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Chrysovalantou Milliou and Emmanuel Petrakis*

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Abstract

Contrary to the seminal paper of Horn and Wolinsky (1988), we demonstrate that upstream firms, which sell their products to competing downstream firms, do not always have incentives to merge horizontally. In particular, we show that when bargaining takes place over two-part tariffs, and not over wholesale prices, upstream firms prefer to act as independent suppliers rather than as a monopolist supplier. Moreover, we show that horizontal mergers can be procompetitive, even in the absence of efficiency gains.

JEL Classification: L41; L42; L22

Keywords: horizontal mergers; bargaining; vertical relations; two-part tariffs; wholesale prices; merger policy

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1 Introduction

The current merger policy, both in the U.S. and in the E.U., does not seem to distinguish between horizontal mergers that take place in vertically related industries from those in final product industries alone.¹ In this paper we argue that, by failing to take into account a number of crucial features of vertically related industries, policy makers could be lead to an imprecise account of the effects of horizontal mergers and thus, possibly, to misleading policy recommendations.

Trading in vertically related industries may take a number of different forms. While in some industries firms use simple linear wholesale price contracts, in others, more complicated non-linear contracts, such as two-part tariffs, are employed. Moreover, the specific terms of the various trading forms - the contract terms - are often the outcome of bargaining between the industry's trading parties.² Both, the contract type employed and the bargaining over the specific contract terms, can affect significantly the market outcomes and, therefore, constitute crucial features of vertically related industries.

In this paper we explore the incentives for upstream horizontal mergers in two-tier industries and evaluate their welfare implications, allowing both for alternative types of vertical contracts and for bargaining over the contract terms. We consider two vertical chains, each consisting of one upstream and one downstream firm, involved into a three-stage game. In stage one, the upstream firms decide whether to merge or not. If they merge, then in stage two, the upstream monopolist bargains simultaneously with the two downstream firms over their contract terms. Otherwise, each independent upstream firm bargains with its respective downstream customer. Finally, the downstream firms compete in quantities. We allow for two distinct types of vertical contracts, a linear wholesale price contract and a two-part tariff contract. We show that the type of vertical contract over which bargaining takes place is crucial not only for the upstream merger incentives but also for the effects of such mergers.

¹Horizontal mergers in intermediate product markets constitute a common practice. See e.g. merger of car engine suppliers (Kolbenschmidt/Pierburg), merger of health IT suppliers (iSoft/Torex), merger of medical devices providers (General Electrics/Instrumentarium).

²For example, large food retailers as well as general retailers (e.g. Wal-Mart) bargain over the terms of trade with their suppliers, just like large tour operators bargain with airlines and hotels, car manufacturers with car parts providers, and large book retailers (e.g. Barnes & Noble) with publishers.

One key difference between the case in which the upstream firms merge and the case in which they remain independent is that, a merged upstream firm who disagrees with one of the downstream firms still has the option of reaching an agreement with the rival downstream firm, and thus, its disagreement payoff is not zero. One might expect that this would imply that the upstream bargaining position is enhanced in the case of merger. And indeed this is so when firms trade using linear wholesale price contracts. Surprisingly though, when firms trade using two-part tariff contracts, the mere existence of an outside option *weakens* the bargaining position of the upstream merged firm. The reason behind this is as follows. In case of disagreement with one of the downstream firms, the rival downstream firm will act as a monopolist in the final product market and will thus increase its output. The downstream production though is subsidized (i.e. wholesale prices are below marginal cost) under two-part tariffs, but not under wholesale prices. Therefore, while the disagreement payoff of an independent upstream firm is always equal to zero, that of a merged upstream firm is effectively *negative* under two-part tariffs and positive under wholesale prices.

A second key difference between a merged supplier and an independent one stems from the fact that an increase in the wholesale price charged to one downstream firm leads to an increase in the output of the rival downstream firm. Since downstream production is subsidized only under two-part tariffs, this creates a negative effect to upstream suppliers under two-part tariffs and a positive effect under wholesale prices. A merged supplier, in contrast to an independent supplier, internalizes this negative (positive) effect under two-part tariffs (wholesale prices). The internalization of this effect in the case of merger, coupled with the above mentioned change in the upstream disagreement payoff, leads to a decrease in the wholesale prices under two-part tariff contracts and to an increase under wholesale price contracts. As a result, the incentives for upstream horizontal mergers depend heavily on the contract type used in vertical trading. Indeed, upstream firms have a *disincentive* to merge when they use two-part tariff contracts and an incentive to merge when they use instead wholesale price contracts.

Regarding the welfare effects of upstream horizontal mergers, we show that such mergers can be *procompetitive* even if they do not generate any synergies. In particular, when bargaining takes place over two-part tariff contracts, an upstream merger is beneficial both

for consumers and overall welfare. The impact of the merger on consumers' surplus is clearly due to the lower wholesale prices which lead to lower final good prices. Surprisingly, the downstream firms are better off when the upstream merger takes place. This is so because when the downstream firms deal with an upstream monopolist, they face better terms of trade due to the monopolist's weaker bargaining position. The two positive effects of a merger, on consumer surplus and downstream profits, dominate its negative effect on upstream profits, and as a consequence the upstream merger turns out to be welfare improving when two-part tariff contracts are used. A reversal of all the above results occurs when wholesale contracts are used since the intuitive arguments work in exactly the opposite direction.

Our findings have important implications for merger policy. The existing merger regulation (see e.g. U.S. Merger Guidelines) fails to distinguish in general among horizontal mergers in upstream and downstream markets. It also fails to distinguish among horizontal mergers under different vertical trading arrangements. Our findings highlight the role of vertical trading arrangements on the welfare impact of horizontal mergers. Hence, they clearly suggest that the antitrust authorities should take the trading arrangements into account in their treatment of horizontal mergers in intermediate industries.

Extending our main analysis, we show that whether the choice of contract type is in the upstream firms' discretion or not plays an important role for the market structure. The same holds for the timing of bargaining between the upstream monopolist and the two downstream firms. In particular, we show that when the upstream firms have the discretion of choosing whether to use wholesale price or two-part tariff contracts, a merger takes place only if the upstream bargaining power is sufficiently low, in which case the upstream monopolist uses a wholesale price contract. If the upstream bargaining power is high, the upstream firms prefer two-part tariff contracts and have thus no incentives to merge. Considering the case in which a merged supplier bargains sequentially, rather than simultaneously, with the two downstream firms, we reassert, under certain conditions, our main result that there are no incentives for a merger under two-part tariffs. We pinpoint though that in this case the upstream monopolist can credibly commit to foreclose one of the downstream firms. The possibility of foreclosure makes the merger more attractive when the final goods are close substitutes and thus when the downstream competition is strong.

As a consequence, we find that, under sequential bargaining, the two-part tariffs can lead to a change not only in the upstream but also in the downstream market structure.

The existing literature on horizontal mergers has focused on mergers in final product markets and has, to a great extent, ignored mergers in vertically related industries. The seminal paper of Horn and Wolinsky (1988) is one of the few exceptions. According to Horn and Wolinsky (1988), when the downstream firms' products are substitutes, the upstream firms always have an incentive to merge as the merger allows them to charge higher wholesale prices. While Horn and Wolinsky restrict attention to linear wholesale price contracts, we allow for a more general contract space and demonstrate that their result is quite sensitive to the type of contract used. We thus highlight the point that the vertical contract type cannot be considered of minor importance. The type of vertical contract can have a strong impact on the equilibrium predictions and in particular, on the market structure. Moreover, we add to Horn and Wolinsky by providing a welfare analysis of upstream horizontal mergers which has important implications for merger policy.

In a model in which firms use only two-part tariff contracts, Ziss (1995) confirms the above mentioned result of Horn and Wolinsky (1988) and shows that an upstream horizontal merger is welfare detrimental. In contrast to us and to Horn and Wolinsky (1988), Ziss abstracts from the possibility of bargaining by assuming that the upstream firms unilaterally and irrevocably set the terms of contracts. As we demonstrate, his results are extremely sensitive to the presence of bargaining.³

The remainder of the paper is organized as follows. In Section 2, we describe our model. In Sections 3 and 4 respectively, we analyze the case of independent upstream firms and the case of an upstream horizontal merger. In Section 5, we examine the upstream firms' incentives to merge. In Section 6, we perform a welfare analysis and discuss its policy implications. In Section 7, we consider a number of extensions of our model. Finally, in Section 8, we conclude. All the proofs are relegated to the Appendix.

³O'Brien and Shaffer (2004) and Inderst and Wey (2003) also examine horizontal mergers in intermediate product markets, however, they consider settings which are very different from ours (e.g. settings in which competition in the downstream market is absent). von Ungern-Sternberg (1996), Dobson and Waterson (1997), and Lommerud et al. (2005) examine instead horizontal mergers in downstream markets restricting attention to wholesale price contracts.

2 The Model

We consider a two-tier industry consisting of two upstream and two downstream firms, denoted respectively by U_i and D_i , with $i = 1, 2$. One could easily think of the upstream and the downstream firms as being respectively input producers and final good manufacturers, labor unions and firms, wholesalers and retailers. We assume that production for the upstream firms involves a constant marginal cost c and that there is a one-to-one relation between the products of U_i and D_i (e.g. between input and final product). Furthermore, we assume that there is an exclusive relation between U_i and D_i , $i = 1, 2$.⁴

Each downstream firm D_i faces the following inverse demand function:

$$p_i = a - q_i - \gamma q_j, \quad i, j = 1, 2, \quad i \neq j, \quad 0 \leq c < a, \quad 0 < \gamma < 1, \quad (1)$$

where p_i and q_i are respectively the price and the quantity of D_i 's final product, and q_j is the quantity of D_j 's final product. The parameter γ denotes the degree of product substitutability, namely, the higher is γ , the closer substitutes the two final products are.

Competitive interactions are modelled as a three-stage game with observable actions. In stage one, the upstream firms decide whether to merge horizontally or not. If the upstream firms do not merge, then in stage two, each downstream firm D_i bargains with its upstream supplier U_i over their terms of trade. If instead the upstream firms do merge then, in stage two, the newly formed upstream monopolist bargains simultaneously with the two downstream firms over their terms of trade.⁵ In the final stage, stage three, the downstream firms compete in the final market in quantities.

Negotiations between the upstream and downstream firms may be conducted either over a linear *wholesale price* contract specifying only a per-unit of input price w_i or over a

⁴This may be the case, for instance, if prior to reaching an agreement on price, U_i and D_i have made some relation-specific investments that prevent them from breaking up. It is reasonable to assume that these investments represent long-run decisions, while decisions regarding the bargained input price are easier to reverse in the short-term (for a further discussion of this assumption see Horn and Wolinsky, 1988, Gal-Or, 1991, and Symeonidis, 2004).

⁵One could think of two representatives of the upstream monopolist, each of them negotiating at the same time with a different downstream firm over their own terms of trade. This is a standard assumption in the literature, see Horn and Wolinsky (1988), Marshall and Merlo (2004), among others. In subsection 7.2 we relax this assumption and examine what happens when the upstream monopolist bargains sequentially, instead of simultaneously, with the two downstream firms.

non-linear *two-part tariff* contract, including both a wholesale price w_i and a fixed fee F_i . Under both types of contracts, we model these negotiations as a generalized Nash bargaining problem, where the bargaining power of each upstream and downstream firm is respectively β and $1 - \beta$, $0 < \beta \leq 1$, and then characterize its equilibrium using the generalized Nash product solution. The entire game is solved by deriving its subgame perfect equilibrium.

3 Independent Upstream Suppliers

In this section we derive the equilibrium outcome for the case in which the upstream firms act as independent suppliers.

In the final market competition stage, no matter whether a wholesale price contract (w_i) or a two-part tariff contract (w_i, F_i) has been negotiated in the previous stage, each D_i chooses its quantity q_i , taking q_j as given, in order to maximize its (gross) profits:

$$\max_{q_i} \pi_{D_i} = (a - q_i - \gamma q_j)q_i - w_i q_i. \quad (2)$$

The first order conditions give rise to the following reaction functions:

$$R_i(q_j, w_i) = \frac{a - w_i - \gamma q_j}{2}. \quad (3)$$

Clearly, a decrease in the wholesale price faced by D_i shifts its reaction function upwards and makes the downstream firm more aggressive in the final market. Solving the system of reaction functions (3), we obtain the equilibrium quantities:

$$q_i(w_i, w_j) = \frac{a(2 - \gamma) - 2w_i + \gamma w_j}{4 - \gamma^2}. \quad (4)$$

It follows that the (gross) profits of D_i and U_i are:

$$\pi_{D_i}(w_i, w_j) = \frac{[a(2 - \gamma) - 2w_i + \gamma w_j]^2}{(4 - \gamma^2)^2}; \quad (5)$$

$$\pi_{U_i}(w_i, w_j) = (w_i - c)q_i(w_i, w_j) = (w_i - c) \frac{a(2 - \gamma) - 2w_i + \gamma w_j}{4 - \gamma^2}. \quad (6)$$

3.1 Bargaining over wholesale price contracts

In stage two, U_i and D_i bargain over the wholesale price w_i , taking into account that the wholesale price paid by D_j is determined in the simultaneously run negotiations between U_j and D_j and thus that the two bargaining problems are interdependent. In particular, letting w_j^S denote the equilibrium outcome of the bargaining between U_j and D_j (i.e. the equilibrium wholesale price paid by D_j), w_i is chosen to maximize the generalized Nash bargaining product:

$$\max_{w_i} [\pi_{U_i}(w_i, w_j^S)]^\beta [\pi_{D_i}(w_i, w_j^S)]^{1-\beta}, \quad (7)$$

where $\pi_{U_i}(w_i, w_j^S)$ and $\pi_{D_i}(w_i, w_j^S)$ are given by equations (6) and (5), and β is the bargaining power of the upstream firms. Note that since both the upstream and the downstream firms do not have any other trading partners, their disagreement payoffs are equal to zero.

Taking the first order condition of (7) we obtain the equilibrium wholesale prices:

$$w^S = w_i^S = w_j^S = c + \frac{\beta(2-\gamma)(a-c)}{4-\beta\gamma} > c. \quad (8)$$

Note that the equilibrium wholesale prices decrease with the degree of product substitutability and remain always above the marginal cost of input c . Finally, substituting (8) into (5) and (6), we obtain the equilibrium downstream and upstream profits under wholesale price contracts:

$$\pi_{D_i}^S = \frac{4(2-\beta)^2(a-c)^2}{(2+\gamma)^2(4-\beta\gamma)^2} \quad \text{and} \quad \pi_{U_i}^S = \frac{2\beta(2-\beta)(2-\gamma)(a-c)^2}{(2+\gamma)(4-\beta\gamma)^2}. \quad (9)$$

3.2 Bargaining over two-part tariff contracts

In stage two, U_i and D_i bargain both over the wholesale price w_i and the fixed fee - upstream transfer F_i , taking as given the outcome of the simultaneously run two-part tariff negotiations between U_j and D_j . Letting $(\hat{w}_j^S, \hat{F}_j^S)$ denote the equilibrium outcome of the bargaining between U_j and D_j , w_i and F_i are chosen in order to maximize the generalized Nash product:

$$\max_{w_i, F_i} [\pi_{U_i}(w_i, \hat{w}_j^S) + F_i]^\beta [\pi_{D_i}(w_i, \hat{w}_j^S) - F_i]^{1-\beta}. \quad (10)$$

Again, disagreement payoffs for both the upstream and the downstream firms are equal to zero since none of the firms has an alternative trading partner. Maximizing (10) first with respect to F_i we get:

$$F_i = \beta \pi_{D_i}(w_i, \hat{w}_j^S) - (1 - \beta) \pi_{U_i}(w_i, \hat{w}_j^S). \quad (11)$$

Using (11) we observe that the net profits of U_i and D_i can be rewritten as:

$$\begin{aligned} \pi_{U_i}(w_i, \hat{w}_j^S) + F_i &= \beta [\pi_{U_i}(w_i, \hat{w}_j^S) + \pi_{D_i}(w_i, \hat{w}_j^S)]; \\ \pi_{D_i}(w_i, \hat{w}_j^S) - F_i &= (1 - \beta) [\pi_{U_i}(w_i, \hat{w}_j^S) + \pi_{D_i}(w_i, \hat{w}_j^S)]. \end{aligned} \quad (12)$$

Substituting the above expressions into (10), it follows that the generalized Nash product reduces to an expression proportional to the joint profits of U_i and D_i . Hence, w_i is chosen to maximize these joint profits:

$$\max_{w_i} [\pi_{U_i}(w_i, \hat{w}_j^S) + \pi_{D_i}(w_i, \hat{w}_j^S)] = [a - q_i(w_i, \hat{w}_j^S) - \gamma q_j(w_i, \hat{w}_j^S) - c] q_i(w_i, \hat{w}_j^S). \quad (13)$$

From the first order conditions of (13) we find the equilibrium wholesale prices:

$$\hat{w}^S = \hat{w}_i^S = \hat{w}_j^S = c - \frac{\gamma^2(a - c)}{4 + 2\gamma - \gamma^2} < c. \quad (14)$$

Note that $\hat{w}_i^S < c$ and $\partial \hat{w}_i^S / \partial \gamma < 0$. That is, the wholesale prices reflect a subsidy from the upstream firms to their respective downstream firms and this subsidy is higher, the higher is the degree of substitutability between the goods. The intuition is as follows. A downstream firm, via a lower wholesale price, can commit to a more aggressive behavior in the final product market. Its reaction curve shifts out, and as the reaction curves are downward sloping, this results in lower quantity for the rival downstream firm, and higher quantity and gross profits for the own downstream firm.⁶ The portion of these gross profits that is transferred upstream, via the fixed fee, not only compensates for the upstream losses but also leaves a "good deal" of profits to the upstream firm. Clearly, in the limit case where the

⁶This is in the same vein as in the strategic delegation literature, where firms' owners unilaterally set two-part tariffs, in anticipation of their managers' quantity competition (see e.g. Vickers, 1985, Fershtman and Judd, 1987, and Sklivas, 1987).

final products are independent, there is no strategic role for subsidies and the equilibrium wholesale prices turn out to be equal to the marginal cost of input c . Note also that the equilibrium level of \widehat{w}^S is independent of the bargaining power distribution. This is so because, as we saw above, while the wholesale price is chosen to maximize the joint profits of U_i and D_i , the role of the fixed fee is to split these joints profits among the upstream and the downstream firm according to their respective bargaining powers (see (12)).

Finally, substituting (14), (5) and (6) into (12), we obtain the net equilibrium profits of the downstream and upstream firms under two-part tariff contracts:

$$\widehat{\pi}_{D_i}^S = \frac{2(1-\beta)(2-\gamma^2)(a-c)^2}{(4+2\gamma-\gamma^2)^2} \quad \text{and} \quad \widehat{\pi}_{U_i}^S = \frac{2\beta(2-\gamma^2)(a-c)^2}{(4+2\gamma-\gamma^2)^2}. \quad (15)$$

4 Upstream Horizontal Merger

We turn now to the analysis of the case in which the two upstream suppliers are horizontally integrated, and thus, act as an upstream monopolist, denoted by U .

The last stage of the game is the same as in the case of independent upstream suppliers and thus the equilibrium quantities are given by (4). The second stage of the game though is different, since now one firm - the upstream monopolist - bargains simultaneously with the two downstream firms. This brings about two important modifications relatively to the case of independent upstream suppliers. First, the (gross) profits of the upstream firm are no longer given by (6), but instead by:

$$\pi_U(w_i, w_j) = (w_i - c)q_i(w_i, w_j) + (w_j - c)q_j(w_i, w_j). \quad (16)$$

And second, while the disagreement payoffs of the downstream firms are again equal to zero, the disagreement payoff of the upstream monopolist is not anymore null since U has now an ‘outside option’. In particular, if D_i does not reach an agreement with U , the disagreement payoff of U will be equal to U ’s profits when D_j operates as a downstream monopolist facing a per unit of input cost equal to the equilibrium wholesale price anticipated to be established in the bargaining between U and D_j . Clearly, the above differences imply that the terms of trade in the case of an upstream merger will differ from those in the case of independent suppliers.

4.1 Bargaining over wholesale price contracts

The upstream monopolist U bargains with the downstream firm D_i over the wholesale price w_i , taking as given the outcome of its simultaneously run negotiations with D_j . Letting w_j^M denote the equilibrium outcome of the bargaining between U and D_j , that is, the anticipated wholesale price to be paid by D_j , w_i is chosen to maximize the generalized Nash product:

$$\max_{w_i} [\pi_U(w_i, w_j^M) - d(w_j^M)]^\beta [\pi_{D_i}(w_i, w_j^M)]^{1-\beta}, \quad (17)$$

where $\pi_U(w_i, w_j^M)$ and $\pi_{D_i}(w_i, w_j^M)$ are given respectively by (16) and (5), and $d(w_j^M) = (w_j^M - c)q_j^m(w_j^M)$, with $q_j^m(w_j^M) = (a - w_j^M)/2$, is the disagreement payoff of the upstream monopolist, in case that D_j acts as downstream monopolist in the final good market facing input price w_j^M . Taking the first order condition of (17) we obtain the equilibrium wholesale prices and the respective net equilibrium profits:

$$w^M = w_i^M = w_j^M = c + \frac{\beta(a - c)}{2} > c; \quad (18)$$

$$\pi_{D_i}^M = \frac{(2 - \beta)^2(a - c)^2}{4(2 + \gamma)^2} \quad \text{and} \quad \pi_U^M = \frac{\beta(2 - \beta)(a - c)^2}{2(2 + \gamma)}. \quad (19)$$

Note that, in contrast to the case of independent suppliers, the equilibrium wholesale prices are now independent of the degree of product substitutability. Moreover, the comparison of the equilibrium wholesale prices in the case of an upstream merger (18) with that in the case of independent suppliers (8), leads to the following result.

Proposition 1 *When firms bargain over wholesale price contracts, the equilibrium wholesale price in the case of an upstream horizontal merger is always higher than in the case of independent upstream firms, $w^M > w^S$.*

The result presented in Proposition 1 is not new and can also be found in Horn and Wolinsky (1988) and in Davidson (1988). The positive effect of an upstream merger on the equilibrium wholesale prices is due to the following two reasons. The first reason has to do with the fact that an increase in the wholesale price charged to D_i has an effect not only on D_i 's output, but also on the output of D_j . It actually, has a positive effect on the latter. A merged upstream firm, in contrast to an independent one, internalizes

this positive effect and sets higher wholesale prices.⁷ The second reason that wholesale prices rise has to do with the upstream disagreement payoffs. An upstream monopolist that does not reach an agreement with D_i , recoups some of its losses because D_j will increase its output in the final good production stage - it has thus a positive disagreement payoff. An independent upstream firm does not recoup any of its losses in case of disagreement, since it does not dispose an ‘outside option’. The positive disagreement payoff increases the upstream monopolist’s effective bargaining position, leading in turn to higher wholesale prices.

4.2 Bargaining over two-part tariff contracts

The upstream monopolist U bargains now with the downstream firm D_i over both the wholesale price w_i and the fixed fee F_i , taking as given the outcome of its simultaneously run negotiations with D_j . Letting $(\hat{w}_j^M, \hat{F}_j^M)$ denote the equilibrium outcome of the bargaining between U and D_j , that is, the anticipated wholesale price and fixed fee to be paid by D_j , w_i and F_i are chosen to maximize the generalized Nash product:

$$\max_{w_i, F_i} [\pi_U(w_i, \hat{w}_j^M) + F_i + \hat{F}_j^M - \hat{d}(\hat{w}_j^M, \hat{F}_j^M)]^\beta [\pi_{D_i}(w_i, \hat{w}_j^M) - F_i]^{1-\beta}, \quad (20)$$

where $\pi_U(w_i, \hat{w}_j^M)$ and $\pi_{D_i}(w_i, \hat{w}_j^M)$ are given respectively by (16) and (5), and $\hat{d}(\hat{w}_j^M, \hat{F}_j^M) = (\hat{w}_j^M - c)q_j^m(\hat{w}_j^M) + \hat{F}_j^M$, with $q_j^m(\hat{w}_j^M) = (a - \hat{w}_j^M)/2$, is the disagreement payoff of the upstream monopolist, in case that D_j acts as downstream monopolist in the final market facing input price \hat{w}_j^M . Note that in this case the disagreement payoff consists of two parts: (1) U ’s profits from selling the input to D_j and (2) the fixed-fee that D_j pays to U independently of the quantity of the input bought. Maximizing (20) first with respect to F_i we get:

$$F_i = \beta \pi_{D_i}(w_i, \hat{w}_j^M) - (1 - \beta) \left[\pi_U(w_i, \hat{w}_j^M) + \hat{F}_j^M - \hat{d}(\cdot) \right]. \quad (21)$$

⁷The ability of the upstream monopolist to internalize the positive effect is also responsible for the independence of w^M from the degree of product substitutability.

Using (21), the expressions within the brackets of (20) can be rewritten as:

$$\begin{aligned}\pi_U(w_i, \hat{w}_j^M) + F_i + \hat{F}_j^M - \hat{d}(\cdot) &= \beta \left[\pi_U(w_i, \hat{w}_j^M) + \hat{F}_j^M + \pi_{D_i}(w_i, \hat{w}_j^M) - \hat{d}(\cdot) \right]; \\ \pi_{D_i}(w_i, \hat{w}_j^M) - F_i &= (1 - \beta) \left[\pi_U(w_i, \hat{w}_j^M) + \hat{F}_j^M + \pi_{D_i}(w_i, \hat{w}_j^M) - \hat{d}(\cdot) \right].\end{aligned}\quad (22)$$

Substituting the above expressions into (20), it follows that the generalized Nash product reduces to an expression proportional to the ‘extra’ joint surplus generated by U and D_i , that is, the sum of the profits of U and D_i minus U ’s disagreement payoff from dealing with D_j alone. Hence, w_i is chosen to maximize this extra joint surplus:

$$\begin{aligned}\max_{w_i} [\pi_U(w_i, \hat{w}_j^M) + \pi_{D_i}(w_i, \hat{w}_j^M) + \hat{F}_j^M - \hat{d}(\cdot)] &= \\ [a - q_i(w_i, \hat{w}_j^M) - \gamma q_j(w_i, \hat{w}_j^M) - c]q_i(w_i, \hat{w}_j^M) + (\hat{w}_j^M - c)q_j(w_i, \hat{w}_j^M) - (\hat{w}_j^M - c)q_j^m(\hat{w}_j^M).\end{aligned}\quad (23)$$

>From the first order conditions of (23) we find the equilibrium wholesale prices and the respective net equilibrium profits under two-part tariff contracts:

$$\hat{w}^M = \hat{w}_i^M = \hat{w}_j^M = c - \frac{\gamma^2(a - c)}{2(2 - \gamma^2)} < c; \quad (24)$$

$$\hat{\pi}_U^M = \frac{(2 - \gamma) [\beta(4 - 2\gamma - 2\gamma^2 + \gamma^3) - \gamma^3] (a - c)^2}{4(2 - \gamma^2)^2}; \quad (25)$$

$$\hat{\pi}_{D_i}^M = \frac{(1 - \beta)(2 - \gamma)^2(a - c)^2}{8(2 - \gamma^2)}. \quad (26)$$

In this case too, the wholesale prices reflect a subsidy from the upstream monopolist to the downstream firms, $\hat{w}^M < c$, and this subsidy decreases as the degree of substitutability of the final goods becomes smaller, $\partial \hat{w}^M / \partial \gamma < 0$. This is now due to the fact that the upstream monopolist conducts two-part tariff negotiations simultaneously with the two downstream firms. While negotiating with D_i , U cannot credibly commit to a high bargained wholesale price w_j that will make the rival downstream firm D_j behave as a soft competitor in the final good market. Clearly then, U and D_i will never agree in setting a wholesale price $w_i \geq c$, because D_i knows that in this case U has an incentive to make D_j an aggressive competitor in the final product market via a lower wholesale price. The upstream monopolist has such an incentive because, via a higher fixed fee - upstream transfer, it will not only recoup its losses from selling input below marginal cost to D_j but it will also obtain higher net overall

profits.⁸ Obviously, the lower is the degree of substitutability between the final goods, the smaller is the impact of the upstream monopolist's inability to commit on the equilibrium wholesale prices. In addition, the latter are again independent of the bargaining power distribution since \hat{w}^M is chosen to maximize the 'extra' joint surplus of U and D_i , with the fixed fee used to split this surplus among them according to their respective bargaining powers.

Surprisingly, the equilibrium wholesale price in the case of an upstream merger (24) turns out to be lower than the wholesale price in the case of independent suppliers (14). This is formally stated in Proposition 2 below.

Proposition 2 *When firms bargain over two-part tariff contracts, the equilibrium wholesale price in the case of an upstream horizontal merger is always lower than in the case of independent upstream firms, $\hat{w}^M < \hat{w}^S$.*

Recall that exactly the opposite result holds under wholesale price contracts. That is, while the impact of an upstream merger on the equilibrium wholesale prices is positive under wholesale price contracts, it is *negative* under two-part tariff contracts. The intuition behind the latter result hinges on two effects. First, the merged suppliers take into account that an increase in the wholesale price charged to D_i leads to an increase in the output of D_j . An increase in the output of D_j means in turn an increase in the subsidy from U to D_j , since as mentioned above U subsidizes the downstream production (i.e. the wholesale price charged to D_j is below c). Thus, in contrast to the case of wholesale price contracts, an increase in the wholesale price charged to D_i has now a *negative*, rather than positive, effect on the upstream firm due to the increase in the output of D_j . Since this negative effect is internalized only when the firms merge, the upstream incentives to increase the wholesale prices are weaker in the presence of an upstream merger. Second, the 'effective' disagreement payoff of the merged suppliers is actually *negative* in the case of two-part tariffs.⁹ This is so because in the case of disagreement between U and D_i , D_j will increase its output acting

⁸This is in the spirit of Rey and Tirole (2003) where an upstream monopolist offering two-part tariff contracts to two downstream firms cannot extract all the surplus in the case that the contracts are secret or can be privately renegotiated.

⁹The term 'effective' refers to the variable part of U 's disagreement payoff, i.e. the first term of $\hat{d}(\hat{w}_j^M, \hat{F}_j^M)$. Its fixed part \hat{F}_j^M does not play any role because it enters in both U 's profits and disagreement payoff, and thus, it cancels out.

as a downstream monopolist, causing higher losses to U who subsidizes its production. Clearly, the negative effective disagreement payoff weakens the bargaining position of a merged supplier relative to that of an independent supplier with zero disagreement payoff, leading to lower wholesale prices under a merger.

5 Merger Incentives

We turn now to the analysis of stage one, that is, we analyze the upstream firms' incentives to merge.

The following Proposition contains our main findings.

Proposition 3 *(i) When firms bargain over wholesale price contracts, the upstream firms always have incentives to merge horizontally.*

(ii) When firms bargain over two-part tariff contracts, the upstream firms have no incentives to merge horizontally.

According to part (i) of Proposition 3, when wholesale price contracts are used, we should always expect the upstream firms to merge. As noted by Horn and Wolinsky (1988), the main reason behind this result is that an upstream monopolist, in contrast to an upstream competitor, internalizes the positive effect mentioned in the discussion of Proposition 1. The internalization of this effect, together with the improvement in the upstream bargaining position due to the monopolist's positive disagreement payoff, leads to an increase in the total upstream profits, creating a clear incentive for an upstream horizontal merger.

Interestingly, the opposite result holds when two-part tariff contracts are used. In this case the upstream firms prefer to remain separated. This result is surprising since it contrasts with the conventional wisdom according to which firms prefer to be monopolists. The intuition behind it comes from the negative effect of the upstream merger on the equilibrium wholesale prices (Proposition 2). An upstream firm using two-part tariffs always subsidizes downstream production. An upstream monopolist, in contrast to an upstream competitor, internalizes the negative effect of a wholesale price increase in total downstream subsidies. This internalization, coupled with the deterioration in the upstream bargaining position due to the monopolist's negative effective disagreement payoff, lead to a fall in the total

upstream profits in the case of a merger compared to total profits in the case of independent suppliers. Our finding suggests that in the case in which two-part tariff contracts are used, the upstream firms will not pursue a horizontal merger, unless the negative effects mentioned above are offset by sufficient merger-related efficiency gains.

Proposition 3 clearly indicates that the predictions of our model regarding the equilibrium market structure under two-part tariff contracts differ sharply from those under wholesale price contracts. It is clear then, that the type of contract over which bargaining takes place between upstream and downstream firms cannot be considered of minor importance. Indeed, the vertical contract type may have significant implications not only for the distribution of gains between the upstream and the downstream firms, but, more importantly, for the equilibrium industry structure. In particular, our analysis predicts that in an industry where vertical trading is conducted through linear contracts, we should expect to observe, in equilibrium, an upstream merger taking place even in the absence of any efficiency gains. In an industry though where vertical trading is conducted through non-linear contracts and an upstream merger does not bring about important efficiency gains, we should expect to observe, in equilibrium, the upstream suppliers remaining independent and dealing separately with their downstream partners.

6 Welfare Analysis

We next examine the effects of an upstream horizontal merger on downstream profits, consumers' surplus and total welfare, as well as we discuss the policy implications of our findings. Defining total welfare as the sum of consumers' surplus and upstream and downstream firms' profits, we obtain the following results.

Proposition 4 *An upstream horizontal merger has a positive (negative) effect on downstream firms' profits, on consumers' surplus and on total welfare when firms bargain over two-part tariff (wholesale price) contracts.*

Proposition 4 implies that an upstream merger can be procompetitive even if it does not lead to any efficiency gains for the merged firms. In particular, when bargaining takes place over two-part tariff contracts, an upstream merger is beneficial both for consumers and total welfare. The intuition behind the effect of an upstream merger on the consumers'

surplus is straightforward. As stated in Proposition 2, under two-part tariff contracts, the equilibrium wholesale prices are lower when upstream suppliers are merged than when they act independently. Lower input prices lead to lower final product prices and thus to higher consumers' surplus. The effect of the upstream merger on total welfare is more involved as one has to consider also how downstream and upstream firms' profits are affected. In contrast to conventional wisdom, Proposition 4 asserts that downstream firms are better off with a monopolized upstream market. The intuition behind this stems from our discussion of Proposition 3(ii). Downstream firms enjoy more favorable terms of trade when dealing with an upstream monopolist. Not only they face a lower input price, but also a lower fixed fee. The latter is due to the fact that the upstream bargaining position is weaker when upstream firms merge than when they act as independent suppliers. In contrast to downstream profits, we have seen in Proposition 3(ii) that upstream profits decrease due to the merger. The two positive effects of the merger, on consumer surplus and downstream profits, dominate its negative effect on upstream profits, and as a result the upstream merger turns out to be welfare improving when two-part tariff contracts are used.

A reversal of all the above results is observed when wholesale contracts are used. Following Propositions 1 and 3(i), it is easy to see that the intuitive arguments work in exactly the opposite direction in this case.

Combining Propositions 3 and 4 one can conclude that the upstream firms choose to merge only when their merger is welfare detrimental. For instance, while under wholesale price contracts, the upstream firms have incentives to merge, welfare is higher if they remain separated. The opposite holds under two-part tariff contracts. Even if a merger would then be welfare improving the firms do not choose to merge in the absence of important merger-related cost savings.

The above findings clearly have important policy implications. The existing merger regulation (see e.g. U.S. Merger Guidelines) does not distinguish in general among horizontal mergers in upstream and downstream markets. Moreover, it does not distinguish among horizontal mergers under different vertical trading arrangements. Our findings point out the role of vertical contracts on the welfare impact of horizontal mergers. Hence, they suggest that the treatment of upstream horizontal mergers by the antitrust authorities should depend, among other things, on vertical trading arrangements. In particular, if a merger

between upstream firms takes place in an industry in which vertical trading is conducted through non-linear contracts, then this merger should not raise serious antitrust concerns. Surprisingly, although such a merger leads to an increase in monopoly power, it also leads to a *decrease* in the prices and an *increase* in downstream profits even in the absence of efficiency gains. Not only this but also the appearance of such a merger could indicate the existence of merger-related efficiency gains since, as we mentioned above, firms would not have incentives to merge otherwise. Things should be different in the case in which an upstream merger takes place in an industry in which firms trade using linear wholesale price contracts. The antitrust authorities should allow such a merger to go through only if it brings about important efficiency gains. If not, then as we have seen above, the merger will be detrimental to welfare.

7 Extensions

In this section we consider two modifications of the basic model in order to discuss the robustness of our main results.

7.1 Endogenous Contract Type

So far we have assumed that when the upstream firms decide whether to merge or not, they take the contract type as given. In this subsection we relax this assumption and consider instead the case in which the choice of contract type is in the discretion of the upstream firm(s). In particular, we extend our model by adding a stage in which the upstream firm(s) choose whether they will use wholesale price or two-part tariff contracts, before negotiating over the terms of trade, but after deciding whether they will merge or not.

Starting with the case of independent upstream firms, we have the following result.

Lemma 1 *An independent upstream firm U_i , $i = 1, 2$, always chooses a two-part tariff contract.*

It is known from the literature (see e.g. Rey and Stiglitz, 1995, Milliou et al., 2004) that upstream firms prefer two-part tariff to wholesale price contracts whenever they are independent and have exclusive relations with the downstream firms. The rationale behind

this result hinges on two arguments. First, while two-part tariff contracts are conditionally efficient - i.e. they maximize the vertical chain's joint profits given the rival chain's strategy - wholesale price contracts are not. Second, while under two-part tariff contracts, the vertical chain's joint profits are shared according to the firms' bargaining powers, under wholesale price contracts the downstream firms enjoy a larger share than the one corresponding to their bargaining power.¹⁰ Not surprisingly, an independent upstream firm therefore prefers a two-part tariff contract to a wholesale price one, since with the former it enjoys a greater share of a larger pie.

As Lemma 2 below states, the same does not always hold in the case of a merged upstream firm.

Lemma 2 *Whenever the final products are sufficiently close substitutes (i.e. $\gamma > 0.806$), an upstream monopolist U always chooses a wholesale price contract. For lower degrees of product substitutability, there exists a $\tilde{\beta}(\gamma)$, such that an upstream monopolist U chooses a wholesale price contract if $\beta < \tilde{\beta}(\gamma)$ and a two-part tariff contract otherwise. Moreover, $\tilde{\beta}(\cdot)$ is increasing in γ and $\tilde{\beta}(0) = 0$.*

According to Lemma 2, the type of contract used in the case of an upstream horizontal merger depends crucially on the distribution of bargaining power and on the degree of product substitutability (i.e. the intensity of downstream competition). In particular, the upstream merged firm prefers to use two-part tariff contracts only if its bargaining power is sufficiently high and the final products are not very close substitutes. In all other cases, it prefers to use wholesale price contracts.

The intuition behind Lemma 2 comes from the observation that two-part tariff contracts have at the same time two disadvantages and two advantages relative to wholesale price contracts. Starting with their disadvantages, recall that while the upstream monopolist's 'effective' outside option is positive under wholesale prices, it is negative under two-part tariffs. Recall also that $\hat{w}^M < c < w^M$, that is, downstream competition under two-part tariffs is fiercer than under wholesale price contracts and thus the total surplus to be shared among the upstream monopolist and the downstream firms is smaller under two-part tariffs. Turning to the advantages of two-part tariffs, first we have seen that while for any given

¹⁰ A more detailed explanation can be found in Milliou et al. (2004).

outcome of the negotiations between U and D_j , a two-part tariff maximizes the extra joint surplus (i.e. that above U 's outside option) of U and D_i , a wholesale price does not.¹¹ Second, we have that while under a two-part tariff U receives the share of the extra joint surplus that corresponds to its bargaining power (see (22)), under a wholesale price it receives a relatively lower portion of the surplus.¹² Clearly, while an increase in upstream bargaining power (higher β) reinforces this second advantage of two-part tariffs, a stronger downstream competition (higher γ) reinforces one of their disadvantages, and thus increases the attractiveness of wholesale price contracts.

We turn next to stage one, that is, we examine whether or not the upstream firms have incentives to integrate horizontally, in the case in which the selection of the contract type is in their own discretion. The following Proposition summarizes our findings.

Proposition 5 *When the final products are sufficiently close substitutes (i.e. $\gamma > 0.975$), the upstream firms always have incentives to merge horizontally. For lower degrees of product substitutability, there exists a $\hat{\beta}(\gamma)$, such that the upstream firms have incentives to merge horizontally if and only if $\beta < \hat{\beta}(\gamma)$. Moreover, $\hat{\beta}(\gamma) < \tilde{\beta}(\gamma)$, $\hat{\beta}(\cdot)$ is increasing in γ and $\hat{\beta}(0) = 0$.*

Proposition 5 reveals that whether the contract type is chosen by the trading parties or not, plays an important role for the market structure. It thus suggests that the assumption that the contract type is exogenously given cannot be innocuous. In fact, the incentives for an upstream merger can change significantly when the contract type is assumed to be chosen by the upstream firms.

In particular, when the final products are not very close substitutes, upstream firms who have the discretion to choose the form of trading, will not merge unless their bargaining power is low ($\beta < \hat{\beta}(\gamma)$). This is so, because when the upstream bargaining power is high (i.e. $\beta > \tilde{\beta}(\gamma)$), we know from Lemmata 1 and 2 that both an independent and a merged upstream firm choose a two-part tariff contract. Then according to Proposition 4,

¹¹Under a two-part tariff, w_i is chosen to maximize the extra joint surplus of U and D_i (see (23)), while under a wholesale price contract, w_i is chosen to maximize their generalized Nash product (see (17)).

¹²To see this last point one has first to rewrite the focs of (17) as: $\frac{\pi_U - d}{\pi_{D_i}} = \frac{\beta}{1-\beta} \frac{\partial \pi_U / \partial w_i}{(-\partial \pi_{D_i} / \partial w_i)}$. Then, by the envelop theorem, $-\partial \pi_{D_i} / \partial w_i = q_i^*$, while $\partial \pi_U / \partial w_i = q_i^* + (w_i - c) \partial q_i^* / \partial w_i < q_i^*$, because $w_i > c$. Hence, $\frac{\pi_U - d}{\pi_{D_i}} < \frac{\beta}{1-\beta}$.

the upstream firms have a disincentive to merge. On the other hand, when $\beta < \tilde{\beta}(\gamma)$, an independent upstream firm chooses a two-part tariff contract, while a merged one a wholesale price contract. In this case, the upstream firms will merge unless they possess sufficient bargaining power (i.e. unless $\hat{\beta}(\gamma) < \beta < \tilde{\beta}(\gamma)$). The main force behind this is that, when the upstream bargaining power is not too low, the inefficiency from double marginalization (under wholesale prices) is stronger than the inefficiency from below marginal cost input pricing (under two-part tariffs) and thus the overall pie to be shared between upstream and downstream firms is larger in the latter case. The opposite is true for relatively low values of β in which case the upstream firms will merge and use wholesale price contracts. Finally and for similar reasons, when the products are almost perfect substitutes ($\gamma > 0.975$), there are incentives for merger independently of how powerful upstream firms are.

7.2 Sequential Bargaining and Market Foreclosure

In this subsection we depart from the assumption that an upstream integrated firm bargains simultaneously with all the downstream firms. We assume instead that it bargains sequentially with them. We show that the pattern of bargaining can play an important role for the upstream merger incentives. In particular, while under some circumstances, we reassert our main result that there are no incentives for an upstream merger under two-part tariff contracts, under others, we find that the firms prefer to merge.

The twisting point of the analysis here is that under sequential bargaining, an upstream monopolist can credibly commit to foreclose one of the downstream firms. To see this, let the upstream monopolist U bargain first with D_1 and then with D_2 . The upstream monopolist has the option to bring the negotiations with D_1 to a “dead end” if it wishes to do so. In case it does so, that is, in case of disagreement with D_1 , the upstream monopolist bargains over a two-part tariff with D_2 . It is easy to see that in this case bargaining will lead to the maximization of their joint profits, which will then be divided according to their respective bargaining powers. In particular, $w_2^f = c$, $\pi_{D_2}^f = (1 - \beta)(a - c)^2/4$ and $\pi_U^f = \beta(a - c)^2/4$. Therefore, under sequential bargaining, the upstream monopolist can foreclose D_1 and attain profits equal to π_U^f .¹³ It will certainly choose to do so whenever

¹³Under simultaneous bargaining, U cannot credibly commit to bring the negotiations with, say D_1 , into a “dead end”, although it has a clear incentive to do so. In fact, D_2 knows that, once it agrees to a wholesale

the overall profits that the upstream monopolist expects from the sequence of successful negotiations with the two downstream firms are lower than π_U^f .

The following Proposition summarizes the main results for the sequential bargaining case.

Proposition 6 *Under sequential bargaining over two-part tariff contracts, when the products are not close substitutes (i.e. $\gamma < 0.702$), there exists $\beta_s(\gamma)$ such that for all $\beta \geq \beta_s(\gamma)$, the upstream firms do not merge horizontally. Otherwise, the upstream firms merge horizontally and the upstream monopolist sells to both downstream firms for all γ if $\beta < \beta_s(\gamma)$, while it forecloses one of the downstream firms for the rest of the parameter values. Moreover, $\beta_s(\cdot)$ is decreasing in γ , with $\beta_s(0) = 1$ and $\beta_s(1) = 0$.*

Figure 1 illustrates Proposition 6 by dividing the (β, γ) parameter space in the three respective regions. Proposition 6 tells us that if the goods are not close substitutes and the upstream bargaining power is relatively high, the upstream firms prefer to act as independent suppliers under two part tariff contracts. It also tells us that when the goods are close substitutes, relatively powerful upstream firms have incentives to merge and via the sequential bargaining pattern, foreclose one of the downstream firms.

Intuitively, when the final goods are close enough substitutes, the upstream suppliers wish to merge because the merger allows them to eliminate the fierce downstream competition through the foreclosure of one of the downstream firms. When instead the final goods are not too close substitutes, the upstream firms may still wish to merge when their bargaining power is not high enough. This is so because a merged upstream firm has a stronger bargaining position than an independent one due to its outside option while bargaining with each one of the downstream firms. On the other hand, when relatively powerful upstream firms do not face strong downstream competition ($\gamma < 0.702$), they prefer to act as independent suppliers. This is due to the fact that when the upstream monopolist conducts successful sequential negotiations with the downstream firms, equilibrium wholesale prices are above marginal cost of input. This results into double marginalization which reduces the size of the pie to be shared among the upstream monopolist and the downstream firms.

price $w_2^f = c$ (and makes its corresponding transfer upstream F_2^f), U has an incentive to settle to a lower wholesale price with D_1 and increase thus its overall profits.

This latter negative effect is stronger than the negative effect due to below marginal cost of input pricing in case that independent suppliers use two-part tariffs and downstream competition is not too strong.

It is worth stressing that, under sequential bargaining, two-part tariff contracts can alter not only the upstream but also the downstream market structure. In particular, if $\gamma \geq 0.702$ and $\beta > \beta_s(\gamma)$, then the downstream market transforms also into a monopoly since the upstream monopolist forecloses one of the downstream firms.

8 Concluding Remarks

We have analyzed the incentives for horizontal upstream mergers in intermediate product markets, along with the welfare implications of such mergers, in the presence of bargaining between the vertically related firms. We have considered both the case of bargaining over linear wholesale price contracts and the case of bargaining over non-linear two-part tariff contracts.

Our key finding is that the type of vertical contract used can play a crucial role both for the merger incentives and for the welfare effects of mergers. In particular, in the absence of any efficiency gains, we show that upstream firms have a disincentive to merge when they trade using two-part tariff contracts and an incentive to merge when they trade using wholesale price contracts. This finding allows us to highlight the point that the vertical contract type cannot be considered of minor importance. Indeed, the type of vertical contract may have significant implications for the equilibrium industry structure.

The same holds for the repercussions of the type of vertical contract on the desirability of upstream horizontal mergers from a social viewpoint. We find that such mergers are welfare enhancing under two-part tariffs and welfare detrimental under wholesale prices. This clearly suggests that the treatment of horizontal mergers by the antitrust authorities should depend, among other things, on the vertical trading arrangements used.

A maintained assumption of our analysis is that the dealing between the vertically related firms is exclusive. An obvious direction to extend our analysis is thus a framework in which the upstream firms could sell to all the downstream firms. A further complication that would arise in this case is the existence of simultaneous multilateral negotiations over

wholesale price or two-part tariff contracts among all the upstream and all the downstream firms. As this is not an easy task, the analysis of this case awaits further work.

9 Appendix

Proof of Proposition 3: (i) The result follows immediately from (19) and (9), by taking the difference between the upstream profits in the case of a merger π_U^M and the sum of each upstream independent firm's profits $\pi_{U_1}^S + \pi_{U_2}^S$.

(ii) The result follows immediately from (25) and (15), by taking the difference between the upstream profits in the case of a merger $\widehat{\pi}_U^M$ and the sum of each upstream independent firm's profits $\widehat{\pi}_{U_1}^S + \widehat{\pi}_{U_2}^S$. ■

Proof of Proposition 4: Under wholesale price contracts, we obtain the result regarding the downstream profits from (19) and (9), by taking the difference of the sum of each downstream firm's profits in the case of a merger $\pi_D^M = \pi_{D_1}^M + \pi_{D_2}^M$ and the respective sum in the case of independent upstream firms $\pi_D^S = \pi_{D_1}^S + \pi_{D_2}^S$. Regarding the consumers' surplus result, we first calculate the consumers' surplus both in the case of a merger and in the case of independent suppliers:

$$CS^k = \frac{1}{2}[q_1(w^k)^2 + q_2(w^k)^2 + 2\gamma q_1(w^k)q_2(w^k)], \quad k = M, S$$

Then we take their difference and our result follows. Regarding the total welfare result, we first calculate total welfare for both cases:

$$W^M = CS^M + \pi_D^M + \pi_U^M \quad \text{and} \quad W^S = CS^S + \pi_D^S + \pi_{U_1}^S + \pi_{U_2}^S.$$

And then taking their difference we see that $W^M < W^S$.

Under two-part tariffs, from (26) and (15), we obtain our results following the same steps as under wholesale price contracts above. ■

Proof of Lemma 1: We already know from (9) and (15), the profits of an independent upstream firm in the case that both vertical chains use wholesale price contracts and in the case that they use two-part tariff contracts. It remains to determine the upstream profits for the case in which one of the vertical chains uses a two-part tariff contract while the other

uses a wholesale price contract, and then check whether an upstream firm has incentives to deviate by switching to the other type of contract.

W.l.o.g. let U_1 use a wholesale price contract and U_2 a two-part tariff contract. U_1 and D_1 , taking as given the outcome (w_2^A, F_2^A) of the simultaneously run negotiations between U_2 and D_2 , choose w_1 to maximize their Nash product, as in (7). At the same time, U_2 and D_2 , taking as given the outcome w_1^A of the simultaneously run negotiations between U_1 and D_1 , choose w_2 to maximize their joint profits, as in (13), which are then split according to their respective bargaining powers, via the suitably chosen fixed fee F_2 . Taking the first order conditions and solving we obtain the equilibrium wholesale prices and upstream profits in the asymmetric contract type case A :

$$w_1^A = c + \frac{\beta(16 - 8\gamma - 8\gamma^2 + 2\gamma^3 + \gamma^4)(a - c)}{32 - 16\gamma^2 + \beta\gamma^4}; \quad (27)$$

$$w_2^A = c - \frac{(2 - \gamma)\gamma^2(4 + \beta\gamma)(a - c)}{32 - 16\gamma^2 + \beta\gamma^4}; \quad (28)$$

$$\pi_{U_1}^A = \frac{2\beta(2 - \beta)(4 - 2\gamma - \gamma^2)(16 - 8\gamma - 8\gamma^2 + 2\gamma^3 + \gamma^4)(a - c)^2}{(32 - 16\gamma^2 + \beta\gamma^4)^2}; \quad (29)$$

$$\widehat{\pi}_{U_2}^A = \frac{2\beta(2 - \gamma)^2(2 - \gamma^2)(4 + \beta\gamma)^2(a - c)^2}{(32 - 16\gamma^2 + \beta\gamma^4)^2}. \quad (30)$$

Now from (29) and (15) one can check that $\pi_{U_1}^A < \widehat{\pi}_{U_1}^S$; hence, when U_2 uses a two-part tariff contract, U_1 has no incentive to switch from a two-part tariff to a wholesale price contract. Moreover, from (30) and (9) one can check that $\widehat{\pi}_{U_2}^A > \pi_{U_2}^S$; hence, when U_1 uses a wholesale price contract, U_2 has always incentive to switch from a wholesale price to a two-part tariff contract. Evoking symmetry, the above arguments prove that a two-part tariff contract strictly dominates a wholesale price contract from the point of view of an upstream firm. Thus, an independent upstream firm will always choose a two-part tariff contract. ■

Proof of Lemma 2: This is an immediate consequence of the comparison of a merged upstream firm's profits in the case that it uses a wholesale price contract (19) and in the case it uses a two-part tariff contract (25). It turns out that $\pi_U^M > \widehat{\pi}_U^M$ if and only if $\beta < \widehat{\beta}(\gamma) = \frac{\gamma(4 - \gamma^2)}{2(2 - \gamma^2)}$. Since $\widehat{\beta}(0) = 0$, $d\widehat{\beta}/d\gamma > 0$ and $\widehat{\beta}(\gamma) = 1$ for $\gamma = 0.806$, the result follows. ■

Proof of Proposition 5: From Proposition 3(ii) we know that, under two-part tariffs, a

merged upstream firm obtains lower profits than the sum of the profits of the independent suppliers. Hence, for all parameter values for which a merged upstream firm prefers a two-part tariff contract (i.e. for all $\beta > \widehat{\beta}(\gamma)$), the upstream firms are better off by staying independent.

For the rest of the parameter values, in which the merged upstream firm prefers a wholesale-price contract, one can check from (19) and (15) that $\pi_U^M > \widehat{\pi}_{U_1}^S + \widehat{\pi}_{U_2}^S$ if and only if $\beta < \widetilde{\beta}(\gamma) = \frac{2\gamma(8+4\gamma+\gamma^3)}{(4+2\gamma-\gamma^2)^2}$. Since $\widetilde{\beta}(0) = 0$, $d\widetilde{\beta}/d\gamma > 0$, $\widetilde{\beta}(\gamma) = 1$ for $\gamma = 0.975$, and $\widetilde{\beta}(\gamma) < \widehat{\beta}(\gamma)$ for all γ , the result follows because by Lemma 1 the independent upstream firms always use two-part tariff contracts. ■

Proof of Proposition 6: Let U bargain with D_1 in stage one and with D_2 in stage two. The final market competition stage, stage three, is the same as in Section 3.

In stage two, U and D_2 bargain over (w_2, F_2) , given the outcome of the previous stage negotiations between U and D_1 . Assume for the moment that U and D_1 have reached an agreement (w_1, F_1) . Then U 's disagreement payoff is equal to $d(w_1, F_1) = (w_1 - c)q_1^m(w_1) + F_1$, where $q_1^m(w_1) = (a - w_1)/2$ is D_1 's output when D_1 is a monopolist in the final market. The disagreement payoff of D_2 is zero. Now, maximization of the generalized Nash product first w.r.t. F_2 leads to a reduced problem where U and D_2 choose w_2 to maximize their extra joint surplus:

$$\begin{aligned} \max_{w_2} [\pi_U(w_1, w_2) + \pi_{D_2}(w_1, w_2) + F_1 - d(\cdot)] = & \quad (31) \\ [a - q_2(w_1, w_2) - \gamma q_1(w_1, w_2) - c]q_2(w_1, w_2) + (w_1 - c)q_1(w_1, w_2) - (w_1 - c)q_1^m(w_1). & \end{aligned}$$

>From the first order conditions of (31), we obtain the wholesale price reaction function of (U, D_2) :

$$w_2(w_1) = \frac{c(2 + \gamma)(2 - \gamma^2)^2 - \gamma[a(2 - \gamma)\gamma - 2(2 - \gamma^2)w_1]}{4(2 - \gamma^2)}. \quad (32)$$

Note that $\partial w_2/\partial w_1 > 0$, i.e. an increase in the wholesale price paid by D_1 makes now less profitable for (U, D_2) to reduce the wholesale price paid by D_2 .

In stage one, U and D_1 bargain over (w_1, F_1) taking into account how (U, D_2) will react in the next stage. The disagreement payoff for D_1 is zero. In order to determine the disagreement payoff of U , we have to understand the continuation of the game in case of disagreement. In the latter market foreclosure case, U and D_2 will bargain over a two-part

tariff (w_2^f, F_2^f) in the next stage. It is easy to see that, since disagreement payoffs for both parties will be zero, U and D_2 will agree on $w_2^f = c$ in order to maximize their joint profits and that, the agreed fixed-fee F_2^f will be such that the maximal joint profits will be shared among U and D_2 according to their respective bargaining powers; therefore, $\bar{d} = \beta(a-c)^2/4$. Taking this into account, the maximization of the generalized Nash product first w.r.t. F_1 leads to the reduced problem where U and D_1 choose w_1 to maximize their extra joint surplus:

$$\begin{aligned} \max_{w_1} [\pi_U(w_1, w_2(w_1)) + \pi_{D_1}(w_1, w_2(w_1)) - \bar{d}] &= -\bar{d} + (w_2(w_1) - c)q_2(w_1, w_2(w_1)) \\ &+ [a - q_1(w_1, w_2(w_1)) - \gamma q_2(w_1, w_2(w_1) - c)]q_1(w_1, w_2(w_1)). \end{aligned} \quad (33)$$

where $w_2(w_1)$ is given by (32). Taking the first order conditions of (33) and using (32), we obtain the equilibrium wholesale prices

$$w_1^M = c + \frac{(a-c)\gamma(2-\gamma)}{2(2-\gamma^2)}; \quad w_2^M = c \quad (34)$$

Note that $w_1^M > w_2^M = c$. In contrast to the case of merged suppliers under simultaneous bargaining, the upstream monopolist does *not* subsidize downstream firms in the sequential bargaining case.

However, (34) is the solution to (33) only if the extra joint surplus - to be shared among U and D_1 according to their respective bargaining powers - is positive. It can be checked that the extra joint surplus is positive only if $\beta \leq \beta_s(\gamma) = 2(1-\gamma)/(2-\gamma^2)$. Moreover, for this range of parameters, the net equilibrium profits of the downstream and upstream firms turn out to be:

$$\pi_{D_1}^M = \frac{(1-\beta)[2-2\gamma-\beta(2-\gamma^2)](a-c)^2}{4(2-\gamma^2)}; \quad \pi_{D_2}^M = \frac{(1-\beta)(2-\gamma)^2(a-c)^2}{8(2-\gamma^2)}; \quad (35)$$

$$\pi_U^M = \frac{[(2-\gamma)^2\gamma^2 - 2\beta^2(2-\gamma^2)^2 + \beta(24-16\gamma-14\gamma^2+8\gamma^3+\gamma^4)](a-c)^2}{8(2-\gamma^2)^2}. \quad (36)$$

Note that $\pi_{D_1}^M < \pi_{D_2}^M$, i.e. there is a last mover advantage for the downstream firms under two-part tariff contracts whenever the suppliers are merged.

If instead $\beta > \beta_s(\gamma)$, U has an incentive to bring its negotiations with D_1 to a dead end. Then under market foreclosure, the solution to the problem is, $w_2^f = c$, $\pi_{D_1}^f = 0$, $\pi_{D_2}^f = (1 - \beta)(a - c)^2/4$, and $\pi_U^f = \beta(a - c)^2/4$.

To complete the proof, we have to compare the aggregate profits of the independent suppliers with those of the upstream monopolist. If $\beta \leq \beta_s(\gamma)$, one can check from (15) and (36) that $\pi_{U_1}^S + \pi_{U_2}^S < \pi_U^M$; hence, an upstream merger will occur in this range of parameters. If $\beta > \beta_s(\gamma)$, then $\pi_{U_1}^S + \pi_{U_2}^S < \pi_U^f$ only if $\gamma > 0.702$; otherwise, the inequality is reversed. Hence, an upstream merger with market foreclosure will occur if $\gamma > .702$ and $\beta > \beta_s(\gamma)$; otherwise, the upstream firms will remain independent. ■

10 References

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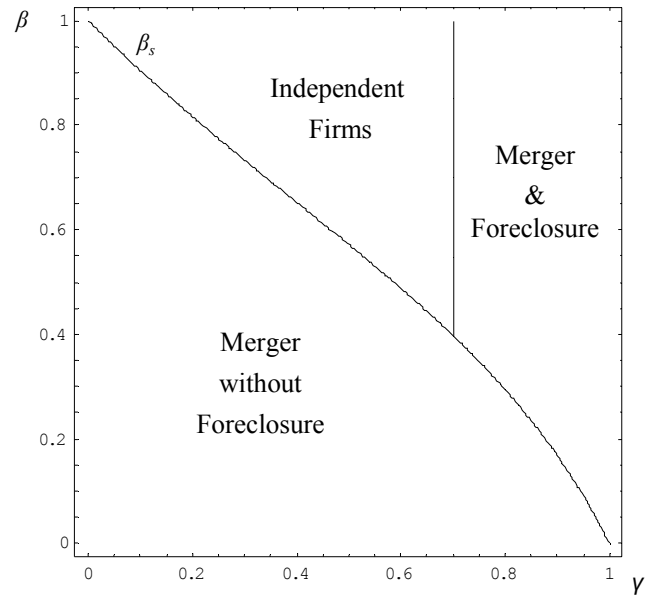


Figure 1: Sequential Bargaining