Buyer Power and the "Waterbed Effect"*

Roman Inderst[†]   Tommaso M. Valletti[‡]

February 2009

Abstract

When a buyer is able to obtain cheaper input prices from a supplier, is it possible that *other* buyers will have to pay more for the same input as a result? Is this bad for consumers? We present a model that analyzes the conditions under which the asymmetric exercise of buyer power can lead to consumer detriment through raising other buyers' wholesale prices (the "waterbed effect"). This can arise when the different buyers compete against each other. A loss of consumer surplus due to the waterbed effect is also more likely if the adversely affected buyers are already sufficiently "squeezed" in terms of higher wholesale prices and smaller market share. Instead, all retail prices decrease and all consumers benefit if suppliers have little scope to set discriminatory wholesale prices due to the presence of sufficiently attractive substitutes.

1 Introduction

In Spring 2008, the UK's Competition Commission completed its inquiry into the national grocery retail market.[1] The purchasing power of the biggest retailers was one of the key issues in this inquiry. Amongst several other concerns, including the possible negative effects on suppliers' incentives to invest and innovate, the Commission, for the first time, also looked seriously into the possibility of a "waterbed effect": the theory that more-advantageous terms of trade for larger or otherwise more powerful buyers could lead to worse terms for their less powerful rivals. On previous occasions, the UK's antitrust authorities had chosen not to consider the possibility of a waterbed effect on the grounds that it lacked an economic foundation.[2]

This paper offers a logically consistent foundation for a theory of the waterbed effect. In addition, and possibly more importantly, this paper provides antitrust authorities with guidelines on when to expect such a waterbed effect to be strong and, in particular, even sufficiently strong to lead to a reduction in consumer surplus or welfare.[3]

Ultimately, the Competition Commission came to the conclusion that there was insufficient empirical evidence to support the existence of a waterbed effect in the UK's grocery market. However, the deliberations made in the course of the several inquiries in the UK have brought this novel theory of competitive harm to the attention of other antitrust authorities and, more generally, to a wider audience of antitrust scholars.[4]

The theory of the waterbed effect that we develop cautions against what could possibly be a too-positive picture of powerful buyers as "consumers' champions".[5] In particular, it

---

[1] Competition Commission (2008), Market Investigation into the Supply of Groceries in the UK, http://www.competition-commission.org.uk/rep_pub/reports/2008/538grocery.htm

[2] For instance, the Office of Fair Trading argued that "there are theoretical questions that would need to be resolved before concluding that the price differentials observed are evidence of a waterbed effect." (OFT, The Grocery Market: The OFT's Reasons For Making a Reference to the Competition Commission, London, May 2006 (para. 6.13).)

[3] The present paper builds on an earlier version (first circulated in 2006), which the Association of Convenience Stores subsequently asked one of the authors to turn into an official submission to the UK's grocery inquiry.

[4] For instance, the president of the American Antitrust Authority, Albert Foer, recently noted: "The key to competition analysis of Buyer Power may be what is becoming known as the waterbed effect" (Foer 2007, p. 1326). The waterbed effect was also discussed explicitly at the OECD roundtable on buyer power (October 2008) and the annual conference of the German antitrust authority that was dedicated to buyer power (September 2008).

[5] The most prominent exposition of the idea that powerful retailers act as agents of consumers undoubtedly comes from Galbraith (1952).

emphasizes that an appropriate analysis of the implications of buyer power can not stop at the vertical dimension, but also must take into account how a given buyer's power vis-à-vis suppliers compares with that of competing buyers. The present theory of the waterbed effect shows that, in principle, the exercise of such *differential* (or asymmetric) buyer power may harm consumers already in the short run–i.e., even when the number of firms and the quality and range of their products all remain constant.[6] While a large and powerful firm improves its own terms of supply by exercising its bargaining power, the terms of its competitors can deteriorate sufficiently so as to ultimately increase average retail prices and, thereby, reduce total consumer surplus. A key contribution of this paper, beyond providing a formally consistent underpinning for the waterbed effect, is that it derives conditions for when we should expect the waterbed effect to be strong and for when we should expect it to be negligible. We find that the observed level of wholesale price discrimination should be key: Consumer detriment from the waterbed effect is more likely if the adversely affected firms are already sufficiently squeezed, due to relatively higher wholesale prices and, consequently, lower market shares.

As noted above, the UK's grocery inquiry, which has raised substantial interest among antitrust agencies around the world, provides the main background to this analysis. However, there is also much wider current interest in buyer power. In Europe, in a number of high-profile merger cases in the retailing industry, concerns about buyer power have lead to outright prohibitions or the imposition of specific remedies.[7] The growing buying power of large retailers has also made several European countries rethink their economic dependency laws. For instance, the German competition law was changed in 2008 to tighten provisions on non-cost justified discounts, thereby ensuring a level playing field for smaller retailers.[8]

Finally, the interest in buyer power goes beyond the narrow boundaries of antitrust

---

[6]In our model, the waterbed effect is already work in the short run, as manifested by the coincidence of a decrease in wholesale prices for some buyers and an increase for other buyers. This is a major difference when compared to the "spiral effec"", another theory of competitive harm from buyer power that is prominent. The theory of the spiral effect is much more prospective: Competitive harm should be expected only in the long run, when less powerful rivals have exited the market, thereby creating scope for a price increase by the remaining oligopolists. Compared to the spiral effect theory, that of a waterbed effect seems, thus, to be more easily testable – and also refutable, as evidenced by the Competition Commission's decision in the grocery inquiry.

[7]E.g., Rewe/Meinl, Kesko/Tuko, and Carrefour/Promodes (Case no IV/M.1221, Case no IV/M.784, and Case no IV/M.1684, respectively).

[8]§ 20 Abs. 3 GWB-E.

policy. The issue of buyer power increasingly attracts public interest for two reasons. First, governments, often pressured by lobby groups but also supported by parts of the public, are concerned about the survival of the small shopkeeper (e.g., the local convenience store). Second, especially in relation to farmers, the exercise of buyer power is often regarded as "unfair." For instance, in the case of dairy products, most notably milk prices, several European countries (e.g., Germany and the UK) have had public discussions and official inquiries on the fate of farmers facing increasingly large and powerful retail chains.

At first, the notion of a waterbed effect would strike economists as being ill-conceived. If a supplier can raise prices, at least with respect to some retailers, then why would he wait to do so until other, more powerful, retailers demanded an additional discount? In fact, previous arguments often invoked some "break-even" constraint of suppliers. To economists, this looks rightly like an ill-founded accounting exercise that is not based on firms' optimal strategies.[9] The present analysis shows, however, that a simple economic logic can underlie such a waterbed effect.

In our model, buyer power arises from size.[10] A larger buyer's additional discount allows it to reduce retail prices and, thereby, attract additional business, some of which will be captured at the expense of other, less powerful buyers. As this lowers not only sales volume, but also purchase volume, for the latter firms, their bargaining position vis-à-vis suppliers is further worsened, resulting in less favorable terms of supply. As a consequence, prices paid to suppliers by a large buyer have indeed fallen, and prices paid by smaller firms have risen.

In terms of retail prices, if prices are strategic complements, then for smaller buyers, two conflicting forces are at work. While smaller buyers would optimally like to pass on some of the increase in their wholesale price, they simultaneously face more aggressive competition from the larger buyer, given that the terms of trade of the large buyer have improved. While the latter effect often may be sufficiently strong so that *all* consumers

---

[9]This is also why the UK's antitrust authorities seem to have ruled out the relevance of a waterbed effect in their previous inquiries into the grocery retail industry (e.g., in Competition Commission, 2000, "Supermarkets: A Report on the Supply of Groceries from Multiple Stores in the United Kingdom," Cm 4842). On the other hand, the possibility of a waterbed effect has been explicitly acknowledged in the European Commission's Guidelines on horizontal agreements (European Commission, 2001, Guidelines on the Applicability of Article 81 of the EC Treaty to Horizontal Agreements, Office Journal C31/5-18, para. 126 and 135).

[10]The precise logic for why size creates buyer power will differ somewhat between the case in which size is generated through acquisitions and the case in which size is generated through more-efficient operations.

benefit from the exercise of buyer power, our model also allows us to characterize the opposite circumstances: when the waterbed effect is sufficiently strong to increase even the average prevailing retail price.[11] In this case, total consumer surplus can decrease through the working of a waterbed effect.

A key presumption of the main analysis in this paper is that more-powerful buyers obtain discounts not only through lump-sum payments (e.g., slotting allowances or listing fees) but also "at the margin." The key difference is the following: Only in the latter case should we reasonably expect that better terms of supply are passed on to consumers, even in the short run. For the present theory of the waterbed effect, this is important since, otherwise, the more powerful buyer would not enjoy a more competitive position at the retail market. Instead, if discounts were granted only "infra-marginally"- e.g., through lump-sum payments - then buyers would face a level playing field in the retail market, regardless of their size or other factors that determine their respective bargaining positions.

Recent evidence from the aforementioned investigation into the UK's grocery retail market strongly supports the picture that, at least in this industry and for the UK, discounts are given "at the margin."[12] The present model captures this in an admittedly simplistic way, namely through assuming linear wholesale contracts.[13] What is key for our results to hold and our theory of the waterbed effect to apply is simply that better terms of trade result in a more competitive position in the retail market. The assumed linearity of wholesale contracts is, instead, relevant only to the explicitly calculated example with

---

[11]In fact, in our model, all retail prices will typically be lower if the outlet of the large buyer (chain) has not yet acquired a dominant position in the considered (local) markets. See Basker (2005) and Basker and Noel (2007) on the price impact of an entry by Wal-Mart.

[12]More precisely, the UK's Competition Commission calculated the relative discount obtained by the largest grocers relative to their smaller rivals, both with respect to the overall net price (i.e., the price net of all payments, whether "fixed or variable") and with respect to only "variable" discounts. They found that discounts were larger when considering only the "variable" components. See Competition Commission (2007), Working Paper on Supplier Pricing, at http://www.competition-commission.org.uk/inquiries/ref2006/grocery/further_working_papers.htm. The Competition Commission notes that these "variable discounts" also include price reductions to fund promotions or per-unit retroactive rebates, all of which effectively lower the (anticipated) unit price that a retailer pays, thereby inducing him to price more competitively.

[13]Interestingly, while many supply contracts are indeed much more complex, casual evidence also suggests that this does not apply to all goods uniformly. E.g., we are aware of instances where fresh produce, bakery products or milk are sold to retailers with a perfectly linear contract. On the theoretical side, Iyer and Villas-Boas (2003) and Milliou, Petrakis and Vettas (2005) also offer some support for the use of simple, linear contracts.

linear demand. This short discussion of the role of contracts between retailers and suppliers suggests that the present theory of the waterbed effect could play a larger role in environments in which discounts are more likely to affect short-run competition. We will, however, also provide a discussion of the case with non-linear contracts below (cf. Section 4.3).

The rest of this paper is organized as follows. Section 2 relates our analysis to the extant literature on buyer power. Section 3 introduces and analyzes the benchmark case of symmetric firms, while Section 4 provides the main analysis with asymmetric buyers. Section 5 contains several extensions that provide, in particular, further comparative results. The concluding remarks in Section 6 pull together the various results so as to provide summary guidelines for policy.

2   Related Literature

Generally, our analysis contributes to the ongoing debate about the economic implications of non-cost justified discounts that more-powerful buyers can negotiate. Battigalli et al. (2006), Chen (2005), Inderst and Wey (2003, 2007), and Vieira-Montez (2007) all analyze the long-run implications of buyer power on the *upstream* industry. Inderst and Valletti (2009) study, instead, the implications of a ban on price discrimination on *downstream* incentives to invest in cost reduction. Earlier contributions by von Ungern-Sternberg (1996) and Dobson and Waterson (1997) analyze when the benefits of lower wholesale prices can outweigh the impact from a further monopolization of the retail market. In their model, symmetric buyers grow through acquisitions. In contrast, our model focuses on the exercise of *differential* buyer power, which may harm consumer, even though, in the short run, it has no effect on the number of competitors or on the breadth and depth of their offering.

The identified waterbed effect is also distinct from "strategic overbuying" with the intent or consequence of raising rivals' costs. Here, the large buyer incurs a short-term reduction in profits with the objective of future recoupment.[14] Furthermore, the predictions of the waterbed effect stand in marked contrast to those from theories that predict a *positive* externality for other buyers if a large and powerful buyer plays out his bargaining

---

[14]On strategic overbuying, see Salop (2005).

power. Snyder (1996) shows how a large buyer's orders can destabilize supplier collusion and, thereby, also lower the prices that other buyers must pay for their smaller orders. In Chen (2003), a supplier sets the linear wholesale price for a fringe of small buyers before negotiating with a large buyer. As the large buyer becomes more powerful, which is modeled as a shift in the sharing rule for the Nash bargaining game, the supplier tries to recapture some of the lost profits by selling more to the fringe, which requires it to lower the respective wholesale price.

Winter (1996), Gans and King (2002), and Majumdar (2005) all show that if one buyer or buyer group has a *first-mover advantage*, then it can benefit at the expense of smaller buyers. In Majumdar (2005), this can also manifest itself, as in our paper, in a more competitive position at the retail market. According to our theory, however, if the market structure remains unchanged, a waterbed effect is only present when the respective buyers are also downstream competitors.[15] Finally, the present analysis complements that in Inderst (2007). There, the focus is on the *creation* of differences in buyer size, namely through acquisitions or improvement of own efficiency. It is shown that buyers that are already larger have also higher incentives to grow further. In a Hotelling model it is shown that the resulting negative impact on rival firms is amplified by the waterbed effect. Instead, the present model generally derives the foundations of a waterbed effect and obtains implications for consumer surplus and welfare.

3   The Benchmark Case with Symmetric Buyers

We take the following stylized picture of a market in which downstream firms engage in local competition. There are altogether $n = 1, ..., N$ symmetric final markets. In each market, two downstream firms -referred to as A_n and B_n- compete. The case of geographically segmented markets may be particularly applicable to retailing. Though there may be a number of competing chains, in a given local market, consumers can choose between just a few outlets.[16]

---

[15]More recently, Smith and Thanassoulis (2009) offer an alternative theory of bargaining in bilateral oligopolies with uncertainty, which can also generate a waterbed effect. This is discussed further below. See, also, Schiff (2008) for the analysis of a different "waterbed effect" in the context of price regulation of a multiproduct firm.

[16]In retailing, in particular in the "one-stop-shopping" segment of super- or hypermarkets, the assumption of a tight local oligopoly (and, in particular, no further entry) is also often realistic given local planning restrictions.

For now, each downstream firm has the same constant marginal cost $c \geq 0$. Downstream firms can procure from the same supplier, which operates at constant marginal cost $k \geq 0$. We stipulate that firms transform one unit of purchased input into one unit of output. The constant input price is given by $w(A_n)$ and $w(B_n)$, respectively. We denote a downstream firm's "gross" marginal cost (i.e., including the wholesale price) by $m(A_n) := c + w(A_n)$ and $m(B_n) := c + w(B_n)$, respectively. All cost parameters are common knowledge. Note also that, for the moment, each downstream firm operates independently. Section 4 introduces large buyers that operate multiple downstream firms. Furthermore, in Section 5, we allow for differences in size that arise from the fact that firms have different marginal costs ($c(A_n)$ and $c(B_n)$).

At this point, recall our discussion of the role of linear wholesale prices in the Introduction. All that matters for the present theory of the waterbed effect is that (additional) discounts are given at least partially "at the margin," where they matter for a firm's competitive position in the downstream market.[17]

In each local market, firms compete in prices, which we denote by $p(A_n)$ and $p(B_n)$, respectively. We further suppose that there is a unique equilibrium in prices and denote the realized profits by $\pi(m(A_n), m(B_n))$ for firm A_n and, symmetrically, by $\pi(m(B_n), m(A_n))$ for firm B_n. We assume that the derived profit function is strictly decreasing in the marginal cost with $\pi_1(\cdot) < 0$ for the respective derivatives. In addition, we stipulate that the second derivatives satisfy

$$\pi_{11} > 0 \text{ and } \pi_{12} < 0. \tag{1}$$

The conditions in (1) are commonly invoked in the literature and are satisfied by many functional specifications (cf. Athey and Schmutzler, 2001).[18] Below, we comment more on the role of (1).

The existence of a waterbed effect will be independent of whether prices are strategic complements or substitutes. If prices are strategic substitutes, then it is straightforward that the adversely affected downstream firm raises its retail price - following a reduction of its rival's and an increase of its own wholesale price. In what follows, we will, therefore, deal mainly with the more interesting case of strategic complements, implying that, through competition, a countervailing effect arises: While the adversely affected firm would want

---

[17]Cf. also, for instance, Katz (1987), DeGraba (1990), or Yoshida (2000) for models with linear supply contracts.

[18]Alternatively, see Katz (1986) for a different application.

to pass on a higher wholesale price, the fact that its rival's retail price decreases will exert a countervailing force.

Negotiations

Wholesale contracts are determined through simultaneous and publicly observable take-it-or-leave-it offers that the incumbent supplier makes to all downstream firms. In the present model, buyer power derives from the respective value of a buyer's outside option. More precisely, if a downstream firm rejects the (incumbent) supplier's offer, it can access an alternative source of supply. This comes at the additional expenditure $F > 0$. Following the seminal contribution of Katz (1987), we may suppose that a downstream firm has the alternative to integrate backwards.[19] In Katz (1987), this alternative is sufficiently attractive for *only* the largest buyer, while in our analysis it will represent a credible alternative for *all* downstream firms. In the context of retailing, we may also interpret this alternative as an investment in the production and marketing of a private-label good.[20] Alternatively, we may suppose that another supplier bids against the incumbent. In this case, the cost F would represent a fixed switching cost, which may also, fully or partially, arise at the supplier. Finally, we can also imagine that, after rejecting the incumbent's offer, a downstream firm has to incur search costs F to locate a new source of supply.[21] When accessing the alternative source of supply, a downstream firm can operate at "gross" marginal cost - i.e., again including the wholesale price, of $m^{AL} := c + k^{AL}$.[22]

With linear wholesale prices, results are unaffected by whether or not bilateral contracts are observed by other downstream firms. We discuss this in more detail in Section 4.3. For the time being, we assume that offers, as well as downstream firms' decisions to accept or reject the supplier's offer, are observable.

Analysis with Symmetric Buyers

---

[19]Cf. also Laffont and Tirole (1990) for such a "bypass" technology.

[20]There are many cases in which retail chains have indeed substituted a branded good for a private-label alternative. For instance, the German discounter ALDI is famous for this strategy. An alternative strategy, which our model does not intend to capture, is to stock a private-label good next to that of a branded supplier, thereby putting more price pressure on the branded good.

[21]We abstract from the possibility that a firm may strategically procure from multiple suppliers (cf. Biglaiser and Vettas, 2005).

[22]Note that we assume that both inputs have the same quality, though the analysis can be extended in this direction. One special case is that in which one unit of the alternative good can, more generally, be transformed into ϕ units of the final good. Another alternative is that in which the other good is inferior in the eyes of all consumers. We allowed for the latter possibility in our working paper version, though only in the Hotelling model.

Key to the analysis of wholesale prices are the participation constraints for downstream firms, namely

$$\pi(m(A_n), m(B_n)) \geq \pi(m^{AL}, m(B_n)) - F \tag{2}$$

for firm A_n and

$$\pi(m(B_n), m(A_n)) \geq \pi(m^{AL}, m(A_n)) - F \tag{3}$$

for firm B_n. Note that we used for (2) and (3) that in case of rejecting the supplier's offer, the respective downstream firm can operate with gross marginal cost m^{AL}, while its rival still operates with gross marginal cost $m(A_n)$ or $m(B_n)$, respectively. The value of the respective outside option is given by the right-hand side of both (2) and (3).[23]

Clearly, the constraints (2) and (3) need not always be binding. In particular, they would *not* be binding if either F or k^{AL} were sufficiently high, thereby making the alternative supply option sufficiently unattractive. In this case, increasing the wholesale prices until the constraints bind would not be optimal for the supplier, given that he would then sell only a very low quantity. We want to exclude this case and focus, instead, on the situation where the alternative option is sufficiently attractive so as to effectively constrain the supplier's optimal choice of wholesale prices. We do this by stipulating that k^{AL} is just equal to the current supplier's marginal cost k. For simplicity, we then abbreviate $m^{AL} = m = k + c$. Furthermore, in what follows, we will always keep F sufficiently low. We have the following result.

Proposition 1 *Consider the benchmark case in which all downstream firms are symmetric, both in size and own marginal cost c. Then, for low F there exists a unique equilibrium. The supplier offers each (independent) firm the same wholesale price w_I, which is strictly increasing in F.*

Proof. See Appendix.

The result that the equilibrium wholesale price for each of the independent downstream firms, w_I, is strictly increasing in F is intuitive given that this reduces the value of their outside option.

Hotelling Model

---

[23]With linear contracts, it is immediate that there would be no scope for mutually profitable renegotiations between the supplier and the single, remaining buyer of his product.

Throughout this paper, we frequently use a standard Hotelling model for each downstream market to, first, illustrate our key results and, second, obtain additional, more quantitative implications. Suppose, thus, that each (local) market is represented by the mass one of consumers that is distributed uniformly over the unit interval. As is well known, this implies that at an interior solution the mass $y_n = 1/2 + [p(B_n) - p(A_n)]/(2t)$ of consumers shop at outlet A_n, where t denotes the unit transportation cost.

Proposition 2 *In the Hotelling case, the supplier realizes with each of the symmetric, independent firms a margin of*

$$w_I - k = 3t \left(\sqrt{1 + 2F/t} - 1 \right),$$ (4)

which is strictly increasing in F and also in t.

Proof. See Appendix.

Proposition 2 confirms the comparative result in F from Proposition 1. In addition, we find that the supplier's margin $w_I - k$ is strictly higher when there is less competition in the downstream market (given higher "shoe-leather" costs t).[24] The supplier can, thus, set higher wholesale prices to extract higher profits that are generated by a less competitive retail market.

4 Differential Buyer Power

4.1 Wholesale Prices

To develop the key insights on the waterbed effect, it is sufficient to introduce a single large buyer. We do this by supposing that one buyer now operates $2 \leq n_L \leq N$ downstream firms (or outlets in the case of retailing), each in a separate market. Without loss of generality, let this be the owner of firms A_n with $n \in \{1, ..., n_L\}$.

In equilibrium, there will now be three different wholesale prices. The large buyer obtains a wholesale price w_L such that $w(A_n) = w_L$ for all $n \in \{1, ..., n_L\}$. For the

---

[24]It should be noted, however, that one can not choose the differentiation parameter t arbitrarily small in equation (4) without simultaneously reducing F. This is the case as the derivation of the equilibrium relies on the assumption that switching to the alternative supply option represents a credible alternative for both downstream firms. If we let $t \to 0$ while F remains bounded away from zero, however, then a firm that rejects the offer of w_I would, instead, be better off when ceasing operations.

competing small firms in these n_L markets, we denote $w(B_n) = w_S$ for $n \in \{1, ..., n_L\}$. Finally, it is immediate that the wholesale price for all other downstream firms in markets $n > n_L$, where the large buyer is not active, will be unaffected by the presence of the larger buyer and will, thus, still be equal to w_I, as used in Proposition 1. In analogy to the analysis with symmetric buyers, the three wholesale prices must jointly satisfy the respective participation constraints:

$$
\begin{aligned}
\text{for } w_I &: & \pi(m_I, m_I) &\geq \pi(m, m_I) - F, \\
\text{for } w_S &: & \pi(m_S, m_L) &\geq \pi(m, m_L) - F, \\
\text{for } w_L &: & n_L \pi(m_L, m_S) &\geq n_L \pi(m, m_S) - F.
\end{aligned}
\tag{5}
$$

The following analysis proceeds as follows. We first derive some general results on the equilibrium characterization in the case of differential buyer power. This is followed by an application to the Hotelling model. As a final step, we study the implications for retail prices and, ultimately, consumer surplus and welfare. (Furthermore, we present a numerical example at the end of this Section.)

Analysis of Wholesale Prices

As in Proposition 1, for low F, all participation constraints in (5) bind in equilibrium. This allows us to obtain the following characterization.[25]

Proposition 3 *Consider the case in which a large buyer controls several downstream firms in separate markets. The large buyer's wholesale price, w_L, is then strictly smaller than the (benchmark) wholesale price in case of symmetric buyers, w_I, from Proposition 1, while the wholesale price of competing smaller firms, w_S, is strictly larger than w_I. Moreover, as the number of firms n_L that the large buyer controls increases, w_L further decreases, while w_S further increases.*

Proof. See Appendix.

Hence, we find a waterbed effect with $w_L < w_I < w_S$. Also, note again that when n_L increases, the wholesale price differential, $w_S - w_L > 0$, widens for two reasons: first, as w_L decreases and, second, as w_S increases.

---

[25]This Proposition generalizes Proposition 2 in Inderst (2007) to general demand.

We now provide more intuition for the results in Proposition 3. Here, the first part is to show that $w_L < w_I$ holds. This will be relatively straightforward. The argument for why $w_S > w_I$ holds is more subtle.

When rejecting the incumbent supplier's offer and switching to the alternative source of supply, a buyer incurs the costs F. A large buyer, who controls $n_L > 1$ firms and consequently buys and sells a larger number of units, can, thus, spread the costs F over a larger number of units. This forces the supplier to reduce the wholesale price so as to still satisfy the large buyer's participation constraint. Formally, this effect can be seen immediately when transforming the large buyer's binding participation constraint (5) into

$$\pi(m_L, m_S) = \pi(m, m_S) - \frac{F}{n_L},$$

after dividing by n_L.

Turn next to the wholesale price of small firms that compete with the large buyer. As the large buyer obtains a discount, which he at least partially passes on into lower retail prices, he will take away market share from smaller firms. A first intuition for why the small firms' wholesale price, w_S, should increase is that, in analogy to the previous argument for the large buyer, a small buyer can now spread the costs F only over a smaller number of units. However, this argument is incomplete as it ignores that the lower retail price of the large buyer's firms, given the large buyer's lower wholesale price, will negatively affect both the value of a smaller firm's outside option, $\pi(m, m_L)$, and the value of his equilibrium payoff under the supplier's offer, $\pi(m_S, m_L)$. It turns out, however, that the first effect is stronger: As the rival firm in a given market becomes more competitive, following a reduction in its wholesale price, the (negative) effect on the value of a firm's outside option is stronger, which relaxes the respective participation constraint and, thereby, allows the supplier to raise his wholesale price. This is, in turn, an immediate consequence of the standard property (1) of reduced profit functions.

Clearly, for such a waterbed effect to arise, it is crucial that the supplier can price discriminate in the first place. In our model, this is the case only if $F > 0$. As F increases, there is increasing scope for price discrimination, leading to a widening of wholesale price differentials.

Corollary 1 *While both wholesale prices, w_L and w_S, strictly increase with F, also the difference $w_S - w_L > 0$ strictly increases.*

Proof. See Appendix.

Note that for our theory of the waterbed effect to apply, the adversely affected small firms must be in competition with the firms that are controlled by the large buyer. In our model, this is the case for all outlets B_n in markets $n \geq n_L$. In contrast, the wholesale price of all other firms, namely in markets $n > n_L$, is not affected. This observation also provides a key difference to (informal) theories of the waterbed effect that rely on adjustments in the upstream market structure. According to these theories, the exercise of bargaining power by a large buyer reduces suppliers' profits and, thereby, leads to further consolidation in the upstream industry by exit, mergers, or reduced entry. While through his bargaining power, a large buyer is shielded from the resulting increase in suppliers' market power, the conditions of small buyers worsens. According to this theory, small buyers would then be negatively affected *irrespective* of whether or not they are rivals of the large buyer.[26]

4.2   Retail Prices and Consumer Surplus

We are working under the assumption that prices are strategic complements. This makes the analysis of final (retail) prices more interesting, as for small firms, which face higher wholesale prices, there are now two conflicting forces at work. Holding all else constant, small firms would optimally pass on some of the wholesale price increase. However, as their competitors, namely the firms controlled by the large buyer, face lower wholesale prices and, thus, reduce their retail prices, small firms would also want to lower their retail prices. We analyze in this Section how these two forces play out. This is done first for the case with general demand, before subsequently deriving more explicit results with the Hotelling model. In the latter case, we can also obtain full explicit implications for changes in consumer surplus and welfare.

Recall, first, that for a given reduction in the large buyer's wholesale price, w_L, the corresponding change for small buyers is obtained by moving along their binding participation constraint in (5). Denote the respective retail prices by p_L and p_S, such that along this trajectory we have, from total differentiation, the following marginal impact on small

---

[26]Besides generating a different set of empirical predictions, this theory of harm and ours differ also in their possible treatment under antitrust rules. As in the present model the waterbed effect raises rivals' costs, though not those of firms in unrelated markets, it may also be captured under secondary-line claims.

buyers' retail prices:

$$\frac{dp_S}{dw_L} = \frac{\partial p_S}{\partial w_L} + \frac{dp_S}{dw_S}\frac{dw_S}{dw_L}. \tag{6}$$

The fact that the first term in (6) is positive while the second term is negative captures the two previously mentioned, conflicting effects: First, $\partial p_S/\partial w_L > 0$ captures the response of small firms to the large buyer's lower wholesale price, given that this induces the large buyer to lower his retail price, p_L; and, second, $dw_S/dw_L < 0$ and $dp_S/dw_S > 0$ jointly capture the impact from the waterbed effect. Consequently, if along the whole trajectory we had that

$$\frac{\partial p_S}{\partial w_L} < -\frac{dp_S}{dw_S}\frac{dw_S}{dw_L}, \tag{7}$$

then the waterbed effect would dominate, leading to an increase in small firms' retail prices. Instead, if the converse of (7) holds along the whole trajectory, then, following a reduction in w_L, all retail prices decrease, despite the working of the waterbed effect.

For the general analysis, we can show that if F is sufficiently small, such that there is altogether little scope for wholesale price discrimination, then any further growth of the large buyer (i.e., an increase in n_L) will reduce *all* retail prices.

Proposition 4 *Suppose that the large buyer's advantage $w_S - w_L > 0$ is sufficiently small, which is the case when F is small such that there is little scope for the supplier to set discriminatory wholesale prices. Then, an increase in the large buyer's size, through the acquisition of additional firms (higher n_L), leads to a reduction of all retail prices, despite the presence of a waterbed effect.*

Proof. See Appendix.

Note that competition in the retail market is key for the result in Proposition 4 to hold. Without competition, there would be no effect on other firms' wholesale and retail prices. Trivially, when the conditions in Proposition 4 hold, as all retail prices go down, consumer surplus and welfare will be higher.

For general demand we can, however, not go beyond Proposition 4 in showing when the waterbed effect will be sufficiently strong to result in a higher retail price for smaller rivals. We also do not know whether the waterbed effect can be sufficiently strong to lead to a reduction in total consumer surplus, even though the large buyer's retail price, p_L, decreases. To analyze these issues, we turn again to the Hotelling model.

Hotelling Model

With Hotelling competition, the total derivative in (6) becomes

$$\frac{dp_S}{dw_L} = \frac{1}{3}\left(1 + 2\frac{dw_S}{dw_L}\right).$$

Hence, the waterbed effect now dominates, such that condition (7) holds, whenever

$$\frac{dw_S}{dw_L} < -\frac{1}{2}. \tag{8}$$

In words, the small firms' retail price decreases if due to the waterbed effect their wholesale price, w_S, increases by at least *half* of the reduction in w_L. From implicit differentiation of the binding participation constraints we now obtain explicitly that

$$\frac{dw_S}{dw_L} = -\frac{w_S - k}{3t + w_L - w_S} = -\frac{1}{6t}\frac{w_S - k}{y_S} < 0, \tag{9}$$

where y_S is the equilibrium market share of the small firm.[27] Note that the waterbed effect is stronger when smaller firms are already more disadvantaged (or "squeezed"), given that they have small market shares (low y_S) and have to pay high wholesale prices. In this case p_S can increase. Precisely, from (8) and (9) the respective condition is that

$$y_S < \frac{w_S - k}{3t}. \tag{10}$$

Proposition 5 *In the Hotelling model, the waterbed effect is stronger if the difference $w_S - w_L > 0$ is already sufficiently large, implying a small market share y_S of the small firm. When (10) holds, then the waterbed effect even dominates the more intense price pressure from the larger rival, resulting in a higher retail price p_S. Condition (10) holds only if the large buyer controls sufficiently many outlets (large n_L), competition is sufficiently intense (low t), and F is not too low. If the converse of (10) holds strictly, instead, then all retail prices decrease, following a (size-induced) marginal reduction of the wholesale price of the larger buyer.*

Proof. See Appendix.

Summing up, the waterbed effect must be sufficiently large to give rise to possible policy concerns, which in turn holds only if the large buyer's advantage is already sufficiently

---

[27]Precisely, we have $y_S := \frac{3t + w_L - w_S}{6t}$.

substantial. For this to hold, it is in turn necessary that the large buyer is sufficiently larger in size (high n_L), while we also know that higher values $F > 0$ provide more scope for price discrimination in the first place.

An increase in the small firm's retail prices clearly harms all consumers who still purchase from small firms. This observation is important if policy-makers take into account distributional effects or intend to protect particular customer groups - e.g., those who are less mobile and, therefore, more exposed to price increases at, say, their local convenience shops in the case of retailing. If, instead, the objective of (antitrust) policy is to ensure that consumers are, on average, better off, then condition (10) is not sufficiently informative: The higher retail price at the smaller firms must still be traded off with the lower retail price at the large buyer's firms.

In the Hotelling model, in which total demand is inelastic, it is immediate that the (marginal) change in consumer surplus, CS, is given by the (marginal) change in the average retail price:[28]

$$\frac{dCS}{dw_L} = -\left[y_S \left(\frac{\partial p_S}{\partial w_L} + \frac{dp_S}{dw_S}\frac{dw_S}{dw_L} \right) + (1 - y_S) \left(\frac{\partial p_L}{\partial w_L} + \frac{dp_L}{dw_S}\frac{dw_S}{dw_L} \right) \right]. \tag{11}$$

Substituting again for the explicit expressions in the case of the Hotelling model, we obtain that, through the waterbed effect, total consumer surplus is lower if

$$2y_S \frac{2 - y_S}{1 + y_S} < \frac{w_S - k}{3t}. \tag{12}$$

Condition (12) is clearly stricter than condition (10), which ensured only that small firms' retail prices increase. Note next that, given $y_S \leq 1/2$, condition (12) is again more easily satisfied when small firms are more disadvantaged, leading to a lower market share y_S and a relatively higher wholesale price w_S.

Proposition 6 *In analogy to Proposition 5, the waterbed effect is sufficiently strong to increase even the average retail price and, thus, decrease consumer surplus in the Hotelling model if condition (12) is satisfied. This holds again only if n_L and F are both sufficiently large, while t is sufficiently small, thereby ensuring that the wholesale price difference $w_S - w_L > 0$ is itself already sufficiently large.*

---

[28]Formally, denoting by u the gross utility from consuming one unit, total consumer surplus equals

$$CS := u - [y_S p_S + y_L p_L] - t \left[\int_0^{y_S} x dx + \int_0^{y_L} x dx \right],$$

which after differentiation w.r.t. w_L yields (11).

Note, finally, that in the Hotelling model, an increase in the large buyer's size, n_L, *always* reduces welfare. This holds, as in order to minimize shoe-leather costs, an equal split of each local market between the respective two firms would be efficient. Any strictly positive wholesale price difference will, thus, lead to inefficiencies. It is important to note that this will be different in the analysis in Section 5, where differences in size and buyer power originate from differences in firms' own efficiencies, as captured by different marginal costs of operations.

Numerical Example

We conclude this Section with a short numerical example. The main objective of this is to show that, in particular, the stricter condition (12) is obtained under parameter values that are not "unrealistic." As the absolute values of the various variables have no particular meaning, given that they can simply be scaled up and down, we focus on firms' margins.

For a simple numerical example, we suppose that a large buyer originally controls $n_L = 2$ firms - i.e., double the number of firms (or outlets) that any of the the small buyers have. Subsequently, the large buyer's number of firms doubles to $n_L = 4$. Our choice for the various variables of the model of Hotelling competition is at follows: $t = 0.7$ for the measure of horizontal differentiation, $k = 7$ for the supplier's marginal cost and $c = 0$ for downstream firms' marginal cost. In addition, we choose $F = 0.4$.

For the original situation - i.e., with $n_L = 2$ - we obtain the respective wholesale prices $w_S \approx 8.43$ and $w_L \approx 7.38$, yielding for the supplier a margin of 20 percent with a small buyer and a margin of only five percent with a large buyer. Overall, the large buyer obtains a discount of 12.4 percent compared to the wholesale price of a small firm. Competition in the downstream market obtains the respective retail prices $p_S \approx 8.78$ and $p_L \approx 8.43$. The margins of the two competitors are, thus, equal to 12.4 percent and four percent, respectively. As the large buyer further grows, its relative discount increases from 12.4 percent to 26.4 percent. To be precise, w_L decreases to about 7.15, while w_S increases to about 9.04. The large buyer's margin is now 14.3 percent, while that of small firms is down to below one percent. Finally, calculating the retail prices that prevail after the large buyer further expands, we find that the average price indeed increases, albeit by only slightly less than one percent.

4.3 Discussion of the Model

In the present model, we assumed that the supplier offers observable linear wholesale contracts. The assumption of observability is, given the restriction to linear contracts, not essential for our results to hold. To see this, take the benchmark case of Proposition 1 and suppose, instead, that offers were *not* observable. We first specify that firms hold "passive beliefs" when encountering an unexpected (off-equilibrium) offer by the supplier. That is, the offer that a particular firm receives will not change the firm's expectations about the offer that the supplier makes to other buyers.

For brevity, we already restrict consideration to candidate equilibria in which the supplier serves all firms. In addition to the equilibrium offers $w(A_n)$ and $w(B_n)$ in market n, we now have to introduce the notation $\widehat{w}(B_n)$ and $\widehat{w}(A_n)$ for the respective *expectations*. In equilibrium, it must hold that $w(B_n) = \widehat{w}(B_n)$ and $w(A_n) = \widehat{w}(A_n)$. Now, take the offer to firm A_n. Using in analogy to (2) and (3) the notation $m(A_n) = w(A_n) + c$ and now also $\widehat{m}(B_n) := \widehat{w}(B_n) + c$, the participation constraint becomes

$$\pi(m(A_n), \widehat{m}(B_n)) \geq \pi(m^{AL}, \widehat{m}(B_n))) - F. \tag{13}$$

Likewise, for firm B_n we obtain

$$\pi(m(B_n), \widehat{m}(A_n)) \geq \pi(m^{AL}, \widehat{m}(A_n))) - F. \tag{14}$$

If both constraints (13) and (14) bind in equilibrium, then, together with $w(B_n) = \widehat{w}(B_n)$ and $w(A_n) = \widehat{w}(A_n)$, the equilibrium is pinned down by exactly the same conditions as in the case of observable contracts. That the two participation constraints bind, at least for low F, follows again from the same argument as in the proof of Proposition 1.[29] Applying these arguments also to the case with asymmetric firms yields the following result.

Proposition 7 *With linear wholesale prices, results are (at least for low F) independent of whether contracts are mutually observable or whether they are unobservable and downstream firms hold passive beliefs.*

It should be noted that the restriction to passive beliefs is not essential. For instance, it is immediate to show that the same result holds under "wary beliefs," where, when

---

[29]More precisely, for low F, any acceptable offer must be close to k, regardless of whether the respective participation constraint is based on the true offer to the other firm or on expectations.

faced with an off-equilibrium offer, a firm tries to back out what would be the supplier's simultaneous optimal offer to the other buyers.[30]

As noted in the Introduction, our presumption of linear contracts intends to capture the fact that, in some markets, discounts to powerful buyers seem to be given at the margin, where they have even a short-run impact on downstream competition. As is well known, this generally would not be the case with non-linear contracts. To see this, we discuss next the use of non-linear contracts in the present model. Without loss of generality we can restrict consideration to two-part tariff contracts that prescribe for A_n a fixed transfer $T(A_n)$, together with a constant (marginal) wholesale price for each purchased unit $w(A_n)$. Suppose that offers are not mutually observable. As is well known, when combined with passive beliefs in particular, this leads to an extreme opportunism problem for the supplier.[31] To see this, note, first, that by optimality the supplier will surely set the respective transfers $T(A_n)$ and $T(B_n)$ so that the respective participation constraint just binds. For instance, this implies for A_n that

$$T(A_n) = F + \left[\pi(m(A_n), \widehat{m}(B_n)) - \pi(m^{AL}, \widehat{m}(B_n)))\right].$$

Moreover, also by optimality and given passive beliefs, $w(A_n)$ and, thus, $m(A_n) = w(A_n)+c$ will be set to maximize the joint surplus realized between the supplier and A_n. The opportunism problem lies in the fact that the two parties do not take into account the negative externality that a resulting reduction of the retail price of A_n has on the profits of B_n. In equilibrium, this leads, for all downstream firms, to marginal wholesale prices that are equal to the supplier's marginal cost: $w(A_n) = w(B_n) = k$.[32] This result extends to the case in which buyers have different size, as now n_L enters the supplier's program only through decreasing the maximally feasible fixed transfer (namely, by the amount $F - F/n_L$).

Suppose, finally, that non-linear contracts are observable, in which case we can again dispose of the additional notation for expectations ($\widehat{w}$ and $\widehat{m}$). It is useful to rewrite the

---

[30]On the other hand, it is also immediate that the equilibrium with unobservable contracts is not generally independent of beliefs. To see this, recall first that, from (1), the participation constraint for a given firm becomes harder to satisfy if the (expected) wholesale price for the rival firm *increases.* Beliefs that associate any out-of-equilibrium offer with a very high wholesale price for the rival firm can sustain equilibria where not both participation constraints bind.

[31]Cf. McAfee and Schwartz (1993) and O'Brien and Shaffer (1994).

[32]Cf. Rey and Vergé (2004).

by optimality binding participation constraints, which yields

$$T(A_n) = F + \left[\pi(m(A_n), m(B_n)) - \pi(m^{AL}, m(B_n)))\right] \tag{15}$$

for A_n and

$$T(B_n) = F + \left[\pi(m(B_n), m(A_n)) - \pi(m^{AL}, m(A_n)))\right] \tag{16}$$

for B_n. Suppose that the supplier would choose $w(A) = w(B_n) = w$ to maximize joint industry profits, which, for given symmetric quantities q, are equal to $2[\pi(m, m) - qk]$. To dampen downstream competition, this would intuitively call for some price $w = \overline{w} > k$.[33] Any lower wholesale price would lead to too-low retail prices and too-high final sales. Still, we find that the supplier's optimal wholesale price is strictly lower, thus satisfying $k < w < \overline{w}$. This holds since through reducing the wholesale price for, say, A_n - i.e., by setting $w(A_n) < \overline{w}$ - the supplier benefits, as this relaxes the participation constraint of the rival firm B_n.[34] It is important to note that the resulting optimal wholesale prices are still symmetric for both buyers, irrespective of whether they both operate a single firm, as presently assumed, or whether one buyer is larger and operates $n_L > 1$ firms.

Proposition 8 *Suppose that the supplier offers non-linear contracts. Then, regardless of whether contracts are observable or non-observable (with passive beliefs), all buyers, regardless of the number of firms they control, receive the same marginal wholesale price and, thus, have the same market share in each local market. With non-observable contracts, the supplier's symmetric wholesale price is equal to his marginal cost, $w = k$, while it is strictly higher with observable contracts.*

As noted in the Introduction, Proposition 8, together with the preceding results from the analysis with linear contracts, points out the importance of the contractual form for

---

[33] We assume for convenience that this is uniquely determined.

[34] Formally, to determine the optimal marginal wholesale prices, denote the equilibrium quantities by $q(m(A_n), m(B_n))$ and $q(m(B_n), m(A_n))$, respectively. The supplier's profits are then equal to

$$[\pi(m(A_n), m(B_n)) - q(m(A_n), m(B_n))c] + [\pi(m(B_n), m(A_n)) - q(m(B_n), m(A_n))c]$$
$$- \left[\pi(m^{AL}, m(B_n))) + \pi(m^{AL}, m(A_n))\right] + 2F,$$

where the first line captures total industry profits and the second line the joint value of the two buyers' outside options. For a symmetric choice $w(A) = w(B_n) = w$ abbreviate industry profits by $\omega(w)$, such that from symmetry w maximizes the above objective function if

$$\left.\frac{d\omega(w(A_n), w)}{dw(A_n)}\right|_{w(A_n)=w} = \left.\frac{d\pi(m^{AL}, w(A_n) + c)}{dw(A_n)}\right|_{w(A_n)=w} > 0.$$

20

the present theory of a waterbed effect: If discounts to larger buyers are not given "at the margin," then, in the short run, large buyers are not made more competitive, which, according to the present theory, rules out a waterbed effect.

Sources of Buyer Power

The present analysis is based on a particular theory of buyer power. According to this theory, a buyer who grows through acquiring more firms (e.g., outlets) in separate markets will obtain a discount as, following Katz (1987), the buyer's outside option becomes more attractive: He can spread over a larger number of units any fixed costs, F, that would arise from switching his source of supply. As noted above, these fixed costs F could also arise at a new supplier that makes a competitive offer.

In retailing, such costs could, for instance, arise from switching to private labels or from tapping into a new, foreign source of supply for a particular merchandise. In both cases, a firm may spend substantial resources to locate a new source of supply and, in addition, to ensure that any new supplier produces, especially in the case of private labels, to a sufficiently high standard of quality. It is straightforward to show that all our results would hold if, instead of incurring fixed costs $F > 0$, all firms could switch to a less productive source of supply at *zero* costs, but could, through the choice of some (continuous) up-front investment, either locate a more attractive source of supply or make a given, alternative supplier more attractive. Again, these costs could be spread over a larger number of units in the case of a large buyer, making his outside option more attractive.

In our model, the fact that larger buyers obtain more attractive terms of supply is key for all results. If, in a given case, data instead suggest that larger buyers can not obtain discounts, then our model of the waterbed effect should not be applicable.[35]

The theory of buyer power in the present model works through an endogenous variation of the value of buyers' outside options. Alternatively, some buyers could receive a higher fraction of joint profits, as the value of the outside option of the respective suppliers is particularly low when dealing with these buyers - e.g., as suppliers become economically dependent on the business with some large buyers. Such a theory of buyer power has been particularly influential in competition policy, though we are not aware of a formalization.

---

[35] For models that generate discounts by smaller buyers or for smaller purchase volumes, see, for instance, in the case of economices of scale, Chipty and Snyder (1999) and Inderst and Wey (2007); without economies of scale but in a more fully-fledged bargaining model, Inderst (2005).

Thus, whether a waterbed effect would hold also with such a foundation of buyer power remains to be analyzed.

5 Extensions

5.1 Further Comparative Results

Using the explicit derivations from the Hotelling model, we can obtain some further comparative results on when the waterbed effect should be stronger or weaker. In the present model, the incumbent supplier's pricing power on the wholesale market derives only from the costs F, given that we have, for simplicity, set the marginal cost of the alternative source of supply equal to the incumbent supplier's own marginal cost: $k^{AL} = k$. Allowing now for an additional cost advantage of the supplier with $k^{AL} \geq k$, we have the following result.

Corollary 2 *In the Hotelling model, the waterbed effect is stronger if, ceteris paribus, the incumbent supplier's power is larger as either F or k^{AL} is larger.*

Proof. See Appendix.

In the present model, the pricing power of the incumbent is constrained by the attractiveness of buyers' alternative supply option. In this sense, the incumbent supplier is a monopolist for the considered subset of firms, albeit one that can be bypassed. Our model does, however, not cover the case in which buyers already "stock" goods of alternative suppliers, implying that they could shift purchases and sales between the different products at zero additional cost (cf. also Section 4.3). Smith and Thanassoulis (2009) consider, instead, a more elaborate bargaining model with uncertainty that allows for a bilateral oligopoly and that can also generate a waterbed effect.[36]

The present analysis has also restricted consideration to the impact that a single large buyer has on each of several smaller buyers. The impact from the waterbed effect should depend, however, also on the strength - i.e., in the present framework, the size - of the affected buyer. To formally investigate this, suppose that in the n_L markets that the large buyer serves, $1 < n_l < n_L$ firms are owned by another buyer. If n_L increases through

---

[36]For different bargaining approaches to bilateral oligopolies see Inderst (2005) and, in particular, Bjornerstedt and Stennek (2007).

further acquisitions, the wholesale prices of both small, independent firms, as well as the wholesale price of the second large buyer with, n_l firms, increase.

Formally, the increase in the respective wholesale prices, w_S and w_l, is again obtained from the binding participation constraints, as in (9).[37] As it is immediate from the participation constraints that $w_S > w_l$ and, thus, also that $y_S < y_l < 0.5$, we have from (9) the following result.

Corollary 3 *In the Hotelling model, if the large buyer who expands his size and obtains an additional discount competes against other buyers of different size, then the waterbed effect is strongest for the smallest buyer.*

5.2   Firm Growth and the Waterbed Effect

In the preceding analysis, we captured the growth of one buyer by enlarging the number n_L of firms that this buyer controls. In this Section, we consider, instead, the case of "organic growth" through a firm's improved efficiency. We can show that this still gives rise to a waterbed effect. However, welfare implications will be markedly different.

For the sake of brevity, we return to the case in which each firm is operated independently, which allows us to analyze each of the N markets in isolation. Our departure from the perfectly symmetric case analyzed in Section 3 is, however, that firms can now differ in their marginal costs, where we set without loss of generality $c(A_n) < c(B_n)$. Competing firms' gross marginal costs $m(A_n)$ and $m(B_n)$ may, thus, differ both because their wholesale prices $w(A_n)$ and $w(B_n)$ are different *and* because they have different costs of operations, $c(A_n) < c(B_n)$. Denote, also, the respective gross marginal costs under the alternative supply option by $m^{AL}(A_n) := k + c(A_n)$ and, likewise for B_n, by $m^{AL}(B_n) := k + c(B_n)$.

Proposition 9 *If differences in firm size are due to differences in their own efficiency, then the insights from Proposition 3 still survive. Precisely, the more efficient and thus larger firm - i.e., A_n as $c(A_n) < c(B_n)$ - also obtains a lower wholesale price, $w(A_n) < w(B_n)$, while a further reduction in $c(A_n)$ leads to a further widening of the difference $w(B_n) - w(A_n) > 0$, both as $w(A_n)$ decreases and as $w(B_n)$ increases (the waterbed effect).*

Proof. See Appendix.

---

[37]It is immediate that, for low F, all three participation constraints (for $w_L < w_l < w_S$) must bind, while the resulting equation system has a unique solution.

Recall that previously, at least in the Hotelling model with inelastic total demand, the growth in buyer power through acquisitions always reduced welfare: Both the reduction of the larger buyer's wholesale price and the increase of the wholesale price of smaller rivals led to a further distortion of market shares away from the efficient (equal) split, given that firms were equally efficient.

Trivially, if firm A_n reduces its own marginal cost, then this a positive direct effect on consumer surplus and (gross of investment costs) also on welfare. This positive effect would, however, exist even without discriminatory wholesale prices - i.e., if $F = 0$ in the present model. For $F > 0$, the more efficient firm enjoys, however, an *additional* comparative advantage as its wholesale price is lower than that of the rival firm. This induces a further shift of market share to the more efficient firm. As is well known, for $c(A_n) < c(B_n)$ but $w(A_n) = w(B_n) = w$ the market share for the more efficient firm is *too low* from the perspective of maximizing efficiency. This holds, as the more efficient firm optimally does not fully pass on its efficiency advantage, but charges, instead, a higher margin. For low values of F, where the difference $w(B_n) - w(A_n) > 0$ is still small, we have the following key difference between the case with acquisitions and that with growth through a firm's improved efficiency.

Proposition 10 *In the Hotelling model, if one buyer is larger only because he owns more firms through prior acquisitions, then an increase in F, which creates more scope for the supplier to set discriminatory wholesale prices, reduces welfare. Instead, if a buyer is larger as he is more efficient, then, at least for low F, the resulting larger wholesale price difference improves welfare.*

Proof. See Appendix.

It should be noted that irrespective of whether a buyer obtains an additional discount either through further acquisitions or after improving its own efficiency, this discount is *not* justified by any additional savings or improved efficiencies on the *wholesale* side. Hence, from an antitrust perspective, the two cases in Proposition 10 would, in principle, not receive different treatment. Proposition 10 suggests, however, at least from a welfare perspective, a different impact.

6   Conclusion

The present paper introduces a formal model of a "waterbed effect" that arises from the exercise of asymmetric buyer power. Key to our theory of the waterbed effect is the interaction of the horizontal and the vertical dimensions: The waterbed effect arises only if buyers compete in the downstream market and if size leads to an additional discount. According to the present theory, the waterbed effect should already work in the short run, having an impact on wholesale and retail prices and, thereby, on consumer surplus and welfare, even when the number of up- and downstream firms remains constant and the quality and range of their products stay the same. This differs from alternative theories of competitive harm through asymmetric buyer power. It makes the present theory also more easily refutable in practice, in contrast to theories of harm that rely on some prospected long-run effects on market structure.

The simple model, in particular with the explicit calculations for the linear (Hotelling) model, allowed us to derive a number of more quantitative predictions on the strength of the waterbed effect. Given that downstream firms compete in strategic substitutes, the exercise of buyer power can still lower all retail prices, despite the presence of a waterbed effect. We found that this is more likely if presently the supplier has little scope to price discriminate or if presently size differences between competing firms are not yet sufficiently large.

The present theory provides the following guidance on when a waterbed effect could be more powerful, leading to aggregate consumer detriment even though the retail price of the advantaged powerful buyer still decreases. This is more likely if discounts are given more "at the margin," where they matter for firms' competitive position. Consumer harm is also more likely if the supplier has substantial scope to price discriminate, as he has a more uncontested position vis-à-vis other sources of supply and if, in addition, downstream firms' present size difference provides substantial grounds to set discriminatory wholesale prices.

The analysis also revealed an important difference when wholesale price discounts are obtained based on size differences that were created from acquisitions and when size differences were due to growth by improved efficiency. In the latter case, discriminatory wholesale prices may have the potential to improve efficiency, provided that the difference

between rivals is not too large.

7   Appendix

Proof of Proposition 1.   We start with some technical observations. We will use throughout that the supplier optimally sets both wholesale prices not below the supplier's marginal cost k. (This property is easily established.) Also, we will assume that we can restrict consideration to some bounded interval $[k, \overline{w}]$ such that both $w(A_n)$ and $w(B_n)$ must lie in this interval. Finally, we will assume that derived downstream profit functions are continuous in marginal costs.

We show first that for $F \to 0$, both $w(A_n)$ and $w(B_n)$ must become arbitrarily close to k. Suppose, to the contrary, that along a sequence of equilibria where $F \to 0$, this would not hold such that the respective values of, say, $w(A_n) > k$ remained bounded away from k. Then, the right-hand side of (2) would clearly exceed the left-hand side for all sufficiently low F.

We argue next that for sufficiently low values of F, it holds from optimality for the supplier that both participation constraints bind. Instead of appealing directly to some concavity restriction imposed on the supplier's problem, our argument assumes only that F shall be small. (Note, however, that this is only a sufficient, but by no means a necessary, assumption.[38]) Denote now for the supplier's profits $\mu(m(A_n), m(B_n)) := (w(A_n) - k)D(m(A_n), m(B_n))$ and likewise $\mu(m(B_n), m(A_n)) := (w(B_n) - k)D(m(B_n), m(A_n))$, where $D(\cdot)$ denotes the by assumption symmetric derived demand function at downstream firms. The supplier's total profit is, thus, given by $\widehat{\mu}(m(A_n), m(B_n)) := \mu(m(A_n), m(B_n)) + \mu(m(B_n), m(A_n))$.

Clearly, if $w(B_n) = k$ and $m(A_n)$ is sufficiently small, then $d\widehat{\mu}(m(A_n), m(B_n))/dm(A_n) > 0$. This also clearly extends to the case in which $w(B_n)$ is close to k. By these observations, it then follows immediately that for low F, at least one participation constraint must bind. Suppose next that only the constraint of B_n was binding, but not that of A_n. When marginally increasing $m(A_n)$ while adjusting $m(B_n)$ to still satisfy the constraint

---

[38]While our key results on consumer surplus will only be derived for low F in the general case, for the Hotelling model, where we need not invoke such low boundaries for F, we also derive results for higher values of F.

for A_n with equality, the supplier's total profits change by

$$\left[D(m(A_n), m(B_n)) + (m(A_n) - k) \frac{dD(m(A_n), m(B_n))}{dm(A_n)} \right] \tag{17}$$

$$+ (m(B_n) - k) \frac{dD(m(B_n), m(A_n))}{dm(A_n)} \frac{dm(B_n)}{dm(A_n)},$$

where

$$\frac{dm(B_n)}{dm(A_n)} = \frac{dw(B_n)}{dw(A_n)} = \frac{\pi_2(m, m(A_n)) - \pi_2(m(B_n), m(A_n))}{\pi_1(m(B_n), m(A_n))}. \tag{18}$$

Given that, for low F, we have that $w(B_n)$ is close to k and, thus, $m(B_n)$ close to m, we have that (18) must be close to zero. (We also assume here that both $w(B_n)$ and $w(A_n)$ stay in $[k, \overline{w}]$, which implies that the denominator is bounded away from zero.) By these observations, the sign of (17) is determined by the first expression in rectangular brackets, which for $w(A_n)$ close to k is again always strictly positive.

Thus, we have established that an optimal pair of offers must satisfy the system of the two binding constraints, which we rewrite as

$$\pi(m, m(B_n))) - \pi(m(A_n), m(B_n)) - F = 0, \tag{19}$$
$$\pi(m, m(A_n))) - \pi(m(B_n), m(A_n)) - F = 0.$$

We show now that, for low F, there is only a single solution to (19). A sufficient condition for this to be the case is that the Jacobian matrix of (19) is strictly positive definite. This holds if all principal minors are positive. To see that this is indeed the case, note first that the derivative of the first line of (19) w.r.t. $m(A_n)$ and the derivative of the second line of (19) w.r.t. $m(B_n)$ are strictly positive from $-\pi_1(\cdot) > 0$. Next, the determinant is given by

$$\pi_1(m(A_n), m(B_n)) \pi_1(m(B_n), m(A_n))$$
$$- [\pi_2(m, m(B_n))) - \pi_2(m(A_n), m(B_n))] [\pi_2(m, m(A_n))) - \pi_2(m(B_n), m(A_n))]$$
$$> 0,$$

where the sign holds surely for low F, given that the second line goes to zero while the first line remains bounded away from zero. (Note that we assume again that both $m(A_n)$ and $m(B_n)$ must become close to m.)

Taken together, we have thus established that in the presently considered symmetric case there is a unique optimal offer to both firms in a given market, w_I, such that $m_I =$

$c + w_I$ satisfies

$$\pi(m, m_I) - \pi(m_I, m_I) - F = 0. \tag{20}$$

Implicit derivation of (20) yields

$$\frac{dm_I}{dF} = \frac{1}{-\pi_1(m_I, m_I) + [\pi_2(m, m_I) - \pi_2(m_I, m_I)]} > 0. \tag{21}$$

Note that in order to sign (21), we could assume that $\pi_1 < 0$ and that F becomes small, which allows us to ignore the second term in the denominator. However, from condition (1) (21) generally holds as, given that $m_I > m$ and $\pi_{12} < 0$, we have also that $\pi_2(m, m_I) - \pi_2(m_I, m_I) > 0$. **Q.E.D.**

Proof of Proposition 2. If there is an equilibrium in which market n is fully covered and both firms are active, the equilibrium price of firm A_n is

$$p(A_n) = t + \frac{2m(A_n) + m(B_n)}{3},$$

while profits of A_n are given by

$$\pi(m(A_n), m(B_n)) = \frac{1}{2t} \left[t + \frac{m(B_n) - m(A_n)}{3} \right]^2.$$

Substituting this into (20), we have the requirement that

$$(w_I - k)^2 + 6t(w_I - k) = 18tF, \tag{22}$$

which transforms to (4). It is immediate that (4) is strictly decreasing in F. Differentiating (4) w.r.t. t, we have next that

$$\frac{dw_I}{dt} = 3\frac{3F - (w_I - k)}{3t + (w_I - k)} > 0. \tag{23}$$

where we assume from (22) that $3F > w_I - k$. **Q.E.D.**

Proof of Proposition 3. The argument why, for low F, the optimal pair of offers is characterized again by the system of binding constraints and why this has a unique solution is perfectly analogous to that in the proof of Proposition 1 and is, therefore, omitted. Denote now for convenience $F_L := F/n_L$ such that the binding constraints become

$$\pi(m, m_L) - \pi(m_S, m_L) - F = 0, \tag{24}$$
$$\pi(m, m_S) - \pi(m_L, m_S) - F_L = 0.$$

28

Total differentiation of (24) yields

$$
\begin{pmatrix} -\pi_1(m_S, m_L) & \pi_2(m, m_L) - \pi_2(m_S, m_L) \\ \pi_2(m, m_S) - \pi_2(m_L, m_S) & -\pi_1(m_L, m_S) \end{pmatrix} \begin{pmatrix} dm_S \\ dm_L \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \end{pmatrix} dF_L
$$

such that by Cramer's rule

$$
\begin{aligned}
\frac{dm_L}{dF_L} &= \frac{-\pi_1(m_S, m_L)}{Det} > 0, \\
\frac{dm_S}{dF_L} &= -\frac{\pi_2(m, m_L) - \pi_2(m_S, m_L)}{Det} < 0.
\end{aligned}
$$

Note that the signs follow from condition (1) and as the determinant satisfies $Det > 0$, which we already showed in the proof of Proposition 1. **Q.E.D.**

Proof of Corollary 1. Proceeding now as in the proof of Proposition 3, we have from Cramer's rule that

$$
\begin{aligned}
\frac{dm_L}{dF} &= \frac{-\pi_1(m_S, m_L)/n_L - [\pi_2(m, m_S) - \pi_2(m_L, m_S)]}{Det} > 0, \\
\frac{dm_S}{dF} &= \frac{-\pi_1(m_L, m_S) - [\pi_2(m, m_L) - \pi_2(m_S, m_L)]/n_L}{Det} > 0.
\end{aligned}
$$

Finally, we have that $d(m_S - m_L)/dF > 0$ holds if

$$
\begin{aligned}
&-n_L \pi_1(m_L, m_S) - [\pi_2(m, m_L) - \pi_2(m_S, m_L)] \\
> \ &-\pi_1(m_S, m_L) - n_L [\pi_2(m, m_S) - \pi_2(m_L, m_S)],
\end{aligned}
\tag{25}
$$

which from $n_L > 1$ holds surely if F is sufficiently low. **Q.E.D.**

Proof of Proposition 4. To evaluate (7), note first that from implicit differentiation of the small firm's binding participation constraint, we have that

$$
\frac{dw_S}{dw_L} = \frac{dm_S}{dm_L} = \frac{\pi_2(m, m_L) - \pi_2(m_S, m_L)}{\pi_1(m_S, m_L)}.
$$

As already noted in the proof of Proposition 1, where we used the same expression in (18), we have from $m_S \to m$ as $F \to 0$ that $dw_S/dw_L \to 0$. This implies that for the *converse* of (7) to hold strictly for low F, we only need that $dp_S/dw_L > 0$, where we use condition (1), must remain bounded away from zero. **Q.E.D.**

Proof of Proposition 5. As the assertion uses Corollary 1 also for costs F that are not close to zero, we have to establish that the result also holds more generally with Hotelling

competition. Substituting the respective expressions into requirement (25), we have after some transformations that

$$n_L[3t + m_S - m] > 3t + m_L - m. \tag{26}$$

Note first that for $n_L = 1$, this holds just with equality, as in this case we have also that $m_S = m_L$. Condition (26) thus holds for all $n_L > 1$ as m_S is strictly increasing and m_L strictly decreasing in n_L.

Next, note that we obtain for the Hotelling case the two participation constraints

$$
\begin{aligned}
2(w_S - k)(w_L - k) + 6t(w_S - k) - (w_S - k)^2 &= 18tF, \\
2(w_S - k)(w_L - k) + 6t(w_L - k) - (w_L - k)^2 &= 18tF/n_L,
\end{aligned}
\tag{27}
$$

from which the respective derivatives in the main text follow immediate. Observe also that from Corollary 1 and Proposition 3 we generally have that both w_S and $w_S - w_L$ increase in F and n_L. Hence, in the Hotelling model, y_S decreases (i.e., the left-hand side of condition (10)), while $(w_S - k)/(3t)$ increases (i.e., the right-hand side of condition (10)) as F or n_L increase. Note next that at $F = 0$, the converse of (10) holds strictly, given that then $y_S = 0.5$ and $w_S - k = 0$. As we now increase F,[39] we ask whether there exists a threshold F' such that from $F > F'$ condition (10) holds. For this we can transform condition (10) to $3t < 3(w_S - k) - (w_L - k)$, while noting that, for any given F, we have $w_L - k \to 0$ as $n_L \to \infty$, such that in the limit the condition transforms to $t < w_S - k$.[40]
Q.E.D.

Proof of Corollary 2. It is useful to first write explicitly the two binding participation constraints. This yields

$$
\begin{aligned}
\left(3t + w_L - k^{AL}\right)^2 - (3t + w_L - w_S)^2 &= 18tF, \\
\left(3t + w_S - k^{AL}\right)^2 - (3t + w_S - w_L)^2 &= 18tF/n_L.
\end{aligned}
\tag{28}
$$

From implicit differentiation of the participation constraint for the small firm, we obtain for the waterbed effect

$$\frac{dw_S}{dw_L} = -\frac{1}{6t}\frac{w_S - k^{AL}}{y_S}. \tag{29}$$

---

[39]That is, with the constraint of staying in the region where it is optimal for the supplier to still choose both wholesale prices such that the respective participation constraints bind.

[40]Importantly, note that at $3t < 3(w_S - k) - (w_L - k)$ both firms have still strictly positive market shares.

Next, assuming again that the determinant of this system is positive, $Det > 0$, we have from Cramer's rule that

$$\frac{dw_S}{dk^{AL}} = \frac{2}{Det}\left[\left(3t + w_L - k^{AL}\right)\left(3t + w_S - w_L\right) - \left(3t + w_S - k^{AL}\right)\left(w_S - k^{AL}\right)\right], \quad (30)$$

$$\frac{dw_L}{dk^{AL}} = \frac{2}{Det}\left[\left(3t + w_L - w_S\right)\left(3t + w_S - k^{AL}\right) - \left(3t + w_L - k^{AL}\right)\left(w_L - k^{AL}\right)\right].$$

To see that dw_S/dw_L in (29) increases with k^{AL}, note that $dw_S/dk^{AL} > 0$ and that $d(w_S - w_L)/dk^{AL} = 0$ follows after substitution from (30). (Hence, in the Hotelling model, a change in k^{AL} has no effect on the difference $w_S - w_L$.) Finally, note that the comparative statics in F follows from Proposition **??**, which is easily adapted to $k^{AL} \neq k$. **Q.E.D.**

Proposition 9. With the additional notation at hand, the participation constraints (2) and (3) now become

$$\pi(m(A_n), m(B_n)) \geq \pi(m^{AL}(A_n), m(B_n))) - F \quad (31)$$

for firm A_n and

$$\pi(m(B_n), m(A_n)) \geq \pi(m^{AL}(B_n), m(A_n))) - F \quad (32)$$

for firm B_n. Total differentiation of the binding constraints, as previously done for (24), yields now

$$\begin{pmatrix} -\pi_1(m(A_n), m(B_n)) & \pi_2(m^{AL}(A_n), m(B_n)) - \pi_2(m(A_n), m(B_n)) \\ \pi_2(m^{AL}(B_n), m(A_n)) - \pi_2(m(B_n), m(A_n)) & -\pi_1(m(B_n), m(A_n)) \end{pmatrix}$$
$$\cdot \begin{pmatrix} dw(A_n) \\ dw(B_n) \end{pmatrix}$$
$$= -\begin{pmatrix} \pi_1(m^{AL}(A_n), m(B_n) - \pi_1(m(A_n), m(B_n)) \\ \pi_2(m^{AL}(B_n), m(A_n)) - \pi_2(m(B_n), m(A_n)) \end{pmatrix} dc(A_n).$$

Note here again that, in particular, $m(A_n) = w(A_n) + c(A_n)$ and $m^{AL}(A_n) = k + c(A_n)$. Thus, we have from Cramer's rule that $\frac{dw(A_n)}{dc(A_n)} = -\frac{D_A}{Det}$, where D_A is given by

$$-\pi_1(m(B_n), m(A_n))\left[\pi_1(m^{AL}(A_n), m(B_n) - \pi_1(m(A_n), m(B_n)))\right]$$
$$- \left[\pi_2(m^{AL}(A_n), m(B_n)) - \pi_2(m(A_n), m(B_n))\right]\left[\pi_2(m^{AL}(B_n), m(A_n)) - \pi_2(m(B_n), m(A_n))\right].$$

For $dw(A_n)/dc(A_n) > 0$ to hold, we thus only need to show that

$$\pi_1(m^{AL}(A_n), m(B_n) - \pi_1(m(A_n), m(B_n)) < 0,$$

31

which follows from $\pi_{11} > 0$ in (1) together with $m^{AL}(A_n) < m(A_n)$ due to $w(A_n) > k$. Next, we have that $\frac{dw(B_n)}{dc(A_n)} = -\frac{D_B}{Det}$, where now D_B is given by

$$\pi_1(m(A_n), m(B_n)) \left[\pi_2(m^{AL}(B_n), m(A_n)) - \pi_2(m(B_n), m(A_n))\right]$$
$$- \left[\pi_1(m^{AL}(A_n), m(B_n) - \pi_1(m(A_n), m(B_n))\right] \left[\pi_2(m^{AL}(B_n), m(A_n)) - \pi_2(m(B_n), m(A_n))\right].$$

To obtain $D_B > 0$ and, thus, $dw(B_n)/dc(A_n) < 0$, we can now assume from (1) that $\pi_{12} < 0$. **Q.E.D.**

Proof of Proposition 10. We show that in the Hotelling model, the wholesale price difference is indeed strictly increasing in F. For simplicity, we abbreviate A_n by A and B_n by B and again denote the respective variables by subscripts. The two binding participation constraints are given by

$$(3t + w_B - k + c_B - c_A)^2 - (3t + w_B + c_B - w_A - c_A)^2 = 18tF,$$
$$(3t + w_A - k + c_A - c_B)^2 - (3t + w_A + c_A - w_B - c_B)^2 = 18tF.$$

Note first that the expression for the waterbed effect is, thus, exactly the same as in (9). With $Det > 0$ for the determinant and

$$\frac{dw_A}{dF} = \frac{36tF}{Det} (3t + c_A - w_B - k - c_B),$$

while the symmetric expression holds for w_B, we thus have that

$$\frac{d(w_B - w_A)}{dF} = \frac{36tF}{Det} [2(c_B - c_A) + (w_B - w_A)] > 0.$$

Q.E.D.

8   References

Athey, S. and Schmutzler, A. (2001), Investment and Market Dominance, Rand Journal of Economics 32, 1-26.

Basker, E. (2005), Selling a Cheaper Mousetrap: Wal-Mart's Effect on Retail Prices, Journal of Urban Economics 58, 203-229.

Basker, E. and Noel, M. (2007), The Evolving Food Chain: Competitive Effects of Wal-Mart's Entry into the Supermarket Industry, Journal of Economics and Management Strategy (forthcoming).

Battigalli, P., Fumagalli, C., and Polo, M. (2006), Buyer Power and Quality Improvement, IGIER Working Paper 310, Bocconi University.

Biglaiser, G. and Vettas, N. (2005), Dynamic Price Competition with Capacity Constraints and Strategic Buyers, mimeo.

Bjornerstedt, J. and Stennek, J. (2007), Bilateral Oligopoly: The Efficiency of Intermediate Goods Markets, International Journal of Industrial Organization 25, 884-907.

Chen, Z. (2003), Dominant Retailers and the Countervailing-Power Hypothesis, Rand Journal of Economics 34, 612-625.

Chen, Z. (2005), Countervailing Power and Product Diversity, mimeo.

Chipty, T. and Snyder, C. (1999), The Role of Firm Size in Bilateral Bargaining: A Study of the Cable Television Industry, Review of Economics and Statistics 81, 326-340.

DeGraba, P. (1990), Input Market Price Discrimination and the Choice of Technology, American Economic Review 80, 1246-1253.

Dobson, P. and Waterson, M. (1997), Countervailing Power and Consumer Prices, Economic Journal 107, 418-430.

Dobson, P.W. (2005), Exploiting Buyer Power: Lessons from the British Grocery Trade, Antitrust Law Journal 2, 529-562.

Foer, A.A. (2007), Mr. Magoo Visits Wal-Mart: Finding the Right Lens for Antitrust, Connecticut Law Review 39, 1307-1335.

Galbraith, J.K. (1952), American Capitalism: The Concept of Countervailing Power. Boston: Houghton Mifflin.

Gans, J.S. and King, S.P. (2002), Exclusionary Contracts and Competition for Large Buyers, International Journal of Industrial Organization 20, 1363-1381.

Inderst, R. (2007), Leveraging Buyer Power, International Journal of Industrial Organization 25, 908-924.

Inderst, R. and Valletti, T. (2009), Price Discrimination in Input Markets, Rand Journal of Economics 40, 1-19.

Inderst, R. and Wey, C. (2003), Bargaining, Mergers, and Technology Choice in Bilaterally Oligopolistic Industries, Rand Journal of Economics 34, 1-19.

Inderst, R. and Wey, C. (2007), Buyer Power and Supplier Incentives, European Economic Review 51, 647-667.

Iyer, G. and Villas-Boas, J.M. (2003), A Bargaining Theory of Distribution Channels, Journal of Marketing Research 40, 80-100.

Katz, M.L. (1986), An Analysis of Cooperative Research and Development, Rand Journal of Economics, 17, 527-543.

Katz, M.L. (1987), The Welfare Effects of Third Degree Price Discrimination in Intermediate Goods Markets, American Economic Review 77, 154-167.

Laffont, J.-J. and Tirole, J. (1990), Optimal Bypass and Cream-Skimming, American Economic Review 80, 1042-61.

Majumdar, A. (2005), Waterbed Effects and Buyer Mergers, mimeo.

Matthewson, F. and Winter, R.A. (1996), Buyer Groups, International Journal of Industrial Organization 15, 137-164.

McAfee, R.P. and Schwartz, M. (1993), Opportunism in Multilateral Vertical Contracting: Nondiscrimination, Exclusivity, and Uniformity, American Economic Review 83, 1011-1021.

Milliou, C., Petrakis, E., and Vettas, N. (2005), (In)efficient Trading Forms in Competing Vertical Chains, mimeo.

O'Brien, D.P. and Shaffer, G. (1994), The Welfare Effects of Forbidding Discriminatory Discounts: A Secondary Line Analysis of Robinson-Patman, Journal of Law, Economics, and Organization 10, 296-318.

Rey, P. and Vergé, T. (2004), Bilateral Control with Vertical Contracts, Rand Journal of Economics 35, 728-746.

Salop, S.C. (2005), Anticompetitive Overbuying by Power Buyers, Antitrust Law Journal 72, 669-715.

Schiff, A. (2008), The 'Waterbed' Effect and Regulation, Review of Network Economics 7, 392-414.

Smith, H. and Thanassoulis, J. (2009), Upstream Competition and Downstream Buyer Power, DP 420, Department of Economics, University of Oxford.

Snyder, C.M. (1996), A Dynamic Theory of Countervailing Power, Rand Journal of Economics, 27(4), 747-769.

Snyder, C.M. (2008), Countervailing Power, in S.N. Durlauf and Blume, L.E. (eds), New Palgrave Dictionary of Economics, Palgrave Macmillan.

Vieira-Montez, J. (2007), Downstream Concentration and Producer's Capacity Choice, Rand Journal of Economics 38, 948–966.

von Ungern-Sternberg, T. (1996), Countervailing Power Revisited, International Journal of Industrial Organization 14, 507-520.

Yoshida, Y. (2000), Third-Degree Price Discrimination in Input Markets: Output and Welfare, American Economic Review 90, 240-246.