertical integration between the retailer and one supplier is profitable for the merging parties if products are substitutes. Why is this so? It is convenient to focus on the effects of integration on the non-merged supplier: Since only the distribution of payoffs is affected, not overall output, any gains of the merging parties must exactly correspond to the losses of the non-merged supplier.

If products are substitutes, each supplier wants to be first to reach an agreement with the retailer. This is so, because bargaining between a supplier and the retailer revolves around the sharing of the marginal rent generated by the negotiating parties: With products being substitutes, the additional rent generated by the first supplier to reach an agreement with the retailer is larger than that generated by the second supplier. Therefore, suppliers prefer negotiating on infra-marginal quantities to bargaining "on the margin." This explains why with substitutes the non-merging supplier loses if the other market actors integrate vertically.

With vertical integration between the retailer and the rival upstream firm, the non-merging supplier cannot be the first to reach an agreement with the retailer, because vertical integration guarantees that an agreement between the rival and the retailer is in place. The non-merging supplier is left with having to bargain at the margin, about the lower surplus it generates by coming second to the retailer.

The same logic holds if goods are complements. In that case, each supplier prefers to be second in reaching an agreement with the retailer: Complementary products imply that the additional surplus generated by the second supplier to reach an agreement with the retailer is larger than that generated by the first one, because adding a complement to the market boosts demand for *both* products. Vertical integration with complements would ensure that the integrated supplier cannot be second to reach an agreement with the integrated retailer. This would benefit the non-merging party and therefore harm the firms considering integration.

Take now the situation in which pre-merger a monopoly supplier negotiates with two retailers. Vertical integration between the supplier and a retailer takes place if unit costs are strictly increasing. The reason is as follows: If unit costs are strictly increasing, each retailer prefers to be first in reaching an agreement with the supplier, i.e., to negotiate about infra-marginal quantities. The retailer coming second faces higher unit costs and is therefore left with a smaller surplus to negotiate about with the supplier. Vertical integration corresponds to a sure agreement between the integrated upstream and downstream firms, leaving the non-merging retailer with the only option to be second. This erodes the bargaining power of the second retailer and therefore benefits the merging parties.

If unit costs are strictly decreasing, each retailer prefers to be second in reaching an agreement with the supplier and to negotiate about marginal quantities. Once a supplier-retailer agreement is in place, the additional rent generated by another retailer is larger since unit costs reduce with the quantity needed to supply that retailer. In this case, a vertical merger is not attractive since it forces the integrated retailer to be first.[18]

Finally, we explain the intuition behind vertical integration incentives under pre-merger

[18] An interesting question is whether an integrated firm could commit to not supplying its own retail

full separation. We focus on the most instructive case, namely when all firms are symmetric as assumed in Corollary 1, and postpone discussing the role of asymmetry for later. Under such circumstances, vertical merger incentives correspond to a mix of vertical integration incentives under upstream and downstream monopoly. These incentives can point into different directions. Whether incentives for vertical integration arise therefore depends on the relative strength of these forces.

With all firms initially separated, whether a vertical merger is profitable or not depends on the degree of complementarity or substitutability of the products compared to how strong unit costs increase or decrease. This relationship is illustrated in Figure 1. The strength of complementarity and substitutability is captured by $\Delta_p^{\Omega'}$ while the extent to which unit costs increase or decrease is measured by $\Delta_C^{\Omega'}$.

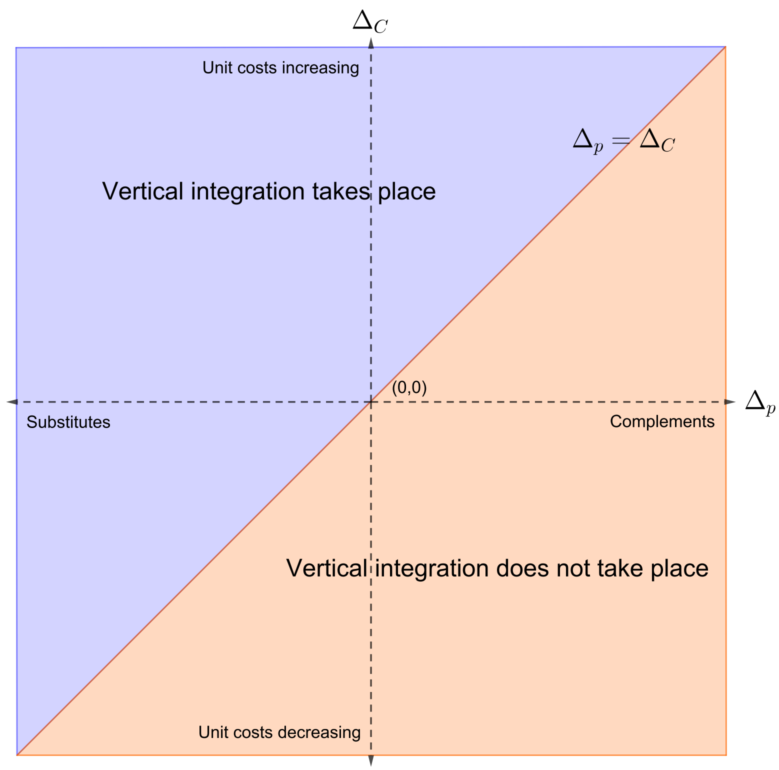

Figure 1: Vertical integration incentives

A vertical merger implies that the integrated firms are always first to reach an agreement with each other. If this is what they would want in absence of the merger, then integration is

entity, until an agreement with another retailer is in place. We are not aware of such practice in the context of bargaining.

unambiguously profitable. This is the case when products are substitutes ($\Delta_p^{\Omega'} < 0$) and unit costs are increasing ($\Delta_C^{\Omega'} > 0$). If unit costs are increasing, retailers want to be first to reach an agreement with each supplier. Being second means having to negotiate about a lower surplus because unit costs are higher for the additional output to be supplied. If products are substitutes, suppliers prefer to be first to reach an agreement with each retailer. The supplier coming second must take into account the negative price externality it imposes on the other supplier and, hence, is left to negotiate about a lower surplus. In summary, with substitute products and strictly increasing unit costs, both retailers and suppliers prefer to be first to reach an agreement with firms on the other market side. This is exactly what a vertical merger guarantees and is therefore unambiguously profitable.

The logic is the same for why vertical mergers are not preferred if products are complements ($\Delta_p^{\Omega'} > 0$) and unit costs are strictly decreasing ($\Delta_C^{\Omega'} < 0$). Under such circumstances, retailers as well as suppliers prefer to be second to reach an agreement with firms on the other market side, because that is when their marginal contribution is largest. A vertical merger undermines this opportunity because it guarantees to be first to reach an agreement and is therefore unprofitable.

Interesting situations arise when products are substitutes (complements) and unit costs are strictly decreasing (increasing). In these cases, the interests of the suppliers and retailers are not aligned. For example, with substitute goods and strictly decreasing unit costs, suppliers prefer to be first to reach an agreement with each retailer, whereas retailers want to be second. Since vertical integration implies that the merging parties are always first to reach an agreement with each other, it benefits the merging supplier but harms the merging retailer. The profitability of such a merger therefore depends on whether the gains of the former exceed the losses of the latter. This is the case if products are sufficiently strong substitutes while unit costs are sufficiently slowly decreasing. The same logic applies in reverse if products are complements and unit costs are strictly increasing.

In the discussion of vertical integration incentives under pre-merger full separation, we remained silent on the role of asymmetries between firms. We address this issue now. While all of what has been said so far stays valid, asymmetries between firms have some implications for vertical merger incentives. According to Claim (iii) of Proposition 1, vertical integration between supplier s and retailer r is profitable if

$$\left(W_{\Omega\setminus s'r'} - W_{\Omega\setminus sr}\right) + W_{\Omega\setminus s} + W_{\Omega\setminus r} \geq W_{\Omega}. \tag{2}$$

Under symmetry, the term in brackets cancels out, but not under asymmetry. Expression (2) implies that vertical integration is more likely to take place if the vertically integrated firm is relatively large compared to the non-merging ones (i.e., if the difference $W_{\Omega\backslash s'r'} - W_{\Omega\backslash sr}$ is large). This is the case if the vertically integrated firms s and r are able to generate a relatively large surplus on their own compared to the surplus generated by the non-merging firms s' and r', which rely solely on each other. This is more likely if products are substitutes and unit costs are increasing.[19] While the thresholds for vertical integration to take place depicted in Figure 1 may shift to the North-West, the qualitative result behind Figure 1 remains intact: vertical integration incentives are stronger when unit costs increase fast and products are stronger substitutes.

Finally, it remains to note that in our setup, vertical integration incentives are not unambiguously larger under upstream competition than under monopoly. This is especially true in the case of substitutes and strictly increasing unit costs. Therefore, our findings are in contrast to the results derived by De Fontenay and Gans (2005b), who find that vertical integration incentives are always stronger with upstream competition in the aforementioned case. To see this, we can compare the conditions for vertical integration under both market structures as given in Claims (i) and (iii) of Proposition 1.

Vertical integration incentives are stronger under upstream monopoly than under competition if

$$W_{\Omega\backslash r} + W_{\Omega\backslash r'} > \left(W_{\Omega\backslash s'r'} - W_{\Omega\backslash sr}\right) + W_{\Omega\backslash s} + W_{\Omega\backslash r}, \tag{3}$$

whereas they are weaker if the opposite holds. To demonstrate that arrangements exist in which vertical integration incentives are stronger under upstream monopoly than under competition, we focus on the case of symmetry. Then, condition (3) reduces to $W_{\Omega\backslash r} > W_{\Omega\backslash s}$, which holds if an additional retailer increases total surplus by a relatively large amount, while the marginal contribution of a supplier is rather small. This is likely to be the case for example if unit costs are strongly increasing while goods are relatively weak substitutes (or even complements). Upstream competition can therefore either enhance or reduce the incentives for vertical integration.

[19] This is the combination when inframagrinal surplus is the largest. The merged firm is guaranteed this inframarginal surplus without negotiation.

5 Comparing Vertical and Horizontal Merger Incentives

In this section, we compare vertical and horizontal merger incentives based purely on bargaining power considerations. Throughout this section, we invoke Assumption 2 (symmetry) to obtain clear-cut results.

We first explain horizontal merger incentives. Since in this case our model corresponds to Inderst and Wey (2003), we summarize their results on horizontal integration. We then explain why vertical merger incentives are a combination of horizontal merger incentives up- and downstream.

Second, we compare the gains from horizontal and vertical mergers. Third, we analyze a bidding game where up- and downstream firms bid for an exogenously picked target firm (either a supplier or a retailer). These are relevant comparisons for competition policy as they allow us to derive conditions for the unmerged entity to be harmed by mergers, and compare the harm resulting from vertical and horizontal mergers.

5.1 Horizontal Mergers

Inderst and Wey (2003) derive conditions under which horizontal mergers are profitable from the perspective of bargaining power. Adapting Corollary 1 of Inderst and Wey (2003), retailers merge if

$$W_{\Omega\setminus a} + W_{\Omega\setminus b} > W_{\Omega}, \tag{4}$$

whereas they stay separated if the inequality is reversed. Similarly, suppliers merge if

$$W_{\Omega\setminus A} + W_{\Omega\setminus B} > W_{\Omega}, \tag{5}$$

and they stay separated if the opposite holds.

This implies that upstream firms merge (stay separated) if products are strict substitutes (complements), while downstream firms merge (stay separated) if upstream firms have strictly increasing (decreasing) unit costs. It should be noted that merger incentives on each market side are independent of whether firms are merged or not on the other side.

Since vertical merger incentives are affected by the same economic determinants, we conclude that they can be regarded as a combination of horizontal integration incentives up- and downstream. The intuition behind this result is as follows: Depending on the substitutability or complementarity as well as the shape of the unit cost function, firms on each market side want to finish their negotiations with firms on the other market side either first or second. A horizontal merger ensures an agreement with both firms on the other market side, because the merged entity becomes a monopolist and therefore indispensable. A vertical merger ensures an agreement only with one firm on the other side of the market. However, contrary to a horizontal merger, a vertical merger involves firms from both markets sides, so that there is a coexistence of integration incentives up- and downstream.

5.2 Comparison of Horizontal and Vertical Merger Gains

We turn to the comparison of horizontal and vertical mergers and define the gain of a merger $\Delta_x,\ x \in \{U, D, V\}$ as the difference in joint pre- and post-merger profits of the merging firms. The subscript U refers to an upstream merger, D to a downstream merger and V to a vertical merger.

$$\begin{aligned}
\Delta_U &= U_{AB}^{\{AB,a,b\}} - U_A^{\{A,B,a,b\}} - U_B^{\{A,B,a,b\}} \\
\Delta_D &= U_{ab}^{\{A,B,ab\}} - U_a^{\{A,B,a,b\}} - U_b^{\{A,B,a,b\}} \\
\Delta_V &= U_{Aa}^{\{Aa,B,b\}} - U_A^{\{A,B,a,b\}} - U_a^{\{A,B,a,b\}}
\end{aligned}$$

Note that we added a superscript to the payoff U_i in order to distinguish between the different market structures under which payoffs are computed. Moreover, we focus on a vertical merger between supplier A and retailer a since firms on both market sides are symmetric.

The result that vertical merger incentives are a combination of horizontal incentives up- and downstream leads directly to a conclusion about the ordering of merger gains. Vertical merger incentives consist equally of horizontal up- and downstream merger incentives. However, each horizontal merger incentive enters only with half strength because only one firm is directly affected. As long as horizontal merger incentives up- and downstream are not equally strong, vertical integration incentives must be strictly between the upstream and downstream merger incentives.[20]

Proposition 2 summarizes this conclusion.

Proposition 2 *The gains from horizontal upstream, horizontal downstream and vertical mergers are ordered as follows:*

$$\Delta_U \gtrless \Delta_V \gtrless \Delta_D \quad \Leftrightarrow \quad W_{\Omega\setminus s} \gtrless W_{\Omega\setminus r}.$$

[20]In the special case of equally strong horizontal merger incentives, vertical incentives will be equal as well, and firms are indifferent between all mergers.

Proof. See Appendix A.

The following lemma links the condition $W_{\Omega\backslash s} \gtrless W_{\Omega\backslash r}$ to the primitives of our model.

Lemma 2 *The following implications holds for all $s \in S^0$ and $r \in R^0$.*

$$\begin{aligned} \forall\, \Omega' \subseteq \Omega : -\Delta_p^{\Omega'} < \Delta_C^{\Omega'} \quad &\Rightarrow \quad W_{\Omega\backslash s} < W_{\Omega\backslash r} \\ \forall\, \Omega' \subseteq \Omega : -\Delta_p^{\Omega'} > \Delta_C^{\Omega'} \quad &\Rightarrow \quad W_{\Omega\backslash s} > W_{\Omega\backslash r} \end{aligned}$$

Proof. See Appendix A.

If products are substitutes ($\Delta_p^{\Omega'} < 0$) and unit costs are decreasing ($\Delta_C^{\Omega'} < 0$), suppliers want to merge, while retailers want to stay separated. In other words, the gain of a horizontal upstream merger is positive, while the gain of a downstream merger is negative. Thus, the incentive for the suppliers to merge is the strongest and the incentive for the retailers is the weakest. Analogously, the order is reversed if products are complements ($\Delta_p^{\Omega'} > 0$) and unit costs are increasing ($\Delta_C^{\Omega'} > 0$).

In the case of substitutes ($\Delta_p^{\Omega'} < 0$) and strictly increasing unit costs ($\Delta_C^{\Omega'} > 0$), the gains of both horizontal up- and downstream mergers are positive, such that the ratio of the strengths of both integration incentives determines the ordering. This is similar to the case of complements ($\Delta_p^{\Omega'} > 0$) and strictly decreasing unit costs ($\Delta_C^{\Omega'} < 0$) in which both merger gains are negative.

Note that these results directly translate into competitive harm from horizontal and vertical mergers to the non-merged entities. Bargaining and mergers constitute a zero-sum game in our setup. Therefore, if a merger is profitable because it shifts bargaining power to the merged firms, it harms outsiders because it weakens their bargaining position.

A particularly surprising implication is that vertical mergers can harm non-merged firms more than some horizontal mergers.[21] Combining Proposition 2 and Lemma 2, this is the case for example (but not only) when products are substitutes ($\Delta_p^{\Omega'} < 0$) and unit costs are decreasing ($\Delta_C^{\Omega'} < 0$). Under this combination of features, a retailer will unambiguously prefer a vertical merger than a horizontal one with its rival (i.e. $\Delta_V > \Delta_D$). The rent shift due to increased bargaining power accruing to the vertically integrated entity is greater than the increase in bargaining power due to complete monopolization of the downstream market.

This puts retailer mergers such as the one between the supermarket chains EDEKA and Plus in Germany mentioned in the Introduction in a novel perspective. Clearly, such a horizontal merger may harm competition by shifting bargaining power away from suppliers to

[21] This is all the more interesting because a horizontal merger in our setup completely monopolizes a market level, upstream or downstream.

the merged retail entity, as the German Federal Cartel Office considered.[22] But - depending on the degree of substitution in of the product portfolios and the cost structure - a merger of one of these supermarkets with a group of suppliers may tilt bargaining even more. At the same time, vertical mergers of supermarkets receive surprisingly little attention from competition authorities. This is not because such mergers were rare. For example, supermarkets effectively merge with suppliers by introducing own-label products, which comes very close to vertical integration.[23] Even where competition authorities consider such vertical supermarket mergers, they tend to be handled rather permissibly, even if they involve top firms in the value chain.[24]

5.3 Bidding Game

Can bargaining incentives drive horizontal and vertically mergers to prevent a takeover by others? And which firm can be expected to prevail in a takeover auction? We investigate these questions in a bidding game, where a single firm is up for sale to the highest bidder in the industry. Bidders evaluate their gain from winning the auction against the possible outcomes when not winning the auction. In the latter case, the counterfactual becomes another firm potentially taking over the target. This has implications for bidding incentives.

We assume that one firm, either up- or downstream, is up for sale. This firm will be referred to as the target firm. The other firms in the market bid to acquire the target, which is sold to the highest bidder. We also consider the existence of an outside option, i.e., the target firm will only be sold if the highest bid exceeds its profit under full separation. We will refer to this minimum bid level as the reservation price. Each possible buyer has a maximum willingness to pay (hereafter referred to as WTP), which consists of two parts. The first part is the gain that a buyer realizes due to the merger, whereas the second part is given by the loss if a competitor merges instead.

Horizontal integration incentives are said to be stronger (weaker) than vertical integration incentives if the bidder on the same market side as the target has a higher (lower) WTP for merging with the target than all bidders from the other market side.

[22]Case B2-333/07 of the German Federal Cartel Office.

[23]Van Dam et al. (2021) show that in about half of the EU member states, *"supermarkets were the leading national brand owners selling packaged foods through own-brand products placed on the market."*

[24]Very recently, the Australian competition agency cleared a merger between Woolworths - one of the largest food retailers in the country - and PFD Food Services, one of the largest wholesale distributors in Australia. Buyer power played a role in the analysis, yet the ACCC concluded that the merger would not harm competition (ACCC (2021)).

The auction is modeled as a two-stage game, with firms submitting sealed bids for the target in the first stage. At the end of the stage, the firm with the highest bid merges with the target if the bid exceeds the reservation price. In the second stage, the acquirer pays out its bid and supply contracts are negotiated. We solve the game using backward induction, and can immediately start with the first stage since second stage profits are determined by the Shapley value derived before.

We first turn to the case where a supplier is the target and assume w.l.o.g. that firm A is up for sale. Firms B and a submit bids β_B and β_a, respectively.

$$\beta_B = \begin{cases} U_{AB}^{\{AB,a,b\}} - U_B^{\{A,B,a,b\}} & \text{if } \beta_a < U_A^{\{A,B,a,b\}} \\ U_{AB}^{\{AB,a,b\}} - U_B^{\{A,B,a,b\}} + U_B^{\{A,B,a,b\}} - U_B^{\{Aa,B,b\}} & \text{if } \beta_a > U_A^{\{A,B,a,b\}} \end{cases} \tag{6}$$

$$\beta_a = \begin{cases} U_{Aa}^{\{Aa,B,b\}} - U_a^{\{A,B,a,b\}} & \text{if } \beta_B < U_A^{\{A,B,a,b\}} \\ U_{Aa}^{\{Aa,B,b\}} - U_a^{\{A,B,a,b\}} + U_a^{\{A,B,a,b\}} - U_a^{\{AB,a,b\}} & \text{if } \beta_B > U_A^{\{A,B,a,b\}} \end{cases} \tag{7}$$

The case distinction accounts for the fact that a merger with a competitor is not necessarily a credible threat if the bidder itself refuses to merge. A takeover by a rival constitutes a credible threat only if the WTP of the competitor exceeds the reservation price of the target. Otherwise, the target is not sold and the distribution of bargaining rents remains unaffected. Consequently, under such circumstances, the bidder's bargaining position remains unaffected in case of non-merging and its WTP equals its bargaining gain in case of merging.

Equations (6) and (7) can be rewritten in terms of the industry profit using Table 2. On this basis, we have to check for each ordering of bids β_B, β_a and $U_a^{\{A,B,a,b\}}$ when it actually occurs. For example, consider the case

$$\beta_B < \beta_a < U_A^{\{A,B,a,b\}}.$$

In this case the target firm has a higher reservation price than the bids, and consequently remains unsold. The WTP of firms B and a reduce to

$$\beta_B = \frac{1}{12}\left[2\,W_{\Omega\backslash a} + 2\,W_{\Omega\backslash A} + W_\Omega\right] \quad \text{and} \quad \beta_a = \frac{1}{12}\left[4\,W_{\Omega\backslash a} + W_\Omega\right].$$

We can then derive the conditions under which the ordering occurs:

$$\begin{array}{lcl} \beta_B < \beta_a & \Leftrightarrow & W_{\Omega\backslash A} < W_{\Omega\backslash a} \\ \beta_B < U_A^{\{A,B,a,b\}} & \Leftrightarrow & W_\Omega < 2W_{\Omega\backslash A} \\ \beta_a < U_A^{\{A,B,a,b\}} & \Leftrightarrow & W_\Omega < W_{\Omega\backslash A} + W_{\Omega\backslash a} \end{array}$$

The computations in all other cases are straightforward. We report them in Appendix A and the results in Proposition 3.

We turn to the case where a retailer is up for sale and assume w.l.o.g. that firm a is the target. Supplier A and retailer b submit bids β_A and β_b, respectively.

$$\beta_A = \begin{cases} U_{Aa}^{\{Aa,B,b\}} - U_A^{\{A,B,a,b\}} & \text{if } \beta_b < U_a^{\{A,B,a,b\}} \\ U_{Aa}^{\{Aa,B,b\}} - U_A^{\{A,B,a,b\}} + U_A^{\{A,B,a,b\}} - U_A^{\{A,B,ab\}} & \text{if } \beta_b > U_a^{\{A,B,a,b\}} \end{cases} \tag{8}$$

$$\beta_b = \begin{cases} U_{ab}^{\{A,B,ab\}} - U_b^{\{A,B,a,b\}} & \text{if } \beta_A < U_a^{\{A,B,a,b\}} \\ U_{ab}^{\{A,B,ab\}} - U_b^{\{A,B,a,b\}} + U_b^{\{A,B,a,b\}} - U_b^{\{Aa,B,b\}} & \text{if } \beta_A > U_a^{\{A,B,a,b\}} \end{cases} \tag{9}$$

As before, these relationships can be rewritten using Table 2 and the conditions under which each firm prevails can be derived for all possible orderings of bids β_A, β_b and the target's reservation price $U_a^{\{A,B,a,b\}}$. The detailed calculations are in Appendix A. The following proposition summarizes our main results from this analysis:

Proposition 3 *The outcome of the auction is independent of whether a supplier or a retailer is up for sale. If, in all possible merger constellations, the joint profit of the merging firms is lower than their joint profit under full separation, no merger takes place. Otherwise a retailer completes the takeover if $W_{\Omega\backslash a} > W_{\Omega\backslash A}$, whereas a supplier acquires the target firm if $W_{\Omega\backslash a} < W_{\Omega\backslash A}$.*

Proof. See Appendix A.

The result that the target firm is not sold if neither vertical nor horizontal mergers with the target are profitable can be explained as follows. In our model changes in bargaining power only affect the distribution of rents. If a merger is unprofitable, the merged firms face a loss compared to their joint profit under full separation and, hence, the nonintegrated firms benefit. Consequently, firms have never an incentive to prevent an unprofitable merger of their competitors and will bid less than the reservation price in order to stay separated.

In the remaining cases, a firm from the market side on which the competitive pressure is largest completes the takeover. To see this, note that the case of strictly decreasing unit costs and complements is excluded because no merger occurs in this case. Thus, on at least one market side firms have an incentive to finish negotiations first so that they are not affected by a negative externality due to substitutability or strictly increasing unit costs. An increase in the strength of the externality has two effects. On the one hand, the contribution of the firm signing a contract second decreases, i.e., $W_{\Omega\backslash A}$ or $W_{\Omega\backslash a}$ increases. On the other hand, the incentive to conclude negotiations first which can be considered as an indicator for the competitive pressure increases. Therefore, the question which firm completes the takeover can be translated into a comparison of the competitive pressures on both market sides.

Further insights can be derived by comparing Proposition 2 and Proposition 3.

Corollary 2 *Consider the cases in which a merger takes place. The firm with the largest gain in profits due to the merger with the target firm completes the takeover.*

Proof. Note that the outcomes of both Propositions 2 and 3 depend on the condition $W_{\Omega\backslash a} \lesseqgtr W_{\Omega\backslash A}$. Corollary 2 results immediately from comparing the outcomes.

As shown in Proposition 2, the gain of a vertical merger is always in between the gains of both types of horizontal mergers. If, as Corollary 2 states, the bidder with the highest gain acquires the target firm, why can a vertical merger occur? The striking difference between our auction model and the simple comparison of merger gains is that the auction does not allow for horizontal mergers on the other market side than that of the target firm. Therefore, a vertical merger is the best way to realize the merger incentives of the other market level. To put it simply, vertical mergers are driven by the merger incentives of the other market side.

The second striking difference is that firms take the other market participants as bidders into account. The idea is that firms might acquire the target firm in order to pre-empt a merger with another bidder. Colangelo (1995) provides conditions under which firms merge vertically in order to prevent a horizontal merger. However, his model is not tailored to the analysis of bargaining power, but merger decisions are affected by the monopolization of the downstream market, the elimination of double markups and price discrimination against non-integrated firms. If, like in our model, the firm with the highest gain in profits completes the acquisition, pre-emption is never the determining factor for the decision. We conclude:

Corollary 3 *Firms never acquire the target firm in order to pre-empt a merger of another market participant.*

Corollary 3 shows that bargaining power considerations neither strengthen nor weaken pre-emption decisions. The intuition is the following. Changes in bargaining power, *ceteris paribus*, lead to a change in the distribution of rents, but the total surplus generated remains unaffected. Thus, if a merger is profitable, the loss of the non-integrated firms is equal to the gain of the merged firms. Consequently, the loss of a single non-integrated competitor is less than the gain of the integrated firm and, hence, the incentive to prevent the merger is always less than the incentive of the other market side to carry out the merger.

Finally, we briefly address counter-mergers. Take first the case of a horizontal merger with the target firm. As shown by Inderst and Wey (2003) (Proposition 2), horizontal merger incentives on each market side are not affected by whether firms are merged or not on the other market level. Thus, a horizontal counter-merger takes place, if the target firm is a supplier and unit costs are strictly increasing or if the target is a retailer and products are substitutes.

Now turn to the case of a vertical merger with the target firm and keep in mind that in our model, mergers only affect the distribution of rents. As shown in Corollary 2, a vertical merger only takes place if it is profitable, i.e., the joint profit of the merged firms increases compared to the case of full separation. This means, in turn, that the joint profit of the non-merging firms decreases. A vertical counter-merger leads to two symmetric vertically integrated firms, so that the surplus is shared equally. A counter-merger, therefore, always takes place because this leads to an increase in the joint profit of the nonintegrated firms to pre-auction level.

6 Conclusion

We propose a model of a bilaterally duopolistic industry where upstream producers bargain with downstream retailers on supply conditions. In the applied framework, integration does not affect the total output produced, but it affects the distribution of rents among players. We make four contributions in this article.

First, we identify conditions for vertical mergers to occur and show that in a framework in which delivery conditions are determined by bargaining, vertical integration incentives can be regarded as a combination of horizontal merger incentives up- and downstream.

Second, we directly compare the strength of horizontal and vertical merger incentives and find that vertical merger incentives always fall between horizontal up- and downstream merger incentives.

Third, we show that—as opposed to conventional wisdom—a horizontal merger to monopoly may convey less bargaining power to the merged entity than vertical integration. Fourth, we find that a vertical merger is never motivated by pre-emptive bargaining power considerations.

Our results carry relevance for competition policy. The finding that under very natural conditions (such as substitute products and decreasing unit costs) a vertical merger erodes the bargaining position of rivals more than a downstream merger to monopoly calls for policy attention. Antitrust policy is traditionally more lenient towards vertical mergers than horizontal ones. This view may clearly be warranted in many environments. We derive precise conditions where such a policy stance may be wrong.

While many of our results are general, this article has some limitations. Our analysis focuses on pure bargaining effects of mergers, taking product market outcomes as constant. This allows us to identify the main forces behind bargaining, in isolation of price and efficiency considerations. These considerations outside our model, however, must remain integral part of merger analysis. We challenge the assumption of no competitive externalities downstream in Appendix B and provide a first path to modeling more complex environments. We find that it does not affect our main result.

A further restriction is the assumption of symmetry for some results. Imposing this assumption helps obtain clear and simple results, at the costs of omitting potential effects from asymmetry between firms. We expect that asymmetry may qualify the strength of various effects identified in our model, but would not turn these around. Uncovering the role of asymmetries in more detail would be an interesting avenue for further research.

Finally, while this article confines itself to the analysis of vertical merger incentives also in comparison to horizontal ones, many possible extensions arise naturally. Extending the bilateral duopoly setup to more firms as well as taking into account investment incentives could be fruitful topics for further research.

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A Appendix

Table related to Lemma 1.

Market structure	Payoffs
$\{A,B,a,b\}$	$U_A = \frac{1}{12}\left[W_{\Omega\backslash Bb} + W_{\Omega\backslash Ba} + W_{\Omega\backslash b} - W_{\Omega\backslash Ab} + W_{\Omega\backslash a} - W_{\Omega\backslash Aa} + W_{\Omega\backslash B} - 3W_{\Omega\backslash A} + 3W_{\Omega}\right]$ $U_B = \frac{1}{12}\left[-W_{\Omega\backslash Bb} - W_{\Omega\backslash Ba} + W_{\Omega\backslash b} + W_{\Omega\backslash Ab} + W_{\Omega\backslash a} + W_{\Omega\backslash Aa} - 3W_{\Omega\backslash B} + W_{\Omega\backslash A} + 3W_{\Omega}\right]$ $U_a = \frac{1}{12}\left[W_{\Omega\backslash Bb} - W_{\Omega\backslash Ba} + W_{\Omega\backslash b} + W_{\Omega\backslash Ab} - 3W_{\Omega\backslash a} - W_{\Omega\backslash Aa} + W_{\Omega\backslash B} + W_{\Omega\backslash A} + 3W_{\Omega}\right]$ $U_b = \frac{1}{12}\left[-W_{\Omega\backslash Bb} + W_{\Omega\backslash Ba} - 3W_{\Omega\backslash b} - W_{\Omega\backslash Ab} + W_{\Omega\backslash a} + W_{\Omega\backslash Aa} + W_{\Omega\backslash B} + W_{\Omega\backslash A} + 3W_{\Omega}\right]$
$\{AB,a,b\}$	$U_{AB} = \frac{1}{6}\left[W_{\Omega\backslash b} + W_{\Omega\backslash a} + 2W_{\Omega}\right]$ $U_a = \frac{1}{6}\left[W_{\Omega\backslash b} - 2W_{\Omega\backslash a} + 2W_{\Omega}\right]$ $U_b = \frac{1}{6}\left[-2W_{\Omega\backslash b} + W_{\Omega\backslash a} + 2W_{\Omega}\right]$
$\{ABa,b\}$	$U_{ABa} = \frac{1}{2}\left[W_{\Omega\backslash b} + W_{\Omega}\right]$ $U_b = \frac{1}{2}\left[-W_{\Omega\backslash b} + W_{\Omega}\right]$
$\{A,B,ab\}$	$U_A = \frac{1}{6}\left[W_{\Omega\backslash B} - 2W_{\Omega\backslash A} + 2W_{\Omega}\right]$ $U_B = \frac{1}{6}\left[-2W_{\Omega\backslash B} + W_{\Omega\backslash A} + 2W_{\Omega}\right]$ $U_{ab} = \frac{1}{6}\left[W_{\Omega\backslash B} + W_{\Omega\backslash A} + 2W_{\Omega}\right]$
$\{Aab,B\}$	$U_{Aab} = \frac{1}{2}\left[W_{\Omega\backslash B} + W_{\Omega}\right]$ $U_B = \frac{1}{2}\left[-W_{\Omega\backslash B} + W_{\Omega}\right]$
$\{ABab\}$	$U_{ABab} = W_{\Omega}$
$\{Aa,B,b\}$	$U_{Aa} = \frac{1}{6}\left[2W_{\Omega\backslash Bb} + W_{\Omega\backslash b} + W_{\Omega\backslash B} - 2W_{\Omega\backslash Aa} + 2W_{\Omega}\right]$ $U_B = \frac{1}{6}\left[-W_{\Omega\backslash Bb} + W_{\Omega\backslash b} - 2W_{\Omega\backslash B} + W_{\Omega\backslash Aa} + 2W_{\Omega}\right]$ $U_b = \frac{1}{6}\left[-W_{\Omega\backslash Bb} - 2W_{\Omega\backslash b} + W_{\Omega\backslash B} + W_{\Omega\backslash Aa} + 2W_{\Omega}\right]$
$\{Aa,Bb\}$	$U_{Aa} = \frac{1}{2}\left[W_{\Omega\backslash Bb} - W_{\Omega\backslash Aa} + W_{\Omega}\right]$ $U_{Bb} = \frac{1}{2}\left[-W_{\Omega\backslash Bb} + W_{\Omega\backslash Aa} + W_{\Omega}\right]$

Table 2: Payoffs under various market structures

Proof of Proposition 1. The proof follows immediately by comparing the change in payoffs of the merging parties as summarized in Table 3.

Change in market structure	Change in payoffs of vertically merging parties (ΔU)
$\{AB, a, b\}$	$[U_{AB} + U_a]_{\{AB,a,b\}} = \frac{1}{6}\left[4W_\Omega - W_{\Omega\backslash a} + 2W_{\Omega\backslash b}\right]$
$\downarrow$	$[U_{ABa}]_{\{ABa,b\}} = \frac{1}{2}\left[W_{\Omega\backslash b} + W_\Omega\right]$
$\{ABa, b\}$	$\Delta U_{ABa} = \frac{1}{6}\left[W_{\Omega\backslash a} + W_{\Omega\backslash b} - W_\Omega\right]$
$\{A, B, ab\}$	$[U_A + U_{ab}]_{\{A,B,ab\}} = \frac{1}{6}\left[4W_\Omega - W_{\Omega\backslash A} + 2W_{\Omega\backslash B}\right]$
$\downarrow$	$[U_{Aab}]_{\{Aab,B\}} = \frac{1}{2}\left[W_{\Omega\backslash B} + W_\Omega\right]$
$\{Aab, B\}$	$\Delta U_{Aab} = \frac{1}{6}\left[W_{\Omega\backslash A} + W_{\Omega\backslash B} - W_\Omega\right]$
$\{A, B, a, b\}$	$[U_A + U_a]_{\{A,B,a,b\}} = \frac{1}{6}\left[3W_\Omega - W_{\Omega\backslash Aa} + W_{\Omega\backslash Bb} - W_{\Omega\backslash A} + W_{\Omega\backslash B} - W_{\Omega\backslash a} + W_{\Omega\backslash b}\right]$
$\downarrow$	$[U_{Aa}]_{\{Aa,B,b\}} = \frac{1}{6}\left[2W_{\Omega\backslash Bb} + W_{\Omega\backslash b} + W_{\Omega\backslash B} - 2W_{\Omega\backslash Aa} + 2W_\Omega\right]$
$\{Aa, B, b\}$	$\Delta U_{Aa} = \frac{1}{6}\left[\left(W_{\Omega\backslash Bb} - W_{\Omega\backslash Aa}\right) + W_{\Omega\backslash A} + W_{\Omega\backslash a} - W_\Omega\right]$

Table 3: Change in payoffs by vertical integration

Q.E.D.

Proof of Corollary 1. We proceed by proving each claim separately.

Claim (i) With suppliers integrated and retailers separated ($\Psi = \{AB, a, b\}$), the condition for a vertical merger between supplier AB and retailer r to take place is given by Claim (i) in Proposition 1. This is identical to the condition for a horizontal merger between retailers to take place in Inderst and Wey (2003). The proof of Claim (i) follows immediately from Corollary 1(ii) and Proposition 2 of Inderst and Wey (2003).

Claim (ii) With suppliers separated and retailers integrated ($\Psi = \{A, B, ab\}$), the condition for a vertical merger between supplier s and retailer ab to take place is given by Claim (ii) of Proposition 1. This is identical to the condition for a horizontal merger between suppliers to take place in Inderst and Wey (2003). The proof of Claim (ii) follows immediately from Corollary 1(i) and Proposition 2 of Inderst and Wey (2003).

Claim (iii) Under Assumption 2 (symmetry), the condition for a vertical merger to take place in Claim (iii) of Proposition 1 reduces to

$$W_{\Omega\backslash s} + W_{\Omega\backslash r} > W_\Omega. \tag{10}$$

We focus w.l.o.g. on a merger between supplier A with retailer a. The proof for any other supplier-retailer combination would proceed analogously. We first show that a vertical merger takes place if the products are substitutes and unit costs are strictly increasing. Let $q_{sr}^{\Omega'}$ denote the quantities of supplier s at retailer r if the subset $\Omega' \subseteq \Omega$ of firms participate. Condition (10) can be written as

$$\left[\sum_{r\in R^0} p_{Br}(q_{Br}^{\Omega\setminus A}, 0)q_{Br}^{\Omega\setminus A} - C_B(q_{Br}^{\Omega\setminus A} + q_{Br'}^{\Omega\setminus A})\right] +$$
$$\left[\sum_{s\in S^0} p_{sb}(q_{sb}^{\Omega\setminus a}, q_{s'b}^{\Omega\setminus a})q_{sb}^{\Omega\setminus a} - \sum_{s\in S^0} C_s(q_{sb}^{\Omega\setminus a})\right] >$$
$$\left[\sum_{s\in S^0}\sum_{r\in R^0} p_{sr}(q_{sr}^{\Omega}, q_{s'r}^{\Omega})q_{sr}^{\Omega} - \sum_{s\in S^0} C_s(q_{sr}^{\Omega} + q_{sr'}^{\Omega})\right]. \tag{11}$$

Note that the sum of payoffs on the LHS in (10) does not increase if the optimal quantities $q_{rs}^{\Omega\setminus A}$ and $q_{rs}^{\Omega\setminus a}$ are replaced by q_{rs}^{Ω}. It follows that (10) holds if

$$\left[\sum_{r\in R^0} p_{Br}(q_{Br}^{\Omega}, 0)q_{Br}^{\Omega} - C_B(q_{Br}^{\Omega} + q_{Br'}^{\Omega})\right] + \left[\sum_{s\in S^0} p_{sb}(q_{sb}^{\Omega}, q_{s'b}^{\Omega})q_{sb}^{\Omega} - \sum_{s\in S^0} C_s(q_{sb}^{\Omega})\right] >$$
$$\left[\sum_{s\in S^0}\sum_{r\in R^0} p_{sr}(q_{sr}^{\Omega}, q_{s'r}^{\Omega})q_{sr}^{\Omega} - \sum_{s\in S^0} C_s(q_{sr}^{\Omega} + q_{sr'}^{\Omega})\right].$$

Under Assumption 2 (symmetry), this inequality can be written as

$$4p(q^{\Omega}, q^{\Omega})q^{\Omega} - 2C(2q^{\Omega}) < 2p(q^{\Omega}, 0)q^{\Omega} - C(2q^{\Omega}) + 2p(q^{\Omega}, q^{\Omega})q^{\Omega} - 2C(q^{\Omega}).$$

Dividing by $2q^{\Omega}$ and rearranging yields

$$p(q^{\Omega}, q^{\Omega}) - p(q^{\Omega}, 0) < \overline{C}(2q^{\Omega}) - \overline{C}(q^{\Omega}),$$

or identically, $\Delta_p^{\Omega} < \Delta_C^{\Omega}$. The RHS is positive if unit costs are strictly increasing (Definition 3), while the LHS is negative if the goods are substitutes (Definition 3). Consequently, if the products are substitutes and unit costs are strictly increasing, Condition (10) holds.

Next, we show that if products are complements and unit costs are strictly decreasing, no vertical merger takes place. A vertical merger does not occur if inequality (11) is reversed, such that

$$\left[\sum_{r\in R^0} p_{Br}(q_{Br}^{\Omega\setminus A}, 0)q_{Br}^{\Omega\setminus A} - C_B(q_{Br}^{\Omega\setminus A} + q_{Br'}^{\Omega\setminus A})\right] +$$

$$\left[\sum_{s\in S^0} p_{sb}(q_{sb}^{\Omega\setminus a}, q_{s'b}^{\Omega\setminus a})q_{sb}^{\Omega\setminus a} - \sum_{s\in S^0} C_s(q_{sb}^{\Omega\setminus a})\right] <$$
$$\left[\sum_{s\in S^0}\sum_{r\in R^0} p_{sr}(q_{sr}^{\Omega}, q_{s'r}^{\Omega})q_{sr}^{\Omega} - \sum_{s\in S^0} C_s(q_{sr}^{\Omega} + q_{sr'}^{\Omega})\right].$$

Under Assumption 2 (symmetry), this can be written as

$$\left[2p(q^{\Omega\setminus A},0)q^{\Omega\setminus A} - C(2q^{\Omega\setminus A})\right] + \left[2p(q^{\Omega\setminus a},q^{\Omega\setminus a})q^{\Omega\setminus a} - 2C(q^{\Omega\setminus a})\right] <$$
$$\left[2p(q^{\Omega},q^{\Omega})q^{\Omega} - C(2q^{\Omega})\right] + \left[2p(q^{\Omega},q^{\Omega})q^{\Omega} - C(2q^{\Omega})\right].$$

Each bracket on the RHS corresponds to half of the industry surplus if all firms participate. We can replace the optimal quantities on the RHS by other quantities and find that if the new inequality holds, the above inequality with optimal quantities would also hold. In the first bracket, we replace q^{Ω} by $q^{\Omega\setminus A}$ and in the second bracket by $q^{\Omega\setminus a}$. Doing so yields

$$2p(q^{\Omega\setminus A},0)q^{\Omega\setminus A} - 2C(q^{\Omega\setminus a}) < 2p(q^{\Omega\setminus A},q^{\Omega\setminus A})q^{\Omega\setminus A} - C(2q^{\Omega\setminus a}).$$

By rearranging and dividing both sides by $2q^{\Omega\setminus a}$, we get

$$\left[p(q^{\Omega\setminus A},q^{\Omega\setminus A}) - p(q^{\Omega\setminus A},0)\right]\frac{q^{\Omega\setminus A}}{q^{\Omega\setminus a}} > \overline{C}(2q^{\Omega\setminus a}) - \overline{C}(q^{\Omega\setminus a}),$$

which by Definition 3 is equivalent to $\Delta_C^{\Omega\setminus a} < \Delta_p^{\Omega\setminus A}\frac{q^{\Omega\setminus A}}{q^{\Omega\setminus a}}$. The LHS of this inequality is negative if unit costs are strictly decreasing, while the RHS is positive if products are complements. We can conclude that if products are complements and unit costs are strictly decreasing, no vertical merger between a supplier and a retailer takes place. *Q.E.D.*

Proof of Proposition 2. We use the Assumption 2 (symmetry) and consider w.l.o.g. $s = A$ and $r = a$. Using the values of Table 2, we rewrite the first inequality as follows.

$$\begin{aligned} & U_{AB}^{\{AB,a,b\}} - U_A^{\{A,B,a,b\}} - U_B^{\{A,B,a,b\}} \gtreqless U_{Aa}^{\{Aa,B,b\}} - U_A^{\{A,B,a,b\}} - U_a^{\{A,B,a,b\}} \\ \Leftrightarrow\quad & W_{\Omega\setminus B} \gtreqless W_{\Omega\setminus Bb} + W_{\Omega\setminus a} - W_{\Omega\setminus Aa} \end{aligned}$$

We apply the symmetry assumption.

$$W_{\Omega\setminus B} \gtreqless W_{\Omega\setminus Bb} + W_{\Omega\setminus a} - W_{\Omega\setminus Aa} \quad\Leftrightarrow\quad W_{\Omega\setminus B} \gtreqless W_{\Omega\setminus a} \quad\Leftrightarrow\quad W_{\Omega\setminus s} \gtreqless W_{\Omega\setminus r}$$

The second inequality can be rewritten in a similar way.

$$\begin{aligned} & U_{ab}^{\{A,B,ab\}} - U_{a}^{\{A,B,a,b\}} - U_{b}^{\{A,B,a,b\}} \gtreqless U_{Aa}^{\{Aa,B,b\}} - U_{A}^{\{A,B,a,b\}} - U_{a}^{\{A,B,a,b\}} \\ \Leftrightarrow \quad & W_{\Omega\setminus b} \gtreqless W_{\Omega\setminus Bb} - W_{\Omega\setminus Aa} + W_{\Omega\setminus A} \\ \Leftrightarrow \quad & W_{\Omega\setminus b} \gtreqless W_{\Omega\setminus A} \\ \Leftrightarrow \quad & W_{\Omega\setminus r} \gtreqless W_{\Omega\setminus s} \end{aligned}$$

Q.E.D.

Proof of Lemma 2. In the following, $\alpha(f)$ denotes the competitor of firm f at the same market side. The inequality $W_{\Omega\setminus r} > W_{\Omega\setminus s}$ can be written as

$$\sum_{s'\in S^0} p_{s'\alpha(r)}\left(q^{\Omega\setminus r}_{s'\alpha(r)}, q^{\Omega\setminus r}_{\alpha(s')\alpha(r)}\right) q^{\Omega\setminus r}_{s'\alpha(r)} - \sum_{s'\in S^0} C_{s'}\left(q^{\Omega\setminus r}_{s'\alpha(r)}\right) >$$
$$\sum_{r'\in R^0} p_{\alpha(s)r'}\left(q^{\Omega\setminus s}_{\alpha(s)r'}, 0\right) q^{\Omega\setminus s}_{\alpha(s)r'} - C_{\alpha(s)}\left(q^{\Omega\setminus s}_{\alpha(s)r'} + q^{\Omega\setminus s}_{\alpha(s)\alpha(r')}\right). \tag{12}$$

Under Assumption 2 (symmetry), the RHS remains unchanged if we replace the quantity $q^{\Omega\setminus s}_{\alpha(s)\alpha(r')}$ by $q^{\Omega\setminus s}_{\alpha(s)r'}$. Furthermore, the LHS does not increase if we replace the quantities by $q^{\Omega\setminus s}_{\alpha(s)r'}$ because the original quantities maximize the expression. We define $q^s := q^{\Omega\setminus s}_{\alpha(s)r'}$. Therefore, inequality (12) holds if the following inequality is fulfilled.

$$2q^{\Omega\setminus s}\cdot p(q^{\Omega\setminus s}, q^{\Omega\setminus s}) - 2C(q^{\Omega\setminus s}) > 2q^{\Omega\setminus s}\cdot p(q^{\Omega\setminus s}, 0) - C(2q^{\Omega\setminus s})$$

Dividing both sides by $2q^{\Omega\setminus s}$ yields

$$p(q^{\Omega\setminus s}, q^{\Omega\setminus s}) - \overline{C}(q^{\Omega\setminus s}) > p(q^{\Omega\setminus s}, 0) - \overline{C}(2q^{\Omega\setminus s}),$$

which can be rearranged to $-\Delta_p^{\Omega\setminus s} < \Delta_C^{\Omega\setminus s}$. As a result, we find that $W_{\Omega\setminus r} > W_{\Omega\setminus s}$ is fulfilled if inequality $-\Delta_p^{\Omega\setminus s} < \Delta_C^{\Omega\setminus s}$ holds for every $\Omega' \subseteq \Omega$.

The argument for $W_{\Omega\setminus r} < W_{\Omega\setminus s}$ is analogous. This inequality can be written as

$$\sum_{s'\in S^0} p_{s'\alpha(r)}\left(q^{\Omega\setminus r}_{s'\alpha(r)}, q^{\Omega\setminus r}_{\alpha(s')\alpha(r)}\right) q^{\Omega\setminus r}_{s'\alpha(r)} - \sum_{s'\in S^0} C_{s'}\left(q^{\Omega\setminus r}_{s'\alpha(r)}\right) <$$
$$\sum_{r'\in R^0} p_{\alpha(s)r'}\left(q^{\Omega\setminus s}_{\alpha(s)r'}, 0\right) q^{\Omega\setminus s}_{\alpha(s)r'} - C_{\alpha(s)}\left(q^{\Omega\setminus s}_{\alpha(s)r'} + q^{\Omega\setminus s}_{\alpha(s)\alpha(r')}\right). \tag{13}$$

Under Assumption 2 (symmetry), the LHS remains unchanged if we replace the quantity $q^{\Omega\setminus r}_{\alpha(s')\alpha(r)}$ by $q^{\Omega\setminus r}_{s'\alpha(r)}$. Furthermore, the RHS does not increase if we replace the quantities by $q^{\Omega\setminus r}_{s'\alpha(r)}$ because the original quantities maximize the expression. We define $q^r := q^{\Omega\setminus r}_{s'\alpha(r)}$. Therefore, inequality (13) holds if the following inequality is fulfilled.

$$2q^{\Omega\setminus r} \cdot p(q^{\Omega\setminus r}, q^{\Omega\setminus r}) - 2C(q^{\Omega\setminus r}) < 2q^{\Omega\setminus r} \cdot p(q^{\Omega\setminus r}, 0) - C(2q^{\Omega\setminus r})$$

Dividing both sides by $2q^{\Omega\setminus r}$ yields

$$p(q^{\Omega\setminus r}, q^{\Omega\setminus r}) - \overline{C}(q^{\Omega\setminus r}) < p(q^{\Omega\setminus r}, 0) - \overline{C}(2q^{\Omega\setminus r}),$$

which can be rearranged to $-\Delta_p^{\Omega\setminus r} > \Delta_C^{\Omega\setminus r}$. As a result, we find that $W_{\Omega\setminus r} < W_{\Omega\setminus s}$ is fulfilled if the inequality $-\Delta_p^{\Omega\setminus r} > \Delta_C^{\Omega\setminus r}$ holds for every $\Omega' \subseteq \Omega$. *Q.E.D.*

Proof of Proposition 3. We start with the case where firm A is up for sale and compare the WTP for all possible orderings of (6), (7) and $U_A^{\{A,B,a,b\}}$.

Outcome 1: No acquisition takes place, i.e., $U_A^{\{A,B,a,b\}} > \beta_B$ and $U_A^{\{A,B,a,b\}} > \beta_a$. Rewriting these inequalities yields:

$$\begin{aligned}
U_A^{\{A,B,a,b\}} > \beta_B \qquad &\Leftrightarrow \qquad W_\Omega > 2\, W_{\Omega\setminus B}\\
U_A^{\{A,B,a,b\}} > \beta_a \qquad &\Leftrightarrow \qquad W_\Omega > W_{\Omega\setminus a} + W_{\Omega\setminus B}
\end{aligned}$$

Outcome 2: Supplier B wins the auction, i.e., $\beta_B > U_A^{\{A,B,a,b\}}$ and $\beta_B > \beta_a$. Note that the value of β_B depends on $U_A^{\{A,B,a,b\}} \lesseqgtr \beta_a$ which can be rewritten as $3W_\Omega \lesseqgtr 2W_{\Omega\setminus a} + 4W_{\Omega\setminus B}$.

$$\begin{aligned}
\beta_B > U_A^{\{A,B,a,b\}} \qquad &\Leftrightarrow \qquad 2W_{\Omega\setminus B} > W_\Omega\\
\beta_B > \beta_a \qquad &\Leftrightarrow \qquad \begin{cases} W_\Omega > 2W_{\Omega\setminus a} & \text{if } 3W_\Omega > 2W_{\Omega\setminus a} + 4W_{\Omega\setminus B}\\ W_{\Omega\setminus B} > W_{\Omega\setminus a} & \text{if } 3W_\Omega < 2W_{\Omega\setminus a} + 4W_{\Omega\setminus B}\end{cases}
\end{aligned}$$

Outcome 3: A retailer wins the auction, i.e., $\beta_a > U_A^{\{A,B,a,b\}}$ and $\beta_a > \beta_B$. Note that the value of β_a depends on $U_A^{\{A,B,a,b\}} \lesseqgtr \beta_B$ which can be rewritten as $W_\Omega \lesseqgtr 2W_{\Omega\setminus B}$.

$$\begin{aligned}
\beta_a > U_A^{\{A,B,a,b\}} \qquad &\Leftrightarrow \qquad \begin{cases} W_\Omega < W_{\Omega\setminus a} + W_{\Omega\setminus B} & \text{if } W_\Omega > 2W_{\Omega\setminus B}\\ 3W_\Omega < 2W_{\Omega\setminus a} + 4W_{\Omega\setminus B} & \text{if } W_\Omega < 2W_{\Omega\setminus B}\end{cases}\\
\beta_a > \beta_B \qquad &\Leftrightarrow \qquad \begin{cases} 4W_{\Omega\setminus B} < W_\Omega + 2W_{\Omega\setminus a} & \text{if } W_\Omega > 2W_{\Omega\setminus B}\\ W_{\Omega\setminus B} < W_{\Omega\setminus a} & \text{if } W_\Omega < 2W_{\Omega\setminus B}\end{cases}
\end{aligned}$$

If $W_\Omega > 2W_{\Omega\setminus B}$ and $W_\Omega > W_{\Omega\setminus B} + W_{\Omega\setminus a}$ hold, outcome 1 is the only possible solution. Otherwise, if $W_\Omega < 2W_{\Omega\setminus B}$ or $W_\Omega < W_{\Omega\setminus B} + W_{\Omega\setminus a}$, it follows from the above conditions that outcome 2 occurs under the condition $W_{\Omega\backslash B} > W_{\Omega\backslash a}$ and outcome 3 under the condition $W_{\Omega\backslash B} < W_{\Omega\backslash a}$.

We turn to the case where retailer a is up for sale and compare all orderings of (8), (9) and $U_a^{\{A,B,a,b\}}$.

Outcome 1: No firm acquires the target, i.e., $U_a^{\{A,B,a,b\}} > \beta_A$ and $U_a^{\{A,B,a,b\}} > \beta_b$.

$$\begin{aligned} U_a^{\{A,B,a,b\}} > \beta_b \quad &\Leftrightarrow \quad W_\Omega > 2\,W_{\Omega\backslash b} \\ U_a^{\{A,B,a,b\}} > \beta_A \quad &\Leftrightarrow \quad W_\Omega > W_{\Omega\backslash A} + W_{\Omega\backslash b} \end{aligned}$$

Outcome 2: A supplier wins the auction, i.e., $\beta_A > U_a^{\{A,B,a,b\}}$ and $\beta_A > \beta_b$. Note that the value of β_A depends on $U_a^{\{A,B,a,b\}} \lesseqgtr \beta_b$ which can be rewritten as $W_\Omega \lesseqgtr 2W_{\Omega\backslash b}$.

$$\beta_A > U_a^{\{A,B,a,b\}} \quad \Leftrightarrow \quad \begin{cases} W_\Omega < W_{\Omega\backslash A} + W_{\Omega\backslash b} & \text{if } W_\Omega > 2W_{\Omega\backslash b} \\ 3W_\Omega < 2W_{\Omega\backslash A} + 4W_{\Omega\backslash b} & \text{if } W_\Omega < 2W_{\Omega\backslash b} \end{cases}$$

$$\beta_A > \beta_b \quad \Leftrightarrow \quad \begin{cases} 4W_{\Omega\backslash b} < W_\Omega + 2W_{\Omega\backslash A} & \text{if } W_\Omega > 2W_{\Omega\backslash b} \\ W_{\Omega\backslash b} < W_{\Omega\backslash A} & \text{if } W_\Omega < 2W_{\Omega\backslash b} \end{cases}$$

Outcome 3: Retailer b wins the auction, i.e., $\beta_b > U_a^{\{A,B,a,b\}}$ and $\beta_b > \beta_A$. Note that the value of β_b depends on $U_a^{\{A,B,a,b\}} \lesseqgtr \beta_A$ which can be rewritten as $3W_\Omega \lesseqgtr 2W_{\Omega\backslash A} + 4W_{\Omega\backslash b}$.

$$\beta_b > U_a^{\{A,B,a,b\}} \quad \Leftrightarrow \quad W_\Omega < 2W_{\Omega\backslash b}$$

$$\beta_b > \beta_A \quad \Leftrightarrow \quad \begin{cases} W_\Omega > 2W_{\Omega\backslash A} & \text{if } 3W_\Omega > 2W_{\Omega\backslash A} + 4W_{\Omega\backslash b} \\ W_{\Omega\backslash b} > W_{\Omega\backslash A} & \text{if } 3W_\Omega < 2W_{\Omega\backslash A} + 4W_{\Omega\backslash b} \end{cases}$$

If $W_\Omega > 2W_{\Omega\backslash b}$ and $W_\Omega > W_{\Omega\backslash A} + W_{\Omega\backslash b}$ hold, outcome 1 is the only possible solution. Otherwise, if $W_\Omega < 2W_{\Omega\backslash b}$ or $W_\Omega < W_{\Omega\backslash A} + W_{\Omega\backslash b}$, it follows from the above conditions that outcome 2 occurs under the condition $W_{\Omega\backslash A} > W_{\Omega\backslash b}$ and outcome 3 under the condition $W_{\Omega\backslash A} < W_{\Omega\backslash b}$. *Q.E.D.*

B Appendix

B.1 Introduction

We adopt the model of Inderst and Wey (2003) as our baseline. This means that we do not allow for competition between the two retailers. The purpose of this appendix is to demonstrate that relaxing this assumption does not affect our main result. More specifically, the introduction of other forces driving mergers may lead to different market outcomes, but the impact of bargaining power considerations remains visible and still has its share in the decision whether to merge or not.

To demonstrate this, we build on a framework proposed by De Fontenay and Gans (2014) that incorporates the framework of Inderst and Wey (2003) as a special case. They use a bargaining game similar to Inderst and Wey (2003) and introduce the possibility of externalities. This enables us to model competition in downstream markets since both retailers are now allowed to exert an externality on each other. The authors show that under a set of fairly reasonable assumptions[25], firms' equilibrium profits are given by a generalized version of the Myerson-Shapley value.

The structure of this appendix is as follows: Section B.2 introduces some additional notation and briefly describes the result of De Fontenay and Gans (2014). In Section B.3, we present Proposition 4 which summarizes integration incentives for different types of mergers in the presence of downstream competition and discuss how it relates to the baseline results. Finally, we prove Proposition 4 in Section B.4.

B.2 Notation and Model

Before we apply the framework of De Fontenay and Gans (2014), we first need to introduce some additional notation[26]. Let P denote a partition of Ω and P^N the set of all partitions. Broadly speaking, a partition divides Ω into mutually exclusive non-empty subsets.[27] If

[25]It is beyond the scope of this appendix to provide a complete overview of the framework proposed by De Fontenay and Gans (2014). However, we would like to emphasize that most of the assumptions are either similar to those of Inderst and Wey (2003) or standard in the literature on vertically related industries. For example, following Inderst and Wey (2003), they assume that firms assign different representatives to each of the other negotiation parties and that bilateral bargaining takes place simultaneously. Furthermore, firms use binding and contingent contracts. The latter means that they can condition on the success of other negotiations. An example for assumptions that are standard in the literature is the adoption of passive beliefs.

[26]For consistency reasons, we alter the original notation of De Fontenay and Gans (2014). The most important changes are that we replace Φ_i by U_i, u_i by π_i, x by q. We also avoid the terminology of link structures.

[27]More formally, a partition P is a set of sets $P = \{P_1, \ldots, P_M\}$ with $P_i \neq \emptyset$ for all i, $\bigcup_{i=1}^{M} P_i = \Omega$, and $P_i \cap P_j = \emptyset$ for all $i \neq j$.

we consider a given partition P, we only consider links between firms in the same set. In addition, and as before, we only allow contractual relationships between suppliers and retailers, but not between firms on the same market side. For example, if we consider the partition $P = \{\{A, a\}, \{B, b\}\}$, supplier A (B) and retailer a (b) share a link. However, there is no link between supplier A (B) and retailer b (a) because these firms are in different sets.

Each firm i is endowed with a (dis-)utility function π_i [28]. Depending on whether the firm is a supplier or retailer, this is either the profit in the downstream market or the costs.

$$\pi_i = \sum_{s \in S^0} p_{si}\left(q_{si}, q_{s'i}, q_{si'}, q_{s'i'}\right) q_{si} \quad \text{for} \quad i \in R^0$$
$$\pi_i = -C_i\left(q_{ir} + q_{ir'}\right) \quad \text{for} \quad i \in S^0$$

Note that contrary to the previous analysis, the inverse demand p_{sr} now depends on four instead of two quantities because we allow for downstream competition. If we consider a merger between two firms i and j, its post-merger utility function is simply the sum of the two pre-merger utility functions, i.e., $\pi_{ij} = \pi_i + \pi_j$.

For a given market structure, firms' bargaining results in bilateral efficient quantities, which means that for a given set of quantities exchanged by the other parties, each pair of negotiating firms chooses its quantity to maximize its joint utility. This clearly features a Nash equilibrium notion, but focuses on bargaining pairs instead of single firms. As before, the quantity is zero if two firms do not share a link. To simplify the notation, we denote the utility of firm i by π_i^P when we face a partition P and firms exchange bilateral efficient quantities. De Fontenay and Gans (2014) proof the existence of a perfect Bayesian equilibrium in which each agent i receives

$$U_i(K) = \\ \sum_{P \in P^N} \sum_{S \in P} \underbrace{(-1)^{|P|-1} (|P|-1)! \left[\frac{1}{|N|} - \sum_{\substack{i \notin S' \in P \\ S' \neq S}} \frac{1}{(|P|-1)(|N|-|S'|)} \right]}_{\text{multiplier}} \underbrace{\sum_{j \in S} \pi_j^P}_{\text{coalition value}} \tag{1'}$$

The formula may seem complicated at first glance, but as with the formula for the Shapley value, it is straightforward to apply. The first sum symbol refers to the sum over all partitions

[28] De Fontenay and Gans (2014) use a set of assumptions about the utility functions to ensure tractability. Any sum of two utility functions $\pi_i + \pi_j$ with $i \neq j$ has to be bounded, continuous and differentiable in $q = (q_{Aa}, q_{Ab}, q_{Ba}, q_{Bb})$, concave, and continuously differentiable in q_{ij}.

P in the set of partitions P^N. For each partition, we calculate the sum over all sets S in that partition. Finally, for each set S, we calculate a multiplier and the coalition value of S, which is the sum of profits of firms in S.

B.3 Result

With this result of De Fontenay and Gans (2014) in hand, it is straightforward to calculate firms' profits under various market structures. By comparing pre- and post-merger profits, we derive conditions under which mergers are profitable.

Since the introduction of downstream competition adds an additional layer of complexity to our analysis, we adopt the symmetry assumption to simplify the presentation for the reader. Our main finding is:

Proposition 4 *(i) An horizontal upstream merger increases the joint profit of the merging firms if*

$$2 \cdot \sum_{i \in \Upsilon = \{A,a,b\}} \pi_i^{\{\Upsilon,\{B\}\}} > \sum_{i \in \Upsilon = \{A,B,a,b\}} \pi_i^{\{\Upsilon\}} \tag{2'}$$

and it decreases the joint profit if the inequality is reversed.

(ii) An horizontal downstream merger increases the joint profit of the merging firms if

$$\begin{aligned} &2 \cdot \sum_{i \in \Upsilon = \{A,ab\}} \pi_i^{\{\Upsilon,B\}} - 2 \cdot \sum_{i \in \Upsilon = \{A,a,b\}} \pi_i^{\{\Upsilon,B\}} + 2 \cdot \sum_{i \in \Upsilon = \{A,B,a\}} \pi_i^{\{\Upsilon,b\}} > \\ &3 \cdot \sum_{i \in \Upsilon = \{A,B,a,b\}} \pi_i^{\{\Upsilon\}} - 2 \cdot \sum_{i \in \Upsilon = \{A,B,ab\}} \pi_i^{\{\Upsilon\}} \end{aligned} \tag{3'}$$

and it decreases the joint profit if the inequality is reversed.

(iii) An vertical merger between supplier A and retailer a increases the joint profit of the merging firms if

$$\begin{aligned} &\sum_{i \in \Upsilon = \{Aa,b\}} \pi_i^{\{\Upsilon,B\}} + \sum_{i \in \Upsilon = \{Aa,B\}} \pi_i^{\{\Upsilon,b\}} + \\ &2 \cdot \pi_{Aa}^{\{\{Aa\},\{B,b\}\}} - 2\pi_{Aa}^{\{\{Aa\},\{B\},\{b\}\}} > \\ &3 \cdot \sum_{i \in \Upsilon\{A,B,a,b\}} \pi_i^{\{\Upsilon\}} - 2 \cdot \sum_{i \in \{Aa,B,b\}} \pi_i^{\{\Upsilon\}} \end{aligned} \tag{4'}$$

and it decreases the joint profit if the inequality is reversed.

Proposition 4 highlights that even in the presence of downstream competition, some parts of the vertical merger incentives share a strong link to horizontal merger incentives up- and downstream. Starting with the merger incentives of the suppliers, we find that inequality ($2'$) looks similar to its Shapley value equivalent (5). The right hand side of the inequality represents the total industry profit in absence of the merger, while the left hand side is the industry profit in the scenario where supplier B is isolated and does not share any link with the retailers. It is worth noting that although ($2'$) and (5) look similar, the downstream competition still has an effect. When supplier B is able to maintain a relationship with both retailer, the quantity sold to one of the retailers also affects the other retailer through the downstream competition and, hence, we observe the downstream externality.

While the inequality that quantifies the horizontal upstream merger incentives looks very similar to its Shapley value equivalent, this is different for the horizontal downstream merger incentives ($3'$) and its equivalent (4). The right hand side contains two terms which, apart from different scaling factors, quantify the difference in the total industry profit before and after the merger. In absence of downstream externalities, the total industry profit remains the same after the merger, leaving the one-time industry profit after applying the different scaling factors. In this case, the right hand side simplifies and equals the right hand side of ($2'$) which, in turn, looks similar to the right hand side of (4).

The first two terms of the left hand side of ($3'$) introduce a component which is not part of the Shapley value equivalent. It is the difference in the total industry profit before and after a retail merger if only one supplier shares links with the retailers. This difference is zero in absence of downstream externatilites, but it can take different values in general.

The last term of the left hand side of ($3'$) is the total industry profit if only one retailer is active in the market and shares links with the suppliers. This expression is also present in the Shapley value equivalent (4).

Turning to the vertical merger incentives and its relationship to horizontal merger incentives up- and downstream, the right hand side of inequality ($4'$) looks similar to the right hand side of ($3'$). It also measures, apart from different scaling factors, the difference in the total industry profit before and after the merger. As in the case of horizontal downstream merger incentives, this expression simplifies in absence of downstream competition and then equals the right hand side of ($2'$) which, in turn, looks similar to the Shapley value equivalent (1).

The most important part for our analysis is the first line of ($4'$) which represent the horizontal merger incentives up- and downstream. This is clear when comparing the line to the left hand side of ($2'$) and to the last term of the left hand side of ($3'$), respectively. The expressions capture the effect of cutting a supplier's or a retailer's links, so that this firm cannot maintain relationships with firms on the other market side. We also observe these components in the Shapley value equivalent (1).

Finally, the second line of (4′) introduces an additional component which is not part of the Shapley value equivalent (1). It captures the magnitude of the externality when the nonintegrated firms form a coalition without sharing any links with the integrated firm. In absence of downstream competition, it is not important whether supplier B provides inputs to retailer b and, hence, this expression would be zero. However, in presence of downstream competition, the relationship between supplier B and retailer b exerts an externality on the integrated firm, so that the expression can take different values.

In summary, we find that even after the introduction of downstream competition, components driving horizontal merger incentives up- and downstream have an impact on the vertical merger incentives. The question to which extend these horizontal integration incentives dominate the decision whether to merge vertically or not depends on the type of downstream competition and, hence, is model-dependent. With a particular model of competition in mind, researchers may be able to derive additional insights for industry-specific applications.

B.4 Proof

To finalize this appendix, we prove Proposition 4. We have already mentioned what steps we need to go through. The idea is to use the generalized version of the Myerson-Shapley value to calculate firms' profits and then compare the respective profits to quantify integration incentives. To make it easier for the reader to follow our analysis, we proceed in three steps. First, in Subsection B.4.1, we derive the multipliers that enter the formula for the profits. Then, in Subsection B.4.2, we apply these multipliers to calculate the profits. Finally, we compare the respective profits in Subsection B.4.3.

B.4.1 Partitions, Sets and Multipliers

Recall formula (1′). Loosely speaking, to calculate the profit, we have to run a nested loop. The outer loop contains all partitions and for each partition, we then loop over all sets in that partition. In this subsection, we provide an overview of all partitions as well as the corresponding sets and the related multipliers. Since the set of all partitions depends on the initial market structure, we provide tables for all four cases (full separation and the three types of mergers).

The first table presents the multipliers in the case of full separation. The first column shows the different partitions (labeled P) and the corresponding sets within these partitions.

The remaining columns show the different multipliers. Since the multipliers depend on the firm for which we compute the profit, there are four columns related to the four different firms.

	A	B	a	b
$P=\{\{A, B, a, b\}\}$				
$\{A, B, a, b\}$	1/4	1/4	1/4	1/4
$P=\{\{A, B, b\}, \{a\}\}$				
$\{A, B, b\}$	1/12	1/12	−1/4	1/12
$\{a\}$	−1/4	−1/4	3/4	−1/4
$P=\{\{A, B, a\}, \{b\}\}$				
$\{A, B, a\}$	1/12	1/12	1/12	−1/4
$\{b\}$	−1/4	−1/4	−1/4	3/4
$P=\{\{A, a, b\}, \{B\}\}$				
$\{A, a, b\}$	1/12	−1/4	1/12	1/12
$\{B\}$	−1/4	3/4	−1/4	−1/4
$P=\{\{B, a, b\}, \{A\}\}$				
$\{B, a, b\}$	−1/4	1/12	1/12	1/12
$\{A\}$	3/4	−1/4	−1/4	−1/4
$P=\{\{A, b\}, \{B, a\}\}$				
$\{A, b\}$	1/4	−1/4	−1/4	1/4
$\{B, a\}$	−1/4	1/4	1/4	−1/4
$P=\{\{A, B\}, \{a, b\}\}$				
$\{A, B\}$	1/4	1/4	−1/4	−1/4
$\{a, b\}$	−1/4	−1/4	1/4	1/4
$P=\{\{A, a\}, \{B, b\}\}$				
$\{A, a\}$	1/4	−1/4	1/4	−1/4
$\{B, b\}$	−1/4	1/4	−1/4	1/4
$P=\{\{A, b\}, \{B\}, \{a\}\}$				
$\{A, b\}$	−1/6	1/6	1/6	−1/6
$\{B\}$	1/6	−1/3	0	1/6
$\{a\}$	1/6	0	−1/3	1/6
$P=\{\{A, B\}, \{a\}, \{b\}\}$				
$\{A, B\}$	−1/6	−1/6	1/6	1/6

$\{a\}$	$1/6$	$1/6$	$-1/3$	0
$\{b\}$	$1/6$	$1/6$	0	$-1/3$
$P = \{\{A, a\}, \{B\}, \{b\}\}$				
$\{A, a\}$	$-1/6$	$1/6$	$-1/6$	$1/6$
$\{B\}$	$1/6$	$-1/3$	$1/6$	0
$\{b\}$	$1/6$	0	$1/6$	$-1/3$
$P = \{\{B, b\}, \{A\}, \{a\}\}$				
$\{B, b\}$	$1/6$	$-1/6$	$1/6$	$-1/6$
$\{A\}$	$-1/3$	$1/6$	0	$1/6$
$\{a\}$	0	$1/6$	$-1/3$	$1/6$
$P = \{\{B, a\}, \{A\}, \{b\}\}$				
$\{B, a\}$	$1/6$	$-1/6$	$-1/6$	$1/6$
$\{A\}$	$-1/3$	$1/6$	$1/6$	0
$\{b\}$	0	$1/6$	$1/6$	$-1/3$
$P = \{\{a, b\}, \{A\}, \{B\}\}$				
$\{a, b\}$	$1/6$	$1/6$	$-1/6$	$-1/6$
$\{A\}$	$-1/3$	0	$1/6$	$1/6$
$\{B\}$	0	$-1/3$	$1/6$	$1/6$
$P = \{\{A\}, \{B\}, \{a\}, \{b\}\}$				
$\{A\}$	$1/2$	$-1/6$	$-1/6$	$-1/6$
$\{B\}$	$-1/6$	$1/2$	$-1/6$	$-1/6$
$\{a\}$	$-1/6$	$-1/6$	$1/2$	$-1/6$
$\{b\}$	$-1/6$	$-1/6$	$-1/6$	$1/2$

Table 4: Partitions, sets and multipliers in the case of full separation

The second table shows the partitions, sets and multipliers in the case of a horizontal upstream merger.

	AB	a	b
$P = \{\{AB, a, b\}\}$			
$\{AB, a, b\}$	1/3	1/3	1/3
$P = \{\{AB, b\}, \{a\}\}$			
$\{AB, b\}$	1/6	−1/3	1/6
$\{a\}$	−1/3	2/3	−1/3
$P = \{\{AB, a\}, \{b\}\}$			
$\{AB, a\}$	1/6	1/6	−1/3
$\{b\}$	−1/3	−1/3	2/3
$P = \{\{a, b\}, \{AB\}\}$			
$\{a, b\}$	−1/3	1/6	1/6
$\{AB\}$	2/3	−1/3	−1/3
$P = \{\{AB\}, \{a\}, \{b\}\}$			
$\{AB\}$	−1/3	1/6	1/6
$\{a\}$	1/6	−1/3	1/6
$\{b\}$	1/6	1/6	−1/3

Table 5: Partitions, sets and multipliers in the case of a horizontal upstream merger

The third table shows the partitions, sets and multipliers in the case of a horizontal downstream merger.

	A	B	ab
$P = \{\{A, B, ab\}\}$			
$\{A, B, ab\}$	$1/3$	$1/3$	$1/3$
$P = \{\{A, ab\}, \{B\}\}$			
$\{A, ab\}$	$1/6$	$-1/3$	$1/6$
$\{B\}$	$-1/3$	$2/3$	$-1/3$
$P = \{\{A, B\}, \{ab\}\}$			
$\{A, B\}$	$1/6$	$1/6$	$-1/3$
$\{ab\}$	$-1/3$	$-1/3$	$2/3$
$P = \{\{B, ab\}, \{A\}\}$			
$\{B, ab\}$	$-1/3$	$1/6$	$1/6$
$\{A\}$	$2/3$	$-1/3$	$-1/3$
$P = \{\{A\}, \{B\}, \{ab\}\}$			
$\{A\}$	$-1/3$	$1/6$	$1/6$
$\{B\}$	$1/6$	$-1/3$	$1/6$
$\{ab\}$	$1/6$	$1/6$	$-1/3$

Table 6: Partitions, sets and multipliers in the case of a horizontal downstream merger

The fourth table shows the partitions, sets and multipliers in the case of a vertical merger.

	Aa	B	b
$P = \{\{Aa,\, B,\, b\}\}$			
$\{Aa,\, B,\, b\}$	$1/3$	$1/3$	$1/3$
$P = \{\{Aa,\, b\},\, \{B\}\}$			
$\{Aa,\, b\}$	$1/6$	$-1/3$	$1/6$
$\{B\}$	$-1/3$	$2/3$	$-1/3$
$P = \{\{Aa,\, B\},\, \{b\}\}$			
$\{Aa,\, B\}$	$1/6$	$1/6$	$-1/3$
$\{b\}$	$-1/3$	$-1/3$	$2/3$
$P = \{\{B,\, b\},\, \{Aa\}\}$			
$\{B,\, b\}$	$-1/3$	$1/6$	$1/6$
$\{Aa\}$	$2/3$	$-1/3$	$-1/3$
$P = \{\{Aa\},\, \{B\},\, \{b\}\}$			
$\{Aa\}$	$-1/3$	$1/6$	$1/6$
$\{B\}$	$1/6$	$-1/3$	$1/6$
$\{b\}$	$1/6$	$1/6$	$-1/3$

Table 7: Partitions, sets and multipliers in the case of a vertical merger

B.4.2 Profits

We are now able to calculate the profits according to (1′). To demonstrate how we proceed, suppose we consider a particular market structure (e.g., no integration) and want to compute the profit U_i of firm i. The first step is to select the table that refers to the market structure of interest. Then, we iterate over all partitions and sets in this table. In doing so, we take the multipliers from the column that belongs to player i and multiply each of them by the corresponding coalition value.

Next, we simplify the expression by omitting terms that refer to isolated players. We call a set of players isolated if it contains players from only one market side. In other words, these players cannot exchange quantities with the other market side and, hence, their coalition value is zero. In addition, we apply the symmetry assumption, i.e., firms on each market side are considered symmetric. This allows us to simplify the expression even further.

We start with the case of full separation and first look at the profit of a supplier.

$$
\begin{aligned}
U_A = &\frac{1}{4}\sum_{i\in\Upsilon=\{A,B,a,b\}}\pi_i^{\{\Upsilon\}}\\
&+\frac{1}{12}\sum_{i\in\Upsilon=\{A,B,b\}}\pi_i^{\{\Upsilon,\{a\}\}}-\underbrace{\frac{1}{4}\pi_a^{\{\{A,B,b\},\{a\}\}}}_{=0\text{ (isolated retailer)}}\\
&+\frac{1}{12}\sum_{i\in\Upsilon=\{A,B,a\}}\pi_i^{\{\Upsilon,\{b\}\}}-\underbrace{\frac{1}{4}\pi_b^{\{\{A,B,a\},\{b\}\}}}_{=0\text{ (isolated retailer)}}\\
&+\frac{1}{12}\sum_{i\in\Upsilon=\{A,a,b\}}\pi_i^{\{\Upsilon,\{B\}\}}-\underbrace{\frac{1}{4}\pi_B^{\{\{A,a,b\},\{B\}\}}}_{=0\text{ (isolated supplier)}}\\
&-\frac{1}{4}\sum_{i\in\Upsilon=\{B,a,b\}}\pi_i^{\{\Upsilon,\{A\}\}}+\underbrace{\frac{3}{4}\pi_A^{\{\{B,a,b\},\{A\}\}}}_{=0\text{ (isolated supplier)}}\\
&+\underbrace{\frac{1}{4}\sum_{i\in\Upsilon=\{A,b\}}\pi_i^{\{\Upsilon,\{B,a\}\}}-\frac{1}{4}\sum_{i\in\Upsilon=\{B,a\}}\pi_i^{\{\Upsilon,\{A,b\}\}}}_{=0\text{ (symmetry)}}\\
&+\underbrace{\frac{1}{4}\sum_{i\in\Upsilon=\{A,B\}}\pi_i^{\{\Upsilon,\{a,b\}\}}}_{=0\text{ (isolated suppliers)}}-\underbrace{\frac{1}{4}\sum_{i\in\Upsilon=\{a,b\}}\pi_i^{\{\Upsilon,\{A,B\}\}}}_{=0\text{ (isolated retailers)}}\\
&+\underbrace{\frac{1}{4}\sum_{i\in\Upsilon=\{A,a\}}\pi_i^{\{\Upsilon,\{B,b\}\}}-\frac{1}{4}\sum_{i\in\Upsilon=\{B,b\}}\pi_i^{\{\Upsilon,\{A,a\}\}}}_{=0\text{ (symmetry)}}\\
&-\frac{1}{6}\sum_{i\in\Upsilon=\{A,b\}}\pi_i^{\{\Upsilon,\{B\},\{a\}\}}+\underbrace{\frac{1}{6}\pi_B^{\{\{A,b\},\{B\},\{a\}\}}}_{=0\text{ (isolated supplier)}}+\underbrace{\frac{1}{6}\pi_a^{\{\{A,b\},\{B\},\{a\}\}}}_{=0\text{ (isolated retailer)}}\\
&\underbrace{-\frac{1}{6}\sum_{i\in\Upsilon=\{A,B\}}\pi_i^{\{\Upsilon,\{a\},\{b\}\}}}_{=0\text{ (isolated suppliers)}}+\underbrace{\frac{1}{6}\pi_a^{\{\{A,B\},\{a\},\{b\}\}}}_{=0\text{ (isolated retailer)}}+\underbrace{\frac{1}{6}\pi_b^{\{\{A,B\},\{a\},\{b\}\}}}_{=0\text{ (isolated retailer)}}\\
&-\frac{1}{6}\sum_{i\in\Upsilon=\{A,a\}}\pi_i^{\{\Upsilon,\{B\},\{b\}\}}+\underbrace{\frac{1}{6}\pi_B^{\{\{A,a\},\{B\},\{b\}\}}}_{=0\text{ (isolated supplier)}}+\underbrace{\frac{1}{6}\pi_b^{\{\{A,a\},\{B\},\{b\}\}}}_{=0\text{ (isolated retailer)}}\\
&+\frac{1}{6}\sum_{i\in\Upsilon=\{B,b\}}\pi_i^{\{\Upsilon,\{A\},\{a\}\}}-\underbrace{\frac{1}{3}\pi_A^{\{\{B,b\},\{A\},\{a\}\}}}_{=0\text{ (isolated supplier)}}
\end{aligned}
$$

$$
\begin{aligned}
&+ \frac{1}{6} \sum_{i \in \Upsilon = \{B,a\}} \pi_i^{\{\Upsilon,\{A\},\{b\}\}} - \underbrace{\frac{1}{3}\pi_A^{\{\{B,a\},\{A\},\{b\}\}}}_{=0 \text{ (isolated supplier)}} \\
&+ \underbrace{\frac{1}{6} \sum_{i \in \Upsilon = \{a,b\}} \pi_i^{\{\Upsilon,\{A\},\{B\}\}}}_{=0 \text{ (isolated retailers)}} - \underbrace{\frac{1}{3}\pi_A^{\{\{a,b\},\{A\},\{B\}\}}}_{=0 \text{ (isolated supplier)}} \\
&+ \underbrace{\frac{1}{2}\pi_A^{\{\{A\},\{B\},\{a\},\{b\}\}}}_{=0 \text{ (isolated supplier)}} - \underbrace{\frac{1}{6}\pi_B^{\{\{A\},\{B\},\{a\},\{b\}\}}}_{=0 \text{ (isolated supplier)}} \\
&- \underbrace{\frac{1}{6}\pi_a^{\{\{A\},\{B\},\{a\},\{b\}\}}}_{=0 \text{ (isolated retailer)}} - \underbrace{\frac{1}{6}\pi_b^{\{\{A\},\{B\},\{a\},\{b\}\}}}_{=0 \text{ (isolated retailer)}} \\
&= \frac{1}{4} \sum_{i \in \Upsilon = \{A,B,a,b\}} \pi_i^{\{\Upsilon\}} \\
&+ \frac{1}{12} \sum_{i \in \Upsilon = \{A,B,b\}} \pi_i^{\{\Upsilon,\{a\}\}} + \frac{1}{12} \sum_{i \in \Upsilon = \{A,B,a\}} \pi_i^{\{\Upsilon,\{b\}\}} \\
&+ \frac{1}{12} \sum_{i \in \Upsilon = \{A,a,b\}} \pi_i^{\{\Upsilon,\{B\}\}} - \frac{1}{4} \sum_{i \in \Upsilon = \{B,a,b\}} \pi_i^{\{\Upsilon,\{A\}\}} \\
&\underbrace{- \frac{1}{6} \sum_{i \in \Upsilon = \{A,b\}} \pi_i^{\{\Upsilon,\{B\},\{a\}\}} + \frac{1}{6} \sum_{i \in \Upsilon = \{B,b\}} \pi_i^{\{\Upsilon,\{A\},\{a\}\}}}_{=0 \text{ (symmetry)}} \\
&\underbrace{- \frac{1}{6} \sum_{i \in \Upsilon = \{A,a\}} \pi_i^{\{\Upsilon,\{B\},\{b\}\}} + \frac{1}{6} \sum_{i \in \Upsilon = \{B,a\}} \pi_i^{\{\Upsilon,\{A\},\{b\}\}}}_{=0 \text{ (symmetry)}} \\
&= \frac{1}{4} \sum_{i \in \Upsilon = \{A,B,a,b\}} \pi_i^{\{\Upsilon\}} + \frac{1}{6} \sum_{i \in \Upsilon = \{A,B,b\}} \pi_i^{\{\Upsilon,\{a\}\}} - \frac{1}{6} \sum_{i \in \Upsilon = \{A,a,b\}} \pi_i^{\{\Upsilon,\{B\}\}}
\end{aligned}
$$

We stick to the case of full separation and turn to the profit of a retailer.

$$
\begin{aligned}
U_a &= \frac{1}{4} \sum_{i \in \Upsilon = \{A,B,a,b\}} \pi_i^{\{\Upsilon\}} \\
&- \frac{1}{4} \sum_{i \in \Upsilon = \{A,B,b\}} \pi_i^{\{\Upsilon,\{a\}\}} + \underbrace{\frac{3}{4}\pi_a^{\{\{A,B,b\},\{a\}\}}}_{=0 \text{ (isolated retailer)}} \\
&+ \frac{1}{12} \sum_{i \in \Upsilon = \{A,B,a\}} \pi_i^{\{\Upsilon,\{b\}\}} - \underbrace{\frac{1}{4}\pi_b^{\{\{A,B,a\},\{b\}\}}}_{=0 \text{ (isolated retailer)}}
\end{aligned}
$$

$$
\begin{aligned}
&+\frac{1}{12}\sum_{i\in\Upsilon=\{A,a,b\}}\pi_i^{\{\Upsilon,\{B\}\}}-\underbrace{\frac{1}{4}\pi_B^{\{\{A,a,b\},\{B\}\}}}_{=0\text{ (isolated supplier)}}\\
&+\frac{1}{12}\sum_{i\in\Upsilon=\{B,a,b\}}\pi_i^{\{\Upsilon,\{A\}\}}-\underbrace{\frac{1}{4}\pi_A^{\{\{B,a,b\},\{A\}\}}}_{=0\text{ (isolated supplier)}}\\
&\underbrace{-\frac{1}{4}\sum_{i\in\Upsilon=\{A,b\}}\pi_i^{\{\Upsilon,\{B,a\}\}}+\frac{1}{4}\sum_{i\in\Upsilon=\{B,a\}}\pi_i^{\{\Upsilon,\{A,b\}\}}}_{=0\text{ (symmetry)}}\\
&\underbrace{-\frac{1}{4}\sum_{i\in\Upsilon=\{A,B\}}\pi_i^{\{\Upsilon,\{a,b\}\}}}_{=0\text{ (isolated suppliers)}}+\underbrace{\frac{1}{4}\sum_{i\in\Upsilon=\{a,b\}}\pi_i^{\{\Upsilon,\{A,B\}\}}}_{=0\text{ (isolated retailers)}}\\
&\underbrace{+\frac{1}{4}\sum_{i\in\Upsilon=\{A,a\}}\pi_i^{\{\Upsilon,\{B,b\}\}}-\frac{1}{4}\sum_{i\in\Upsilon=\{B,b\}}\pi_i^{\{\Upsilon,\{A,a\}\}}}_{=0\text{ (symmetry)}}\\
&+\frac{1}{6}\sum_{i\in\Upsilon=\{A,b\}}\pi_i^{\{\Upsilon,\{B\},\{a\}\}}-\underbrace{\frac{1}{3}\pi_a^{\{\{A,b\},\{B\},\{a\}\}}}_{=0\text{ (isolated retailer)}}\\
&\underbrace{+\frac{1}{6}\sum_{i\in\Upsilon=\{A,B\}}\pi_i^{\{\Upsilon,\{a\},\{b\}\}}}_{=0\text{ (isolated suppliers)}}-\underbrace{\frac{1}{3}\pi_a^{\{\{A,B\},\{a\},\{b\}\}}}_{=0\text{ (isolated retailer)}}\\
&-\frac{1}{6}\sum_{i\in\Upsilon=\{A,a\}}\pi_i^{\{\Upsilon,\{B\},\{b\}\}}+\underbrace{\frac{1}{6}\pi_B^{\{\{A,a\},\{B\},\{b\}\}}}_{=0\text{ (isolated supplier)}}+\underbrace{\frac{1}{6}\pi_b^{\{\{A,a\},\{B\},\{b\}\}}}_{=0\text{ (isolated retailer)}}\\
&+\frac{1}{6}\sum_{i\in\Upsilon=\{B,b\}}\pi_i^{\{\Upsilon,\{A\},\{a\}\}}-\underbrace{\frac{1}{3}\pi_a^{\{\{B,b\},\{A\},\{a\}\}}}_{=0\text{ (isolated retailer)}}\\
&-\frac{1}{6}\sum_{i\in\Upsilon=\{B,a\}}\pi_i^{\{\Upsilon,\{A\},\{b\}\}}+\underbrace{\frac{1}{6}\pi_A^{\{\{B,a\},\{A\},\{b\}\}}}_{=0\text{ (isolated supplier)}}+\underbrace{\frac{1}{6}\pi_b^{\{\{B,a\},\{A\},\{b\}\}}}_{=0\text{ (isolated retailer)}}\\
&\underbrace{-\frac{1}{6}\sum_{i\in\Upsilon=\{a,b\}}\pi_i^{\{\Upsilon,\{A\},\{B\}\}}}_{=0\text{ (isolated retailers)}}+\underbrace{\frac{1}{6}\pi_A^{\{\{a,b\},\{A\},\{B\}\}}}_{=0\text{ (isolated supplier)}}+\underbrace{\frac{1}{6}\pi_B^{\{\{a,b\},\{A\},\{B\}\}}}_{=0\text{ (isolated supplier)}}\\
&-\underbrace{\frac{1}{6}\pi_A^{\{\{A\},\{B\},\{a\},\{b\}\}}}_{=0\text{ (isolated supplier)}}-\underbrace{\frac{1}{6}\pi_B^{\{\{A\},\{B\},\{a\},\{b\}\}}}_{=0\text{ (isolated supplier)}}\\
&+\underbrace{\frac{1}{2}\pi_a^{\{\{A\},\{B\},\{a\},\{b\}\}}}_{=0\text{ (isolated retailer)}}-\underbrace{\frac{1}{6}\pi_b^{\{\{A\},\{B\},\{a\},\{b\}\}}}_{=0\text{ (isolated retailer)}}
\end{aligned}
$$

$$
\begin{aligned}
&= \frac{1}{4}\sum_{i\in\Upsilon=\{A,B,a,b\}}\pi_i^{\{\Upsilon\}} \\
&- \frac{1}{4}\sum_{i\in\Upsilon=\{A,B,b\}}\pi_i^{\{\Upsilon,\{a\}\}} + \frac{1}{12}\sum_{i\in\Upsilon=\{A,B,a\}}\pi_i^{\{\Upsilon,\{b\}\}} \\
&+ \frac{1}{12}\sum_{i\in\Upsilon=\{A,a,b\}}\pi_i^{\{\Upsilon,\{B\}\}} + \frac{1}{12}\sum_{i\in\Upsilon=\{B,a,b\}}\pi_i^{\{\Upsilon,\{A\}\}} \\
&+ \underbrace{\frac{1}{6}\sum_{i\in\Upsilon=\{A,b\}}\pi_i^{\{\Upsilon,\{B\},\{a\}\}} - \frac{1}{6}\sum_{i\in\Upsilon=\{A,a\}}\pi_i^{\{\Upsilon,\{B\},\{b\}\}}}_{=0\text{ (symmetry)}} \\
&+ \underbrace{\frac{1}{6}\sum_{i\in\Upsilon=\{B,b\}}\pi_i^{\{\Upsilon,\{A\},\{a\}\}} - \frac{1}{6}\sum_{i\in\Upsilon=\{B,a\}}\pi_i^{\{\Upsilon,\{A\},\{b\}\}}}_{=0\text{ (symmetry)}} \\
&= \frac{1}{4}\sum_{i\in\Upsilon=\{A,B,a,b\}}\pi_i^{\{\Upsilon\}} - \frac{1}{6}\sum_{i\in\Upsilon=\{A,B,b\}}\pi_i^{\{\Upsilon,\{a\}\}} + \frac{1}{6}\sum_{i\in\Upsilon=\{A,a,b\}}\pi_i^{\{\Upsilon,\{B\}\}}
\end{aligned}
$$

Next, we focus on a horizontal upstream merger and calculate the profit of the integrated firm.

$$
\begin{aligned}
U_{AB} &= \frac{1}{3}\sum_{i\in\Upsilon=\{AB,a,b\}}\pi_i^{\{\Upsilon\}} \\
&+ \frac{1}{6}\sum_{i\in\Upsilon=\{AB,b\}}\pi_i^{\{\Upsilon,\{a\}\}} - \underbrace{\frac{1}{3}\pi_a^{\{\{AB,b\},\{a\}\}}}_{=0\text{ (isolated retailer)}} \\
&+ \frac{1}{6}\sum_{i\in\Upsilon=\{AB,a\}}\pi_i^{\{\Upsilon,\{b\}\}} - \underbrace{\frac{1}{3}\pi_b^{\{\{AB,a\},\{b\}\}}}_{=0\text{ (isolated retailer)}} \\
&\underbrace{- \frac{1}{3}\sum_{i\in\Upsilon=\{a,b\}}\pi_i^{\{\Upsilon,\{AB\}\}}}_{=0\text{ (isolated retailers)}} + \underbrace{\frac{2}{3}\pi_{AB}^{\{\{a,b\},\{AB\}\}}}_{=0\text{ (isolated suppliers)}} \\
&- \underbrace{\frac{1}{3}\pi_{AB}^{\{\{AB\},\{a\},\{b\}\}}}_{=0\text{ (isolated suppliers)}} + \underbrace{\frac{1}{6}\pi_a^{\{\{AB\},\{a\},\{b\}\}}}_{=0\text{ (isolated retailer)}} + \underbrace{\frac{1}{6}\pi_b^{\{\{AB\},\{a\},\{b\}\}}}_{=0\text{ (isolated retailer)}} \\
&= \frac{1}{3}\sum_{i\in\Upsilon=\{AB,a,b\}}\pi_i^{\{\Upsilon\}} + \frac{1}{3}\sum_{i\in\Upsilon=\{AB,b\}}\pi_i^{\{\Upsilon,\{a\}\}}
\end{aligned}
$$

Then, we repeat the exercise for a horizontal downstream merger.

$$
\begin{aligned}
U_{ab} = & \frac{1}{3} \sum_{i \in \Upsilon = \{A,B,ab\}} \pi_i^{\{\Upsilon\}} \\
& + \frac{1}{6} \sum_{i \in \Upsilon = \{A,ab\}} \pi_i^{\{\Upsilon,\{B\}\}} - \underbrace{\frac{1}{3}\pi_B^{\{\{A,ab\},\{B\}\}}}_{=0 \text{ (isolated supplier)}} \\
& \underbrace{- \frac{1}{3} \sum_{i \in \Upsilon = \{A,B\}} \pi_i^{\{\Upsilon,\{ab\}\}}}_{=0 \text{ (isolated suppliers)}} + \underbrace{\frac{2}{3}\pi_{ab}^{\{\{A,B\},\{ab\}\}}}_{=0 \text{ (isolated retailers)}} \\
& + \frac{1}{6} \sum_{i \in \Upsilon = \{B,ab\}} \pi_i^{\{\Upsilon,\{A\}\}} - \underbrace{\frac{1}{3}\pi_A^{\{\{B,ab\},\{A\}\}}}_{=0 \text{ (isolated supplier)}} \\
& + \underbrace{\frac{1}{6}\pi_A^{\{\{A\},\{B\},\{ab\}\}}}_{=0 \text{ (isolated supplier)}} + \underbrace{\frac{1}{6}\pi_B^{\{\{A\},\{B\},\{ab\}\}}}_{=0 \text{ (isolated supplier)}} - \underbrace{\frac{1}{3}\pi_{ab}^{\{\{A\},\{B\},\{ab\}\}}}_{=0 \text{ (isolated retailers)}} \\
& = \frac{1}{3} \sum_{i \in \Upsilon = \{A,B,ab\}} \pi_i^{\{\Upsilon\}} + \frac{1}{3} \sum_{i \in \Upsilon = \{A,ab\}} \pi_i^{\{\Upsilon,\{B\}\}}
\end{aligned}
$$

Finally, we turn to the vertical merger and, again, calculate the profit of the integrated firm.

$$
\begin{aligned}
U_{Aa} = & \frac{1}{3} \sum_{i \in \{Aa,B,b\}} \pi_i^{\{\Upsilon\}} \\
& + \frac{1}{6} \sum_{i \in \Upsilon = \{Aa,b\}} \pi_i^{\{\Upsilon,\{B\}\}} - \underbrace{\frac{1}{3}\pi_B^{\{\{Aa,b\},\{B\}\}}}_{=0 \text{ (isolated supplier)}} \\
& + \frac{1}{6} \sum_{i \in \Upsilon = \{Aa,B\}} \pi_i^{\{\Upsilon,\{b\}\}} - \underbrace{\frac{1}{3}\pi_b^{\{\{Aa,B\},\{b\}\}}}_{=0 \text{ (isolated retailer)}} \\
& - \frac{1}{3} \sum_{i \in \Upsilon = \{B,b\}} \pi_i^{\{\Upsilon,\{Aa\}\}} + \frac{2}{3}\pi_{Aa}^{\{\{B,b\},\{Aa\}\}} \\
& - \frac{1}{3}\pi_{Aa}^{\{\{Aa\},\{B\},\{b\}\}} + \underbrace{\frac{1}{6}\pi_B^{\{\{Aa\},\{B\},\{b\}\}}}_{=0 \text{ (isolated supplier)}} + \underbrace{\frac{1}{6}\pi_b^{\{\{Aa\},\{B\},\{b\}\}}}_{=0 \text{ (isolated retailer)}} \\
& = \frac{1}{3} \sum_{i \in \{Aa,B,b\}} \pi_i^{\{\Upsilon\}} \\
& + \frac{1}{6} \sum_{i \in \Upsilon = \{Aa,b\}} \pi_i^{\{\Upsilon,\{B\}\}} + \frac{1}{6} \sum_{i \in \Upsilon = \{Aa,B\}} \pi_i^{\{\Upsilon,\{b\}\}}
\end{aligned}
$$

$$+\frac{1}{3}\pi_{Aa}^{\{\{B,b\},\{Aa\}\}}-\frac{1}{3}\pi_{Aa}^{\{\{Aa\},\{B\},\{b\}\}}$$

B.4.3 Horizontal and Vertical Integration Incentives

Finally, we compare pre- and post merger profits calculated in the previous section. We start with the *horizontal upstream merger incentives.*

$$U_{AB}\left(\{AB,a,b\}\right)>U_{A}\left(\Omega\right)+U_{B}\left(\Omega\right)$$

We insert the profits calculated in the previous section and find

$$\begin{aligned}\frac{1}{3}\sum_{i\in\Upsilon=\{AB,a,b\}}\pi_i^{\{\Upsilon\}}+\frac{1}{3}\sum_{i\in\Upsilon=\{AB,b\}}\pi_i^{\{\Upsilon,\{a\}\}}>\frac{1}{2}&\sum_{i\in\Upsilon=\{A,B,a,b\}}\pi_i^{\{\Upsilon\}}\\&+\frac{1}{3}\sum_{i\in\Upsilon=\{A,B,b\}}\pi_i^{\{\Upsilon,\{a\}\}}\\&-\frac{1}{3}\sum_{i\in\Upsilon=\{A,a,b\}}\pi_i^{\{\Upsilon,\{B\}\}}\end{aligned}$$

Note that

$$\sum_{i\in\Upsilon=\{AB,a,b\}}\pi_i^{\{\Upsilon\}}=\sum_{i\in\Upsilon=\{A,B,a,b\}}\pi_i^{\{\Upsilon\}}$$

and

$$\sum_{i\in\Upsilon=\{AB,b\}}\pi_i^{\{\Upsilon,\{a\}\}}=\frac{1}{3}\sum_{i\in\Upsilon=\{A,B,b\}}\pi_i^{\{\Upsilon,\{a\}\}}$$

This is because the cost function of each supplier depends only on its own quantity and not on the quantity of the supplier. When the suppliers merge, they bargain as a single unit and, hence, both cost functions enter the objective function of bargaining pairs that include the integrated supplier. However, as we take the partial derivative of the objective function w.r.t. each quantity separately, the derivative of one of the two cost functions is always zero. Therefore, the derivatives that determine the quantities are the same regardless of whether the suppliers are integrated or not.

We use these identities to simplify the inequality even further.

$$\frac{1}{3}\sum_{i\in\Upsilon=\{A,a,b\}}\pi_i^{\{\Upsilon,\{B\}\}}>\frac{1}{6}\sum_{i\in\Upsilon=\{A,B,a,b\}}\pi_i^{\{\Upsilon\}}$$

We multiply both sides by 6 and get the final inequality stated in the proposition.

$$2 \cdot \sum_{i \in \Upsilon = \{A,a,b\}} \pi_i^{\{\Upsilon,\{B\}\}} > \sum_{i \in \Upsilon = \{A,B,a,b\}} \pi_i^{\{\Upsilon\}}$$

Next, we turn to the *horizontal downstream merger incentives.*

$$U_{ab}\left(\{A,B,ab\}\right) > U_a\left(\Omega\right) + U_b\left(\Omega\right)$$

We insert the profits calculated in the previous section.

$$\begin{aligned}\frac{1}{3}\sum_{i \in \Upsilon = \{A,B,ab\}} \pi_i^{\{\Upsilon\}} + \frac{1}{3}\sum_{i \in \Upsilon = \{A,ab\}} \pi_i^{\{\Upsilon,\{B\}\}} > \frac{1}{2}&\sum_{i \in \Upsilon = \{A,B,a,b\}} \pi_i^{\{\Upsilon\}} \\ -\frac{1}{3}&\sum_{i \in \Upsilon = \{A,B,b\}} \pi_i^{\{\Upsilon,\{a\}\}} \\ +\frac{1}{3}&\sum_{i \in \Upsilon = \{A,a,b\}} \pi_i^{\{\Upsilon,\{B\}\}}\end{aligned}$$

We rearrange the terms.

$$\begin{aligned}\frac{1}{3}\sum_{i \in \Upsilon = \{A,ab\}} \pi_i^{\{\Upsilon,\{B\}\}} - \frac{1}{3}\sum_{i \in \Upsilon = \{A,a,b\}} \pi_i^{\{\Upsilon,\{B\}\}} + \frac{1}{3}\sum_{i \in \Upsilon = \{A,B,b\}} \pi_i^{\{\Upsilon,\{a\}\}} > \\ \frac{1}{2}\sum_{i \in \Upsilon = \{A,B,a,b\}} \pi_i^{\{\Upsilon\}} - \frac{1}{3}\sum_{i \in \Upsilon = \{A,B,ab\}} \pi_i^{\{\Upsilon\}}\end{aligned}$$

We multiply both sides by 6 and get the final inequality.

$$\begin{aligned}2 \cdot \sum_{i \in \Upsilon = \{A,ab\}} \pi_i^{\{\Upsilon,\{B\}\}} - 2 \cdot \sum_{i \in \Upsilon = \{A,a,b\}} \pi_i^{\{\Upsilon,\{B\}\}} + 2 \cdot \sum_{i \in \Upsilon = \{A,B,b\}} \pi_i^{\{\Upsilon,\{a\}\}} > \\ 3 \cdot \sum_{i \in \Upsilon = \{A,B,a,b\}} \pi_i^{\{\Upsilon\}} - 2 \cdot \sum_{i \in \Upsilon = \{A,B,ab\}} \pi_i^{\{\Upsilon\}}\end{aligned}$$

Finally, we turn to the *vertical merger incentives.*

$$U_{Aa}\left(\{Aa,B,b\}\right) > U_A\left(\Omega\right) + U_a\left(\Omega\right)$$

We insert the profits calculated in the previous section and find

$$\frac{1}{3}\sum_{i \in \{Aa,B,b\}} \pi_i^{\{\Upsilon\}} + \frac{1}{6}\sum_{i \in \Upsilon = \{Aa,b\}} \pi_i^{\{\Upsilon,\{B\}\}} + \frac{1}{6}\sum_{i \in \Upsilon = \{Aa,B\}} \pi_i^{\{\Upsilon,\{b\}\}}$$

$$+\frac{1}{3}\pi_{Aa}^{\{\{B,b\},\{Aa\}\}} - \frac{1}{3}\pi_{Aa}^{\{\{Aa\},\{B\},\{b\}\}} >$$

$$\frac{1}{4}\sum_{i\in\Upsilon=\{A,B,a,b\}}\pi_i^{\{\Upsilon\}} + \frac{1}{6}\sum_{i\in\Upsilon=\{A,B,b\}}\pi_i^{\{\Upsilon,\{a\}\}} - \frac{1}{6}\sum_{i\in\Upsilon=\{A,a,b\}}\pi_i^{\{\Upsilon,\{B\}\}}$$

$$+\frac{1}{4}\sum_{i\in\Upsilon=\{A,B,a,b\}}\pi_i^{\{\Upsilon\}} - \frac{1}{6}\sum_{i\in\Upsilon=\{A,B,b\}}\pi_i^{\{\Upsilon,\{a\}\}} + \frac{1}{6}\sum_{i\in\Upsilon=\{A,a,b\}}\pi_i^{\{\Upsilon,\{B\}\}}$$

Note that some terms cancel out.

$$\frac{1}{3}\sum_{i\in\{Aa,B,b\}}\pi_i^{\{\Upsilon\}} + \frac{1}{6}\sum_{i\in\Upsilon=\{Aa,b\}}\pi_i^{\{\Upsilon,\{B\}\}} + \frac{1}{6}\sum_{i\in\Upsilon=\{Aa,B\}}\pi_i^{\{\Upsilon,\{b\}\}}$$

$$+\frac{1}{3}\pi_{Aa}^{\{\{B,b\},\{Aa\}\}} - \frac{1}{3}\pi_{Aa}^{\{\{Aa\},\{B\},\{b\}\}} >$$

$$\frac{1}{2}\sum_{i\in\Upsilon=\{A,B,a,b\}}\pi_i^{\{\Upsilon\}}$$

We rearrange the terms.

$$\frac{1}{2}\sum_{i\in\Upsilon=\{A,B,a,b\}}\pi_i^{\{\Upsilon\}} - \frac{1}{3}\sum_{i\in\{Aa,B,b\}}\pi_i^{\{\Upsilon\}} <$$

$$\frac{1}{6}\sum_{i\in\Upsilon=\{Aa,b\}}\pi_i^{\{\Upsilon,\{B\}\}} + \frac{1}{6}\sum_{i\in\Upsilon=\{Aa,B\}}\pi_i^{\{\Upsilon,\{b\}\}}$$

$$+\frac{1}{3}\pi_{Aa}^{\{\{B,b\},\{Aa\}\}} - \frac{1}{3}\pi_{Aa}^{\{\{Aa\},\{B\},\{b\}\}}$$

We multiply both sides by 6 and get the final inequality.

$$3\cdot\sum_{i\in\Upsilon=\{A,B,a,b\}}\pi_i^{\{\Upsilon\}} - 2\cdot\sum_{i\in\{Aa,B,b\}}\pi_i^{\{\Upsilon\}} <$$

$$\sum_{i\in\Upsilon=\{Aa,b\}}\pi_i^{\{\Upsilon,\{B\}\}} + \sum_{i\in\Upsilon=\{Aa,B\}}\pi_i^{\{\Upsilon,\{b\}\}}$$

$$+2\cdot\pi_{Aa}^{\{\{B,b\},\{Aa\}\}} - 2\cdot\pi_{Aa}^{\{\{Aa\},\{B\},\{b\}\}}$$

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Heinrich-Heine-Universität Düsseldorf

Düsseldorfer Institut für Wettbewerbsökonomie (DICE)

Universitätsstraße 1, 40225 Düsseldorf

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