The Effects of Buyer Power on Long-term Welfare

by

Bjørn Olav Johansen

Master Thesis
Department of Economics
University of Bergen
April 2007

UNIVERSITY OF BERGEN

Contents

Contents . . . ii

Acknowledgements **v**

1 Introduction **1**

2 The Concept of Buyer Power **5**

3 The Bargaining Problem **9**
3.1 Nash's axiomatic approach . . . 9
3.2 The Rubinstein strategic approach . . . 12
Outside Options . . . 13
Risk of Breakdown . . . 14
Games of Infinite Horizon . . . 15
3.3 The relation between NBS and the Rubinstein game . . . 17
3.4 Multilateral Bargaining . . . 20
3.5 An Axiomatic Approach to Multilateral Bargaining . . . 26
3.6 Summary . . . 29

4 Dynamic Effects of Buyer Power **31**
4.1 Process Innovation . . . 32
Market Power and Buyer Countervailing Power . . . 32
Bargaining With a Risk Averse Supplier . . . 39
Convex Technologies and Buyer Power . . . 43
Outside Options and Buyer Power . . . 56
4.2 Product Innovation . . . 61
Retail Mergers, Buyer Power and Product Variety . . . 61
Dominant Buyers and Product Diversity . . . 68
4.3 Summary . . . 76

5 A New Model of Buyer Power **79**
The Model . . . 79
Analysis . . . 82
Possible Extensions . . . 89

Conclusion 90

6 Discussion **91**

7 Summary and Concluding Remarks **95**

Bibliography 98

Acknowledgements

I would like to thank my primary supervisor, Tommy Staahl Gabrielsen, who came up with the idea for this thesis, and whose inspiration and guidance has been of great import. Thanks also to my co-supervisor, Frode Meland, who helped me along the way and provided valuable comments during the early stages of my work.

Thanks to students and staff at the Department of Economics at the University of Bergen. Especially thanks to my friend and fellow student Andreas Tveito for the many good conversations and discussions, and for reading through and commenting parts of the thesis.

I would also like to thank my family – my parents for encouraging me throughout my studies, and my uncle, Torbjørn, for helping me understand advanced mathematics.

Finally, Anett, thank you for being patient with me during the many long days and nights spent completing this dissertation.

Bergen, April 2007

Bjørn Olav Johansen

1 Introduction

Many intermediary markets are experiencing a trend towards increased downstream concentration. An apparent example is the emergence of large retail chains in the grocery industry in particular, and in the markets for consumer goods in general. In the Norwegian food industry, e.g., today as much as 99.3 percent of the trade is carried out by four nationwide chains: Norgesgruppen ASA, Ica Norge AS, Coop Norge AS and Rema 1000 AS (The Nordic Competition Authorities (2005)). This is exceptional by European standards, but the general trend of increased concentration is observable in markets all over the EU; the number of shops per inhabitant has been steadily declining, and the size of both supermarkets and retail chains are growing.

These structural trends are accompanied by more general changes in consumer habits: Consumers act more on impulse when doing their shopping – and to minimize travel costs and the amount of time spent, they favour "fewer, one-stop shopping trips".[1] Both tendencies add to the significant market power that retailers often enjoy at their outlets.

It is expected that these developments should contribute to the retailers' buying power vis-à-vis their suppliers, here defined as the ability of big retailers or retail chains to obtain price discounts from manufacturers. Hence, it has encouraged investigations by competition authorities and economists on 1) the creation of buyer power, 2) its (short-term) effects on retail prices, and 3) its (long-term) effects on suppliers' incentives.

This thesis adds to the first and latter category of this literature. That is, we are mainly interested in investigating the effect of increased buyer power on the suppliers' investment incentives. This can not be done, however, without first explaining how the buyers may obtain price discounts from their suppliers – i.e., we have to explain the sources of buyer power before we can say something about its consequences.

[1] In a study by the Retail Institute of Scandinavia (1997), it is found that as much as 75 percent of total purchases in the Nordic retail shops are decided after arrival at the shop. (Source: The Nordic Competition Authorities (2005))

On the tendency towards one-stop shopping, see OECD (1999).

The part of the literature that is seeking to explain the creation of buyer power is very heterogenous, in that there exists no single coherent theoretical framework for how transactions are carried out between suppliers and buyers (Battigalli, Fumagalli and Polo (2006)). The models differ in both how prices are set, and in how contracts are formulated.[2]

It is recognized, however, that contracts between suppliers and buyers in intermediary markets often are determined by bargaining. Most of the literature on buyer power therefore relies on theories of bargaining. We will review the most important of these theories in Section 3 of this thesis.

The second category of the buyer power literature explores whether an increase in buyer power may result in positive short-term welfare effects. The idea is that big buyers may be able to use their countervailing power to extract price discounts from dominant suppliers, and that these discounts are (partially) passed on to consumers in form of lower final prices. The theory that the countervailing power of big buyers may benefit consumers by mitigating the market power of dominant manufacturers, was first expressed by Galbraith (1952).

Traditionally, with a basis in the Galbraith theory, buyer power has entered as an efficiency defence in the competition authorities' handling of merger cases.[3] Firms merge locally or cross-border to cut costs, set free purchasing synergies, reduce competition, and to be able to take on greater risk in their business opportunities. Finally, they may merge to gain leverage in negotiations with their suppliers – that is, to create buyer power or buyer countervailing power. Importantly, the latter effect of increased buyer power may be a direct or indirect consequence of the former effects.

The increased market power of big buyers will lead to higher prices, ceteris paribus. However, it is argued that the potential for cost reductions may benefit consumers through lower final prices. Hence, the creation of buyer power may be presented as a defence for mergers in the retailing sector. Furthermore, the presence of countervailing power may also be presented as a defence in cases following mergers between suppliers; if there are strong buyers amongst the supplier's customers, the countervailing power of these buyers may lessen the potential adverse anticompetitive effects of increased market power at the supplier level.

It should be noted that formal studies on these effects are so far inconclusive. In fact, the notion that buyer power may benefit consumers because discounts obtained from the suppliers are passed on, is theoretically sustainable only as long as retailer-supplier contracts

[2] Prices may be determined either by bargaining, auctions, or by the intersection of supply and demand in a market interface.

Contracts may differ in both the type of tariffs used and in the type of conditions that are included.

[3] See Inderst and Shaffer (2005) for a presentation of the role of buyer power in merger control.

are inefficient – that is, as long as they consist of a per unit wholesale price only.

Lately there has been a shift in focus, however; antitrust authorities have become increasingly worried about the prospect for negative long term welfare effects of increased buyer power. The concern is that the ability of big buyers to squeeze the margins of their manufactures may translate into reduced R&D activity at the supplier level (see European Commission (1999)). The dynamic effects of increased buyer power have so far received little attention by economists. Yet, the shift in focus has encouraged a small but growing literature on the subject. A significant part of it is reviewed in Section 4 of this paper.

If the dynamic welfare effects of increased buyer power are negative, in that it reduces the amount invested in new technologies and products at the supplier level, then surely the buyer power efficiency defence ought to be balanced against these prospective negative effects.

To predict how increased buyer power may affect a supplier's incentives is not as straightforward as it may seem at the outset, however. Even though a stronger buyer is able to acquire a larger share of the realized profit by obtaining price discounts, it is not for certain that he also is able to acquire a larger share of the incremental profit following an investment. Depending on the nature of the buyer's countervailing power, the creation of it might either lessen or strengthen the supplier's incentives, as we will see.

The rest of this thesis is structured as follows: Section 2 provides a short presentation of the ideas of buyer power and buyer countervailing power. Section 3 examines the most important theories used in economic models of bargaining. Section 4 reviews existing theories on buyer power and suppliers' incentives, while Section 5 presents a new model that hopefully fills a gap in this literature. Section 6 sums up and discusses the results from the previous sections, and identifies areas open for further work. Section 7 concludes.

2 The Concept of Buyer Power

The term countervailing power[4] was first used by Galbraith (1952) to describe the ability of big buyers to obtain price discounts from their suppliers. According to Galbraith's theory, buyer power is a good thing, because it may contribute to a lessening of the adverse anti-competitive effects of increased market power at the supplier level. A critical assumption is that these price concessions are passed on to consumers in form of lower final prices.

Galbraith used as examples both the US grocery industry, where nationwide retail chains deal with large food producers, and the big industrial buyers in the automobile industry that are buying steel from big steel producers, etc.

The notion of countervailing power was, and is, disputed, because it was not supported by a rational explanation for why the buyers would pass on the gains obtained to their customers.

> ...we may say the Galbraith's notion of countervailing power is a dogma, not a theory. It lacks a rational development and must be accepted or rejected without reference to its unstated logical antecedents. Dogmas can be true, and every man knows many things he cannot fully explain; so the characterization of dogma does not constitute a rejection of Galbraith's position – and may even commend it to some persons. (Stigler (1954) p. 10)

> The central defect in the theory of countervailing power is that it cannot explain why the customers benefits ... All it can do is explain how the possessors of countervailing power might force the possessors of original power to give them "a share in the rewards". (Whitney (1953) p. 239)

Even if an increase in buyer power ultimately may benefit final customers, by lowering the resale price, the theory rises another question about the consequences for the manufacturers

[4] The terms "buyer power" and buyer "countervailing power" are used interchangeably in the literature.

incentives: The theory states that the creation of countervailing power leads to a redistribution of wealth in favour of the buyers. So what then is the effect of redistributing wealth away from the agents that are the primary executors of R&D activities, the producers, towards the agents that ultimately may just be (re)selling the products? This is the question we will try to answer in this thesis.

To answer the latter, however, we have to investigate what exactly are the sources of the buyer power that Galbraith describes. Galbraith does not presents any clear explanation himself, but states that

> ...Countervailing power, as a restraint on market power, only operates when there is a relative scarcity of demand. Only then is the buyer important to the seller and this is an obvious prerequisite for bringing his power to bear on the market power of the seller. If buyers are plentiful, that is, if supply is small in relation to current demand, the seller is under no compulsion to surrender to the bargaining power of any customer. The countervailing power of the buyer, however great, disappears with an excess of demand. (p. 136)

Hence, he assumes that when they are just a few, the buyers will obtain bargaining power vis-à-vis their manufacturers, and further, that a relative scarcity of demand is a prerequisite. The argumentation is somewhat vague, however, and not sufficient for our purpose.

Yet, economic theory has since come up with a number of explanations for how buyer power may arise.

The Textbook View

The standard approach to the concept of buyer power rests on the idea that dominant buyers are able to strategically withhold demand, and hence reduces the market clearing price in the upstream market. This is what we can call the monopsony model of buyer power, which assumes that there exists a market interface operating between suppliers and buyers (Inderst and Shaffer (2005)). It is assumed that suppliers are competitive, and that there exists both an aggreagate supply and demand curve, the intersection of which determines the market clearing wholesale price. Using the Cournot model, this produces the standard result that when firms merge in the downstream market, they will strategically reduce their supply of goods – hence, aggregate demand in the upstream market is reduced, and the market clearing price will fall. This benefits all the downstream firms, as they all buy their inputs at the same uniform market clearing price.

This may be a poor model of how transactions occur between upstream and downstream firms, however, as real life upstream markets often are highly concentrated, and as supply contracts often are determined by bilateral negotiations between buyers and suppliers. If contracts are negotiated, it opens the possibility for the supplier charging its buyers with different input prices, according to the buyers' relative strength in the negotiations.

The Bargaining Interface

The alternative approach, which is applied in most of the new literature on buyer power, assumes that prices are determined by bilateral negotiations between suppliers and buyers. This is probably also more in line with Galbraith's original argumentation.

There are a number of reasons for why big buyers may be provided with more leverage in the negotiations with their suppliers than small buyers. It may be that big buyers have better outside options, and that they therefore are able to threaten the supplier into giving them a discount. E.g., if a big buyer is equipped with a better alternative supply options than a small buyer, he may be able to credibly threaten to switch to this alternative source of supply. This might be the case if big buyers are able to sponsor entry into the industry (Fumagalli and Motta (2000)), or if it is profitable for the big buyer to incur a relatively high set-up cost to become its own source of supply (Katz (1987), Inderst and Wey (2005a)).

The latter argument is certainly actual, since big retail chains increasingly are resorting to private labels (or store-brands) and hence in many instances are becoming their own source of supply.

It may also be that a supplier facing a big buyer has a poorer "status quo point" than a supplier facing several small buyers. The status quo point, in the bargaining literature often referred to as the threat point or the disagreement point, is here defined as the supplier's status as he enters into the negotiations with the buyer. If the downstream market is completely concentrated, and consists only of a single monopolist buyer, the supplier enters the negotiations with nothing. That is, if the negotiations with the buyer break down, the supplier is left with zero (or negative) profit. While if the supplier instead is faced with several small buyers, when the negotiations with one of them break down, he can still sell his product to the remaining buyers. The latter is believed to improve the supplier's position in the negotiations.

Another theory is that big buyers merely are better negotiators than smaller buyers – i.e., that they simply have more "bargaining strength". The fraction of the incremental surplus that a player is able to extract in the negotiations, is what the bargaining literature refers to as the player's bargaining power. That is, in axiomatic models of bargaining, a player's bargaining power is simply a parameter, or a sharing rule, that decides how much of the negotiated pie the player is able to appropriate. Nothing is said, however, about what decides this parameter, and often it is just taken to be exogenously given. Yet, strategic models of bargaining has offered som insights that may shed light on what determines the players' relative bargaining strength: One result is that a player's bargaining power increases with his relative "patience". E.g., in a two-person bargaining game consisting of a series of alternating offers, a patient player is able to extract more of the incremental surplus than a player that behaves impatient (Binmore, Rubinstein and Wolinsky (1986)).

No theory in the Industrial Organization literature on buyer power has so far come up with an explanation for why large buyers may behave more patient than small buyers, even though this argument may sound intuitive. Yet, if a buyer accounts for a large fraction of the supplier's profit, and if the supplier is financially fragile, then one might expect the supplier to behave impatient in the negotiations with this buyer (Inderst and Shaffer (2005)). This argument remains to be formalized.

An alternative theory, perhaps more plausible, is that a player's bargaining power may be determined by his relative risk aversion. A result, again from the non-cooperative bargaining literature, is that a risk averse player will receive a smaller fraction of the pie than a risk neutral player. Applied to the concept of buyer power, we know that there is more risk involved for the supplier when dealing with a big buyer than when negotiating with several small buyers – simply because the big buyer accounts for a larger fraction of the supplier's total profit than any small buyer does. Hence, the supplier may be willing to pay the big buyer a relatively high "risk premium" to avoid the eventuality that the negotiations break down. The validity of this argument is however depending upon us giving a reasonable explanation for why firms might behave risk averse – which certainly is not always a reasonable assumption.

*

We will not exhaust the argumentation in this section, and rather return to it in more detail in Section 3 and 4. Suffice it to say, however, that the downstream market structure, and the relative size of the buyers, may affect the outcome of supplier-buyer negotiations in one way or another. Before we can elaborate, a more detailed examination of the bargaining theory is called for. This is the topic of the next section.

3 The Bargaining Problem

Because of the complexity of real life bargaining situations and the myriad of factors that may affect the outcome in one way or another, the bargaining problem has challenged economists for decades. However, the *game theoretic* problem could be described very easily. Nash (1950) introduced it as follows:

> A two-person bargaining situation involves two individuals who have the opportunity to collaborate for mutual benefit in more than one way ... no action by one of the individuals without the consent of the other can affect the well-being of the other one ... the two individuals are highly rational, ... each can accurately compare his desires for various things, ... they are equal in bargaining skill, ... each has full knowledge of the tastes and preferences of the other (p. 155).

Whereas Rubinstein's (1982) definition goes:

> Two individuals have before them several possible contractual agreements. Both have interests in reaching agreement but their interests are not entirely identical. What "will be" the agreed contract, assuming that both parties behave rationally? (p. 97)

Nash and Rubinstein's definitions are similar, yet they approached the bargaining problem in very different ways: Nash (1950) suggested an axiomatic approach, while Rubinstein resorted to a strategic model of alternating offers. However, these approaches are interdependent, as we will see. I will now look at them in turn.

3.1 Nash's axiomatic approach

The axiomatic approach consists of setting out a range of properties that one thinks all bargaining outcomes should share, and then identifying a "value" or "rule" that inherits all of these properties. Nash himself stated five axioms initially in his 1950-paper (added two in his 1953-paper, however they are not important here), and then proved that the maximization of the Nash product (exp. (1) below) is the only solution that satisfies all of these axioms.

Nash's five axioms can be stated like this:

1. *Uniqueness.* For every game there should be a unique solution (u_1^*, u_2^*) in U (the set of possible solutions) that is distributed to the players.

2. *Efficiency.* No point (u_1', u_2') in U should (weakly) dominate (u_1^*, u_2^*). That is, if $u_1' \geqslant u_1^*$ and $u_2' \geqslant u_2^*$ then either $(u_1', u_2') = (u_1^*, u_2^*)$ or $(u_1', u_2') \notin U$. This axiom simply states that if there are points in the set of possible solutions that are Pareto preferred to the point (u_1^*, u_2^*), then (u_1^*, u_2^*) can not be the solution we are seeking.

3. *Noncomparability.* Any transformation of the players' utility functions that preserves the players' orderings of different alternatives, should not affect the relative position of (u_1^*, u_2^*).

4. *Symmetry.* (u_1^*, u_2^*) should not depend on procedural or other factors, e.g. as which player is called player one. I.e., the only thing that separates the individuals, are their preference orderings and their different sets of possible strategies (threats).

   This axiom is often interpreted (also by Nash himself, 1950) as expressing that the players should be equal with respect to bargaining skills. Though, Nash later stated (1953) that this interpretation is meaningless, because of the assumption of rational, intelligent players.

5. *Independence of irrelevant alternatives.* If we can restrict the set U and create a new set U', where $U' \subset U$, and the new set includes the solution point (u_1^*, u_2^*), then (u_1^*, u_2^*) should also be the solution point in this new game.

Nash then proved that the maximization of the product $(u_1 - t_1)(u_2 - t_2)$ is the only solution that will satisfy axiom 1-5. So that

$$\mathbf{u}_s^* = \arg\max (u_1 - t_1)(u_2 - t_2), \tag{1}$$

where t_i represents player i's threat or disagreement point.[5]

[5] This parameter is also referred to as the breakdown point or the player's outside option. (It has many names!) More on this below.

Most economic models that include negotiations resort to this solution, known as the (symmetric) Nash bargaining solution (NBS hereafter), both because of the simple set-up and because of some appealing intuitive properties: Among other things, the solution has the attribute that if the players are identical with respect to their sets of possible strategies, the negotiation will result in an equal split. Further, (1) carries the property that if a player i has a "better" or "stronger" alternative strategy t_i than player j, such that $t_i > t_j$, then player i gains an advantage. Most important, the solution is Pareto optimal, i.e., it holds that none of the players should agree to a solution that makes them worse off, and that they should not settle for a solution that is open for improvement.

In addition to the properties above, NBS has the attribute – even though it is not made explicit in any of the axioms, or by Nash himself – of rewarding risk takers. That risk averse players are punished in negotiations, is immediately intuitive.

NBS has been further developed to allow for asymmetrical solutions. Roth (1977) simply abandoned the symmetry axiom and stated that by maximizing the *weighted* geometric average of the players' gains, $u_i - t_i$, we can open for situations where "we have some information that the bargaining abilities of the players (or some other factors "outside" the model) are not all equal" (p. 17). We can write the asymmetric Nash solution (ANS hereafter) as

$$\mathbf{u}_a^* = \arg\max \left(u_1 - t_1\right)^{\alpha_1} \left(u_2 - t_2\right)^{\alpha_2}, \tag{2}$$

where $0 \leqslant \alpha_i \leqslant 1$ for $i = 1, 2$. That is, the parameter α_i is interpreted as to contain some information about player i's bargaining ability. What is troublesome about this approach, is that nothing here is said about what determines this "bargaining ability".

Yet, this indeterminancy related to the players' bargaining skills is not the only problem with the Nash solution. For there exists also a variety of interpretations related to what is the proper definition of the player's threat or disagreement point, t_i. Is it the *impasse/ status quo point* – i.e. what the player will receive if he fails to reach an agreement with the other party/ if the negotiations continues forever? Is it the player's *best alternative option*, defined as the best option that the player could resort to by voluntarily opting out of the negotiations? Or is it what we could call a *breakdown point* – that is, the payoff the player will receive if, in the middle of the bargaining, the negotiated business opportunity is missed? The latter may be experienced in bargaining situations where there exists a certain probability that an event outside the model will make the pie shrink or simply disappear.

The abovementioned candidates for the disagreement point need not be the same. Generally they are not. Even worse, the solution may be seriously affected by which candidate we choose. This problem has been highlighted by the work of Binmore, Rubinstein and Wolinsky (1986), which I will return to below.

3.2 The Rubinstein strategic approach

Rather than setting out a set of properties that one thinks the solution should occupy, the strategic approach is fixed on describing the bargaining situation in detail, as a game with a well-defined set of rules and possible strategies. To locate the outcome of the game, one has to search for the players' equlibrium strategies – whether they are mixed, pure, subgame perfect or static Nash equilibria.

Rubinstein (1982) described the bargaining situation as a infinitely repeated game of offers and counteroffers. The Rubinstein game is simply an extension of the ultimatum game.

The Ultimatum Game Two players are to split a pie of size 1. Player 1 gets to propose a division, and then player 2 has the opportunity simply to accept or reject. If he rejects, both will receive nothing. If he accepts, player 1's proposal will be enacted.

Because of the assumption that the players behave rationally, the only subgame perfect Nash equlibrium (SPNE hereafter) in the ultimatum game is the outcome where player 1 demands the whole pie for himself and player 2 accepts.

What if we extend the ultimatum game to include a *finite* number of rounds? This was first done by Staahl (1972). He also explored what would happen if the players were to behave impatiently, i.e., if they discounted their future shares of the pie.[6]

Let us first study the game where the ultimatum game is extended to include another round after player 2 has rejected player 1's proposal. So that if the game reaches the second stage, player 2 gets to set forth his own proposal.

The Extended Ultimatum Game With Impatient Players Two players are to split a pie of size 1. In the first round player 1 proposes a division (x_1, x_2), or simply $(x_1, 1 - x_1)$, where $0 \leqslant x_1 \leqslant 1$. Player 2 can then accept this proposal or reject it. If he accepts, the players will receive $(x_1, 1 - x_1)$. If player 2 rejects, he gets to set forth his own proposal, $(x'_1, 1 - x'_1)$. Then, if player 1 accepts this final proposal, they will receive the payoff $(x'_1, 1 - x'_1)$. (If he declines, they both get nothing.) However,

[6]It should be noted in Staahl's original set up, the players were only allowed to divide the pie discretely.

because the players are impatient, they discount their future payoffs, so that, assessed from period one, their round two payoff will be $(\delta_1 x_1', \delta_2 (1 - x_1'))$, where $0 < \delta_i < 1$ for $i = 1, 2$.

To use backward induction: In the second round, the equlibrium strategy for player 2 is to propose $x_1' = 0$, and for player 1 it is to accept all proposals. Assessed from the first round, the worth for player 2 of going to round two is simply δ_2. Therefore his equlibrium strategy is to accept all $x_2 \geqslant \delta_2$ in round one. Accordingly, player 1's dominant strategy is to propose $(x_1, x_2) = (1 - \delta_2, \delta_2)$ in the first round.

The SPNE of the game can be summarized as follows:

- Player 1 proposes $(1 - \delta_2, \delta_2)$ in the first round and accepts all proposals thereafter.
- Player 2 accepts all $x_2 \geqslant \delta_2$ in the first round and proposes $(0, 1)$ in the second.

The outcome of the game is the division $(1 - \delta_2, \delta_2)$.

The conclusion, not surprisingly, is that player 2's impatience affects his bargaining power negatively. Player 1 can exploit this impatience by forcing player 2 to pay for striking an early agreement.

Outside Options

The strategic model can be further developed to explore the effect of the parties having outside options (Binmore (1985), Shaked and Sutton (1984)). We can study this in the simple two-period model with impatient players laid out above. What will be the effect of player 2 having an outside option y that he could pursue after rejecting player 1's initial proposal? (Alternatively 2 could accept player 1's proposal, or reject it and put forth his own proposal.) We assume that if 2 chooses his outside option, 1 will get nothing.

From the analysis above, we know that the value for 2 of reaching the second stage, is δ_2. The value of pursuing the outside option, is y. Hence, simple reasoning tells us that, after rejecting 1's first offer, if $\delta_2 \geqslant y$, player 2 will take the game to the second stage and set forth his own proposal $(x_1, x_2) = (0, 1)$. So, as was the conclusion in the first version of the game, 1 has to propose $x_2 \geqslant \delta_2$ to get an acceptance from 2 in the first round. But if $\delta_2 < y$, we know that, if he rejects 1's first offer, 2 will pursue his outside option and receive y. If this is the case, 1 has to offer $x_2 \geqslant y$ to strike a deal with 2 in the first round. The SPNE of the game can be summarized as follows:

1st case: $\delta_2 \geqslant y$

- The SPNE can be summarized as in the first version of the game.

2nd case: $\delta_2 < y$

- Player 1 proposes $(1 - y, y)$ in the first round and accepts all proposals thereafter.
- Player 2 accepts all $x_2 \geqslant y$ in the first round and takes up his outside option for all $x_2 < y$. Proposes $(0, 1)$ if the game reaches the second stage.

The outcome of the game is the division $(1 - \delta_2, \delta_2)$ in the first case and $(1 - y, y)$ in the second. The conclusion is that an outside option only affects the outcome as long as it is *credible* – that is, as long as it yields the mentioned player more than he can hope for by continuing the negotiations. This important result is called *the outside option principle.* And as we will see below, it could be generalized to games of infinite horizon.

Risk of Breakdown

The effect of there being an exogenous risk of breakdown was explored by Binmore, Rubinstein and Wolinsky (1986).[7] As was the case with impatience, risk of breakdown could be a source of motivation for reaching agreement. In many situations there are reasons to belive that the negotiations could be terminated by an outside event – e.g., if there is a risk that the negotiated business opportunity will disappear in the middle of the negotiations (a competitor may snatch it); or, in wage negotiations, if there is a risk for compulsory arbitration.

This risk of breakdown could be modelled in a game of alternating offers where, after every rejection, there is a exogenously given chance $q > 0$ that the negotiations will break down. In case of breakdown, the players will receive their breakdown payoffs $b_1, b_2 > 0$. However, we have to assume that there exist some divisions x_i such that $0 \leqslant b_i < x_i$ for both $i = 1, 2$. Since there exists some uncertainty about how the game will unfold, we assume the players will maximize their *expected* payoffs.

Again we can analyse the outcome using the simple two-stage game from above. (To abstract from the effect of impatience, I will assume $\delta_1 = \delta_2 = 1$.) At stage one, player

[7] See also Sutton (1986).

1 proposes x_1. If 2 accepts, the players will receive the payoff $(x_1, 1-x_1)$. If 2 rejects, then there is a probability q that the negotiations will break down and that the players will receive their breakdown payoffs, b_1 and b_2, and a probability $(1-q)$ that the negotiations will continue and that 2 gets to propose x_1'.

Player 2's dominant strategy in the subgame following a rejection of player 1's proposal, is to propose $x_1' = 0$. And for 1 it is to accept all proposals. Hence 2's expected payoff following a rejection is $1-q+qb_2$. So 1 has to propose $x_2 \geqslant 1-q+qb_2$ to get an acceptance from 2 in the first round.

We can summarize the SPNE of the game as follows:

- Player 1 proposes $(q(1-b_2), 1-q(1-b_2))$ in the first round and accepts all proposals thereafter.
- Player 2 accepts all $x_1 \leqslant q(1-b_2)$ and rejects all $x_1 > q(1-b_2)$ in the first round. Proposes $(0,1)$ if the game reaches the second stage.

The outcome of the game is the division $q(1-b_2), 1-q(1-b_2)$. The lesson is that the risk of breakdown, q, affects 1's payoff positively in the same way that impatience did, because it reduces player 2's expected payoff in the subgame following a rejection in the first round. However, we can also notice that player 2's breakdown payoff b_2 affects his equilibrium payoff positively, this because it has the opposite effect of *increasing* his expected payoff in the subgame following a rejection.

If we compare this result with the outcome in the game where 2 had an *outside option*, we notice that even small values of b_2 affects player 2's equilibrium payoff. Whereas with the alternative option y, small values $(\delta_2 > y)$ has no effect on 2's payoff in the subgame following a rejection.

Games of Infinite Horizon

The models laid out above are all poor descriptions of any real life bargaining situation. First of all, it is not realistic for there to be a fixed number of rounds. Furthermore, the finite game deals an unreasonable advantage to the player that gets to make the final proposal. These issues were dealt with in Rubinstein's 1982-analysis and in Binmore, Rubinstein and Wolinsky's analysis of 1986. Here I will only quickly summarize the implications of extending the games to infinity.

Impatient Players Rubinstein, in a game with impatient players and no risk of breakdown, allowed for an infinite number of rounds. So that each player, after rejecting an offer, always has the opportunity to make a counteroffer. The players' equilibrium strategies in this game results in a unique division of the pie, agreed in the first round, where player 1 receives the share $(1-\delta_2)/(1-\delta_1\delta_2)$, and player 2 gets $\delta_2(1-\delta_1)/(1-\delta_1\delta_2)$.[8] As we can see, the game rewards patience, which is intuitive. However, again there exists a procedural advantage, this time for the player who gets to make the opening proposal. But this advantage can be eliminated by letting the time Δ that elapses between a rejection and a counteroffer go to zero (Binmore, Rubinstein and Wolinsky (1986), Sutton (1986)). In case $\Delta \to 0$, player 1's equilibrium payoff becomes

$$x_1^* = \lim_{\Delta \to 0} \frac{1-\delta_2^{\Delta}}{1-\delta_1^{\Delta}\delta_2^{\Delta}} = \frac{\ln \delta_2}{\ln \delta_1 + \ln \delta_2},$$

which is strictly increasing in δ_1 and strictly decreasing in δ_2. For $\delta_1 = \delta_2$, the game results in an equal split.

Outside Options For bargaining situations where one of the players have the opportunity to pursue an outside option, we have allready concluded that this option only affects the outcome of the game as long as it renders the mentioned player more than he can hope for by continuing the negotiations. Hence, in the infinite alternating offers game where player 2 has an outside option y and $\Delta \to 0$, player 1's equilibrium payoff is

$$x_1^* = \min\left\{\frac{\ln \delta_2}{\ln \delta_1 + \ln \delta_2}, 1-y\right\},$$

i.e., the outside option y affects the outcome only as long as $y > \ln \delta_1 / (\ln \delta_1 + \ln \delta_2)$. If both players have outside options that exceeds their equlibrium payoffs in the alternating offers game, they will both rationally leave the table and invoke their outside payoffs.

Risk of Breakdown In an infinite alternating offers game with risk of breakdown, it can be shown that as $q \to 0$, the first mover advantage disappears (look at the two-stage game above) and $x_i \to b_i + \frac{1}{2}(1-b_i-b_j)$ for $i = 1, 2$ and $i \neq j$. Thus, the outcome of the game is a "split the difference" rule, where each player receives his breakdown payoff plus half of the surplus rent. As before, a player's breakdown payoff increases his equilibrium payoff because,

[8] You can follow the proof in Shaked and Sutton (1984) or in Sutton (1986).

as it increases his expected payoff following a rejection, it becomes more credible that the player will take the risk of bringing the game to the next stage.

3.3 The relation between NBS and the Rubinstein game

As Nash himself recognized in his analysis of 1953, the axiomatic approach and the strategic models are closely interdependent:[9]

> The two approaches to the problem, via the negotiation model or via the axioms, are complementary; each helps us to justify and clarify the other. (p. 129).

Binmore (1987) was the first to identify the close connection between NBS and the Rubinstein strategic model of alternating offers. The relation was further explored by Binmore, Rubinstein and Wolinsky (1986). First of all, their analysis justified the use of NBS in economic modelling. Furthermore, they showed that it is important to recognize the underlying bargaining framework when utilizing and setting up the Nash product in economic models. This especially applies to the meaning of the bargaining parties' disagreement points and the understanding of what is their "bargaining power" in different settings. The following is a summary of their results.

Risk of Breakdown As we could see above in the infinite alternating offers game with risk of breakdown, there is a very close relation with the Nash solution. As the chance of breakdown q drops to zero, the outcome of the game approaches the *symmetric* NBS, exp. (1), for which $t_i = u_i(b_i)$, and where b_i represents player i's breakdown payoff:

$$\mathbf{u}_s^* = \arg\max\left[u_1 - u_1(b_1)\right]\left[u_2 - u_2(b_2)\right] \quad (3)$$

The conclusion is that if we are to model a bargaining situation where the primary motivation to strike an agreement stems from an exogenously given risk of breakdown, the disagreement point t_i should represent the player's *breakdown payoff*. In addition, there is no reason for the outcome of the negotiations to depend on any other asymmetries than the ones represented by the breakdown payoffs and/ or the players' relative risk aversion – the latter reflected in the players' utility functions, u_1 and u_2.

[9] Nash (1953) actually supplemented his axiomatic approach with a strategic "demand game".

Impatient Players The resemblance between ANS and the outcome of the alternating offers game with impatient players, is also obvious. As we saw in subsection 3.3.3., in the time preference model where the time between every rejection and counteroffer Δ drops to zero, the first mover advantage disappears and the outcome depends only on the players' discount rates. Hence, as $\Delta \to 0$, the outcome of the time preference model approaches ANS

$$\mathbf{u}_a^* = \arg\max u_1^{\alpha} u_2^{1-\alpha}, \tag{4}$$

where the disagreement points are $t_1 = t_2 = 0$ and the bargaining powers, $\alpha = \ln \delta_2 / (\ln \delta_1 + \ln \delta_2)$ and $1 - \alpha = \ln \delta_1 / (\ln \delta_1 + \ln \delta_2)$, reflect relative impatience.

The lesson is that if we are to model a bargaining situation where the motivation to strike an agreement stems from the players' valuation of time, the weights in the Nash product (the players' bargaining power, if you like) should reflect the players' relative valuation of time. Furthermore, with no risk of breakdown, the disagreement points should be normalized to zero.

Outside Options Perhaps the most important result from the strategic approach, is *the outside option principle.* It states that a player's outside option affects the outcome of the negotiations only as long as it is *credible.* Furthermore, if a player's outside option *is* in fact credible, the outcome of the negotiations will be that he receives exactly the value of this alternative option. Hence, it operates only as a *constraint* on the outcome in the model of alternating offers. The lesson is that the disagreement point should never be identified with the player's outside option. Rather, in a bargaining situation with alternating offers, impatient players and outside options, the outcome approaches the Nash solution

$$\begin{aligned} \mathbf{u}_a^* &= \arg\max u_1^{\alpha} u_2^{1-\alpha}, \\ \text{s.t.} \quad u_i^* &\geqslant u_i^o, \text{ for } i = 1, 2, \end{aligned} \tag{5}$$

where u_i^o represents player i's utility from pursuing his outside option. If u_i^o is credible, the condition becomes binding, $u_i^* = u_i^o$, so that i receives exactly the value of his outside option.

Impatience, Risk of Breakdown *and* Outside Options[10] In most economic applications, it is relevant to include both time valuation, risk of breakdown and the possibility of

[10] This analysis follow closely that of Binmore, Osborne and Rubinstein (1992).

outside options. Furthermore, it is realistic to assume asymmetries in all factors – in both time preferences, $\delta_1 \neq \delta_2$, breakdown payoffs, $b_1 \neq b_2$, and in outside options, $u_1^o \neq u_2^o$.

In this analysis, the exact assumptions of the underlying bargaining framework are: We have a game of alternating offers and risk of breakdown. The negotiations break down with probability $q = \lambda\Delta$ in any period with length Δ. Because of the players' time preferences, we have that, valued from the first period, player i's breakdown payoff in period t is $\delta_i^t b_i$. Finally, the players could resort to outside options, so that in any period t in which there is no breakdown, player i could pursue the payoff u_i^o, valued $\delta_i^t u_i^o$ in the first period.

It can be shown that as $\Delta \to 0$, the outcome of this alternating offers game approaches

$$\begin{aligned} \mathbf{u}^* &= \arg\max\,(u_1 - t_1)^{\alpha_1}\,(u_2 - t_2)^{\alpha_2}\,, \\ \text{s.t.} \quad u_i^* &\geqslant u_i^o, \text{ for } i = 1, 2, \end{aligned} \tag{6}$$

where

$$t_i = \lim_{\Delta \to 0} \sum_{j=0}^{\infty} u_i\,(b_i)\,\delta_i^{\Delta j} q\,(1-q)^j = u_i\,(b_i)\,\frac{\lambda}{\lambda - \log \delta_i}, \text{ for } i = 1, 2. \tag{7}$$

Again, $u_i\,(b_i)$ represents player i's utility in case of breakdown.

We can see that if the risk of breakdown dominates, the effect of time valuation ($\log \delta_i$ small compared to λ), then $\lambda/\left(\lambda - \log \delta_i\right) \to 1$ and $t_i \to u_i\,(b_i)$, so the disagreement points approach the players' breakdown payoffs By the same reasoning, we have that as time preferences dominates, $\lambda/\left(\lambda - \log \delta_i\right) \to 0$ and $t_i \to 0$, so that the disagreement point approaches the impasse point, normalized to zero.

Furthermore, the weights in the Nash product now reflect both risk of breakdown and time preference, and the relevant importance of the two determine the degree of asymmetry in the solution:

$$\alpha_i = \frac{\lambda - \log \delta_j}{\lambda - \log \delta_i - \log \delta_j}. \tag{8}$$

We can see that as the risk of breakdown dominates, both $\alpha_1, \alpha_2 \to 1$, so the powers in the product approach one another. And at the same time $t_i \to u_i\,(b_i)$, so the solution comes near the (*symmetric*) NBS, exp. (3) above.

As the time preferences dominate, $\alpha_i \to \log \delta_j / (\log \delta_i + \log \delta_j)$, so that the weights increasingly reflect relative impatience. Simultanously we have that $t_i \to 0$, so that the solution approaches ANS, exp. (4) above.

What is interesting here, is that in a model with both time preferences and risk of breakdown, the disagreement point could be any point $0 < t_i < u_i(b_i)$, depending on the relative importance of the two factors, time and risk of breakdown.

Finally, we can see that the solution is constrained by the players' outside options. In case one of the players' outside options is credible, say u_2^o, the outcome depends only on the size of this outside option: Player 2 receives $u_2^* = u_2^o$, and player 1 receives the remainder.

Example We can illustrate the points made above with the bargaining problem where the players are to split a pie of size one. I assume the players' utility functions are linear, so that $u_i(x_i) = x_i$ for $i = 1, 2$. The players engage in a infinite game of alternating offers. Further, there is risk of breakdown $q = \lambda\Delta$ in any period of length Δ. And if breakdown should occur, the players will receive $b_1, b_2 > 0$. In addition, player 2 has an outside option of value y. As the time between any rejection and counteroffer Δ approaches zero, this bargaining problem reduces to the maximization of the Nash product

$$(x - t_1)^{\alpha_1}(1 - x - t_2)^{\alpha_2}, \quad \text{s.t.} \quad 1 - x \geqslant y,$$

where α_1 and α_2 are determined by exp. (8), and $t_i = b_i\lambda/(\lambda - \log\delta_i)$ (as in exp. (7) above). The solution to this problem is

$$x^* = \frac{\alpha_1 - t_2\alpha_1 + t_1\alpha_2}{\alpha_1 + \alpha_2},$$

as long as $(\alpha_2 - t_1\alpha_2 + t_2\alpha_1)/(\alpha_1 + \alpha_2) \geqslant y$, and simply

$$x^* = 1 - y,$$

in case $y > (\alpha_2 - t_1\alpha_2 + t_2\alpha_1)/(\alpha_1 + \alpha_2)$.

3.4 Multilateral Bargaining

The abovementioned games apply immediately to *independent bilateral bargaining situations*, where the bargaining problem to be studied is *economically independent* from that of other bargaining situations. However, bilateral contracts are often interrelated, as in the contracts negotiated between parties operating in oligopolistic industries. A few authors have investigated the problem, which seems mainly to be one of stability and uniqueness (see Cremer and Riordan (1987), Davidson (1988), Horn and Wolinsky (1988)).

Think of the situation where a monopolist is committed to supplying its product to two horizontally differentiated retailers competing in quantities. Each retailer face the inverse linear demand function $P_i = 1 - Q_i - \gamma Q_j$, where $0 < \gamma < 1$ and Q_j is the quantity supplied by the other retailer. The supplier produces its product at a constant unit cost, $c = 0$, and then negotiates the wholesale prices w_i and w_j with the retailers, wich indirectly determines the sold quantities Q_i and Q_j. The retailer's profit function then is $\Pi_i(w_i, w_j) = (P_i(Q_i, Q_j) - w_i)\, Q_i$, and the supplier's profit is $\Pi^p = Q_i w_i + Q_j w_j$. The two supply contracts are negotiated simultaneously, but separately. The bargaining game is an alternating offers game with no risk of breakdown. All players are equal with respect to their time preferences. What is the outcome?[11]

Each of the two negotiations consists of setting a wholesale price w_i which the individual retailer has to be pay to the supplier, and as mentioned, this price indirectly determines the sold quantity Q_i. However, what distinguishes this problem from that of other (independent) bargaining situations, is that the retailers profit functions, and hence the Pareto frontiers of the two bargaining situations, are interdependent. In the situation with two competing retailers, the contract negotiated with the first retailer will affect which contract is the most efficient to sign with the second. The bargaining problem could therefore result in a multitude of different equilibria, due to the many beliefs a retailer can form whenever he receives an out-off-equilibrium offer from the supplier (McAfee and Schwartz (1995)).

However, imposing *pairwise proofness* as a condition, as in Davidson (1988), and Horn and Wolinsky (1988), seems sufficient for there to be a unique contracting equilibrium.[12] Using pairwise proofness, we can define a contracting equilibrium as a situation where there is no joint incentive for the supplier and any individual retailer to alter the terms of their contract (Crémer and Riordan (1987)).[13]

Assume that the underlying bargaining structure is a form of the Rubinstein-game. Then we can take advantage of the fact that the outcome of the game approaches NBS as the time between offers and counteroffers goes to zero. Yet, before we can specify the Nash product, we have to assert what is the bargaining parties' disagreement points. This is not at all obvious. The disagreement point is the revenue that the parties receive whenever an

[11] This game was first studied in Horn and Wolinsky (1988).

[12] McAfee and Schwartz (1995) show that under certain conditions a pairwise-proof equilibrium may not exist. More on this below.

[13] A closely related restriction sufficient for equilibrium, is that of *passive beliefs*. Imposing passive beliefs require that a player, irrespective of the offers he receives, continues to believe that others recevie equilibrium offers. Note that passive beliefs indirectly impose pairwise proofness on the equilibrium outcome (McAfee and Schwartz, 1995).

agreement has not been reached. For the individual retailer, this disagreement revenue is zero – that is, as long as he is inactive, he will not earn anything. For the supplier, the situation is different. In this game, there are *two* competing downstream retailers, and thus we have to make assumptions about the supplier's revenue when only one retailer is active. We have two alternative assumptions: 1) That contracts are contingent, in case the supplier does not reach an agreement with the other retailer. This allows an active retailer to operate as a monopolist as long as the other retailer is inactive. However, another plausible assumption is 2) that the active retailer operates "at the anticipated equilibrium level", even when the other retailer is inactive (Horn and Wolinsky (1988)). Note that with contingent contracts, the supplier's bargaining position is strengthened compared to the alternative. However, for convenience, let us assume non-contingent contracts. If this is the case, the supplier will receive the revenue $w_j^* Q_j^*(w_j^*, w_i^*)$ as long as an agreement has not been reached with i, where Q_j^* is the equilibrium quantity supplied to j, and w_j^* and w_i^* are the equilibrium wholesale prices whenever both retailers are active.

Now we can specify the Nash product of the two individual bargaining problems. In negotiations with retailer i, the agreed wholesale price is

$$\begin{aligned} w_i^* &= \arg\max \left\{ \Pi_i(w_i, w_j^*) \left(Q_i(w_i, w_j^*) w_i + Q_j(w_j^*, w_i) w_j^* - Q_j^*(w_j^*, w_i^*) w_j^* \right) \right\}, \\ & \text{where } i, j = 1, 2 \quad \text{and} \quad i \neq j. \end{aligned} \tag{9}$$

The FOC for (9) is

$$\Pi_i \left(Q_i + w_i \frac{\partial Q_i}{\partial w_i} + w_j^* \frac{\partial Q_j}{\partial w_i} \right) + w_i Q_i \frac{\partial \Pi_i}{\partial w_i} = 0, \quad i = 1, 2. \tag{10}$$

We can immediately notice that the bargaining problem between the supplier and retailer i does not only depend on w_i's effect on $w_i Q_i$, but also on w_i's effect on $w_i Q_j$.

To solve eq. (10), we have to find the retailers' best response functions, and their derivatives. From the assumptions about the demand functions, we have that each retailer face the maximization problem

$$\max_{Q_i} \left(1 - Q_i - bQ_j - w_i\right) Q_i, \quad i = 1, 2. \tag{11}$$

The FOC for (11) is

$$1 - 2Q_i - bQ_j - w_i = 0, \quad i = 1, 2. \tag{12}$$

Substituting the best response of j into (12) and solving gives the Cournot equilibrium

$$Q_i^c = \frac{2 + \gamma w_j - 2w_i - \gamma}{4 - \gamma^2}, \quad i = 1, 2, \tag{13}$$

which is rising in w_j and decreasing in w_i. Specifically, we have

$$\frac{\partial Q_i^c}{\partial w_i} = -\frac{2}{4 - \gamma^2}, \quad i = 1, 2, \tag{14}$$

and

$$\frac{\partial Q_i^c}{\partial w_j} = \frac{\gamma}{4 - \gamma^2}, \quad i = 1, 2. \tag{15}$$

Substituting (13) into the profit function gives the equilibrium profit as a function of wholesale prices:

$$\Pi_i^c = \frac{(2 + \gamma w_j - 2w_i - \gamma)^2}{(2 + \gamma)^2 (2 - \gamma)^2}, \quad i = 1, 2, \tag{16}$$

which is decreasing in w_i:

$$\frac{\partial \Pi_i^c}{\partial w_i} = -\frac{4 (2 + \gamma w_j - 2w_i - \gamma)}{(2 + \gamma)^2 (2 - \gamma)^2}, \quad i = 1, 2. \tag{17}$$

Finally, substituting (13), (14), (15), (16) and (17) into (10) and solving gives us the outcome of the negotiations between the supplier and the retailers:

$$w_1^* = w_2^* = w^* = \frac{2 - \gamma}{8 - 2\gamma}. \tag{18}$$

What we should notice about NBS (18), is that it is stable, in that it constitutes a unique contracting equilibrium. There is no joint incentive for the supplier and any of the retailers to alter the terms of their contract.

What if we allow for non-linear prices? Let us assume that the downstream retailers are identical, and that both face the inverse demand function $P = 1 - Q_i - Q_j$. Furthermore, the supplier produces its product at a constant marginal cost $c = 0$. The underlying bargaining framework is as before. However, now the parties simultaneously and privately negotiate over *two*-part tariffs, on the form $\{w_i, F_i\}$, $i = 1, 2$. Afterwards, the retailers choose which quantity to buy from the supplier.

There are two aspects we should look into. First, as with the bargaining problem above, what is the supplier's disagreement point? That is, what will he earn when only one retailer is active? Again, let us assume that the contracts are non-contingent.

Second, at which point in the game will the retailers learn each others' marginal costs, and at which point do they decide which quantity to buy from the supplier? There are two alternative assumtions: 1) Contracts are never observable, so the retailers can never observe each others' unit costs. 2) Retailers learn each others' unit costs *before* they decide which quantity to buy. As we will see, the specific assumption we make has implications for whether or not there exists a pairwise-proof equilibrium.

Let us first assume that contracts are never observable. The outcome of the bargaining problem is the unique contract

$$\begin{aligned}\{w_i^*, F_i^*\} &= \arg\max \left(\Pi_i(w_i, w_j^*) - F_i\right) \times \\ &\quad \left(Q_i(w_i, w_j^*)w_i + F_i + Q_j(w_j^*, w_i)w_j^* + F_j(w_i, w_j^*) - Q_j^* w_j^* - F_j^*\right), \\ &\quad \text{where} \quad i, j = 1, 2 \quad \text{and} \quad i \neq j \end{aligned} \tag{19}$$

The FOCs for (19) are

$$(\Pi_i - F_i)\left(Q_i + \frac{\partial F_j}{\partial w_i} + w_i \frac{\partial Q_i}{\partial w_i} + w_j^* \frac{\partial Q_j}{\partial w_i}\right) + \frac{\partial \Pi_i}{\partial w_i}(F_i + w_i Q_i) = 0, \quad i = 1, 2, \tag{20}$$

and

$$\Pi_i - Q_i w_i - 2F_i = 0, \quad i = 1, 2, \tag{21}$$

As with the first example, we have to find the retailers equilibrium quantities and profits as functions of wholesale prices. With the simple linear demand function above, it is straightforward to see that

$$Q_i = \frac{1 + w_j - 2w_i}{3}, \quad i = 1, 2, \tag{22}$$

and

$$\Pi_i = \frac{(1 + w_j - 2w_i)^2}{9}, \quad i = 1, 2. \tag{23}$$

The derivatives of (22) and (23) are

$$\frac{\partial Q_i}{\partial w_i} = -\frac{2}{3}, \quad i = 1, 2, \tag{24}$$

$$\frac{\partial Q_i}{\partial w_j} = \frac{1}{3}, \quad i = 1, 2, \tag{25}$$

and

$$\frac{\partial \Pi_i}{\partial w_i} = -\frac{4\left(1 + w_j - 2w_i\right)}{9}, \quad i = 1, 2. \tag{26}$$

Finally, from (21) we have that

$$\frac{\partial F_j}{\partial w_i} = \frac{1}{2}\left(\frac{\partial \Pi_j}{\partial w_i} + w_j \frac{\partial Q_j}{\partial w_i}\right) = \frac{1}{2}\left(\frac{2\left(w_i - 2w_j + 1\right)}{9} - \frac{1}{3}w_j\right), \quad i = 1, 2. \tag{27}$$

Now, substituting (22), (23), (24), (25), (26) and (27) into (20) and (21), and solving, gives the unique equilibrium contract

$$\{w_i^*, F_i^*\} = \left\{c, \frac{\Pi^c}{2}\right\} = \left\{0, \frac{1}{18}\right\}, \quad i = 1, 2,$$

where Π^c is the Cournot profit when wholesale prices are $w_i = w_j = 0$. That is, when we allow for fixed fees, the supplier and the individual retailer will maximize their joint realized profit (by setting $w_i = c$, avoiding double marginalizaton), and then negotiate their share of this surplus. This is a standard result. Could any $w_i > 0$ be an equilibrium? No. To see this, note that the supplier's profit is

$$S = \frac{\Pi_1(w_1, w_2)}{2} + w_1 Q_1 + \frac{\Pi_2\left(w_2, w_1\right)}{2} + w_2 Q_2. \tag{28}$$

S is maximized by setting $w_i = w_j = 2/5$. Though, if this is the case, the supplier has an incentive to renegotiate one of the contracts, say with retailer 1, setting $w_1 = 7/40 < 2/5 = w_2$, which implies increasing 1's profit. Both retailers will realize this, and therefore they will not accept any contract where $w_i > 0$.

However, potentially there lies a problem of opportunism in the game, depending both on the timeline and the information that the retailers possess when they decide how much to buy from the retailer (see Hart and Tirole (1990), McAfee and Schwartz (1994), O'Brien and Shaffer (1994)). To see this, assume the following sequence of events: 1) The supplier negotiates two-part tariffs, on the form $\{w_i, F_i\}$, simultaneously and privately with both retailers. If the retailers accept the terms, they immediately have to pay the fixed fee. 2) The retailers observe each others' contracts, that is, each others' marginal costs, w_1 and w_2, decide on which quantities to buy from the supplier, and then compete for final consumers.

Given this sequence of events, will the contract equilibrium $\{w_i^*, F_i^*\} = \{c, \Pi^c/2\}$ hold? Let us assume that both retailers have accepted it. The supplier's profit is

$$\begin{aligned} S &= F_1 + (w_1 - c)\, Q_1 + F_2 + (w_2 - c)\, Q_2 \\ &= \frac{\Pi_1^c\,(w_1, w_2)}{2} + (w_1 - c)\, Q_1 + \frac{\Pi_2^c\,(w_2, w_1)}{2} + (w_2 - c)\, Q_2. \end{aligned}$$

However, note that, with the timeline set out above, F_1 and F_2 is already paid, so that altering the terms of one of the retailers' contract will not affect the amount received from the other. Hence, both retailer i and the supplier could gain by renegotiating w_i. To see this, note that

$$\frac{\partial S}{\partial w_i} = Q_1 + \frac{1}{2}\frac{\partial \Pi_1}{\partial w_1} = -\frac{1-c}{9}, \quad \text{if } w_i = c, \quad i = 1, 2. \tag{29}$$

As long as $c < 1$, we will have that $\partial S/\partial w_i$ is negative, and thus $w_i = c$ can not be a pairwise proof equilibrium. The supplier will gain by renegotiating i's contract, reducing w_i and collecting the extra profit through the fixed fee. By the same logic, no $w_i > c$ can be an equilibrium. Hence, a pairwise proof equilibrium implies $w_i < c$.

McAfee and Schwartz (1995) demonstrate under which conditions a pairwise proof equilibrium requires that w_i is set so low that the output price P does not cover the marginal cost c, that is $P < c$, which again implies that the supplier's profit is negative. Hence, with this sequence of events, it could be the case that no pairwise-proof equilibrium exists. However, note that we can avoid the problem by assuming non-observable contracts.

3.5 An Axiomatic Approach to Multiunit Bargaining

Many models that involve multiunit bargaining utilize the axiomatic approach of Shapley (1953), which resulted in the Shapley value. The Shapley value started out as a measure for evaluating the players' power in cooperative games. But since then, it has often been interpreted as the outcome of games in which the players' have conflicting interests, as in situations of collective bargaining. Therefore, as with NBS, several authors have tried to form non-cooperative games that supports the Shapley value.[14] These games are quite different both in structure and interpretation from that of the Rubinstein alternating offers game, and not immediately applicable to the bargaining situations studied in this paper. Since the

[14] See Winter (2002) for a review.

Shapley value is utilized in one of the articles to be discussed, however, I will give a brief review of this solution concept.

Think of a coalition game that consists of a set of *players* $N = \{1, 2, \ldots n\}$, a set of *coalitions*, where each coalition $S = \{1, \ldots k\} \subseteq N$ (N is the *grand coalition*), and for each S a set of actions that assigns to each player i a value v_i, so that $\sum_{i=1}^{k} v_i = V(S)$, which constitutes the *value* of the S-coalition. What will be the outcome $\{v_1^*, \ldots v_n^*\}$ of this game?

We could resort to the familiar game-theoretic solution concept known as the core. The core of a coalition game is simply the set of all stable actions of the grand coalition N. However, in many situations the core is empty (no stable actions of the grand coalition exists), or it could be disproportionately large.

As an alternative solution concept, Shapley presented a value that he supported with four axioms:

1. *Efficiency.* In every game, the players should distribute among themselves *all* of the the resources available to the grand coalition. Specifically: $\sum_{i=1}^{k} v_i^* = V(S)$.

2. *Symmetry.* If two players $i \neq j$ are identical with respect to their expected marginal contribution to the grand coalition, so that $E[\Delta_i V(S)] = E[\Delta_j V(S)]$, they should receive the same, that is $v_i^* = v_j^*$.

3. *Dummy.* If a player's marginal contribution to all coalitions is zero, he should receive nothing. That is, if $\Delta_i V(S) = 0$ for every $S \subseteq N$, then $v_i^* = 0$.

4. *Additivity.* If we combine two coalition games described by the value functions $V(S)$ and $W(S)$, then the value distributed to player i, $v_i(V+W)$ should correspond to the sum of his value in $V(S)$ and his value in $W(S)$. That is, $v_i^*(V+W) = v_i(V) + v_i(W)$.

Shapley then asserted that there is a unique value, the Shapley value, that inherits all of these properties:

Definition In a cooperative game where the grand coalition S gives rise to the total profit/ rent/ utility $V(S)$, the **Shapley value** gives to each player i his expected (marginal) contribution $E[\Delta_i V(S)]$ over all possible permutations of the grand coalition.

To give an example of what the Shapley value is: Think of two players $i = (1, 2)$ (a seller 1 and a buyer 2) involved in a cooperative game trading a good x. 2 is willing to pay a maximum of $\overline{p_x} = 100$, and 1 is willing to sell for a minimum of $\underline{p_x} = 50$. The value of the grand coalition $N = \{1, 2\}$ is thus $V(N) = \overline{p_x} - \underline{p_x} = 50$. But how are we to distribute this surplus rent? The Shapley value gives us a suggestion: What if we give to each player his average marginal contribution over all possible permutations of the grand coalition?

This gives us the following

Prob.	Coalition	Marg. contrib., $\Delta_i V(N)$
$\frac{1}{2}$	(1,2)	(0,50)
$\frac{1}{2}$	(2,1)	(0,50)

The players' contributions are symmetric, so every player i receives $E[\Delta_i V(S)] = \frac{1}{2} \times 50 + \frac{1}{2} \times 0 = 25$.

To take another example, involving the sharing of costs: Two players $i = 1, 2$ participate in a group activity. The activity has certain costs attached to it. Marginal costs (the additional cost for every new player that actively participate) are rising. In addition, the marginal costs are not symmetrical – i.e., one of the players contributes relatively more to the total costs than the other. Specifically, let us assume that player 2 is the one to contribute relatively more, and that if player 1 is the first to attend the activity, his contribution to the total costs, $C(N) = 100$, is $\Delta_1^1 C(N) = 30$ (where $\Delta_i^k C(N)$ is the marginal contribution of player i when he appears as number k in the coalition).The contribution of player 2 then is $\Delta_2^2 C(N) = 70$, both because he is relatively more expensive to include in the coalition, and because the unit costs are rising.

Assume that the alternative permutation gives rise to the marginal contributions $\Delta_1^2 C(N) = 60$ and $\Delta_2^1 C(N) = 40$. This gives us the following:

Prob.	Coalition	Marg. contrib., $\Delta_i C(N)$
$\frac{1}{2}$	(1,2)	(30,70)
$\frac{1}{2}$	(2,1)	(40,60)

How should we divide the costs? The Shapley value suggests that player 1 should pay $E[\Delta_1 C(N)] = \frac{1}{2} \times 30 + \frac{1}{2} \times 60 = 45$, and that player 2 should pay $E[\Delta_2 C(S)] = \frac{1}{2} \times 40 + \frac{1}{2} \times 70 = 55$.

The fact that the Shapley value is the only sharing rule that satisfies the four axioms stated above, is important in its own right. However, the Shapley value also recognizes something intuitive. Namely the idea that bargaining power should vary with value contributed.

Interestingly, we should note that NBS and the Shapley value are not that different as it seems at the outset. In fact, as we will see, the Shapley value corresponds to NBS, given a proper specification of the disagreement points, even in games of simultaneous multiunit bargaining. More on this in Section 4.

3.6 Summary

This section has provided a review of the most important tools and concepts used in economic models of bargaining. The main focus has been on NBS and ANS, and on the correspondence between these solutions and the outcomes of strategic games of bargaining. We have seen that the strategic approach may help us clarify how to apply the Nash solution, given what we believe to be the underlying bargaining structure at hand.

Perhaps the most important result from the strategic approach, is the outside option principle. It states that a player's threat of opting out of the negotiations and resorting to his outside option, affects the outcome of the negotiations only as long as the outside option is credible – i.e., only as long as it gives the player a higher payoff than he would receive by continuing the negotiations without the outside option. Hence, outside options should only operate as constraints on NBS. Futhermore, outside option should not be confused with the players' disagreement points, which we have learned should be interepreted as the payoff streams accruing to the players whenever they are in a state of disagreement.

There are a number of ways in which players may gain leverage in negotiations – e.g., we have seen that relative time valuation, degree of risk aversion, risk of breakdown, and the size of both disagreement points and outside options, are all factors that will affect the outcome in one way or another. We should have all of them in mind when we now turn to the analysis of sources and consequences of buyer power.

4 Dynamic Effects of Buyer Power

The following section deals with the main questions of this thesis: Building upon our knowledge and models of bargaining, what determines how profit is distributed between agents in a vertical chain? What creates countervailing power, and how is it affecting upstream product and process innovation?

A growing yet limited number of articles have tried to shed light on these issues. The authors have arrived at diverging results, however, both with respect to the sources of buyer power and its (dynamic) welfare effects.

The majority of studies on the subject sees the buyer's *size* as the single most important factor contributing to his power. The idea is that larger buyers are better negotiators than smaller ones. Often bargaining power is included as an exogenous variable in the models, using ANS. By scaling up the buyer's bargaining power, one will find that the buyer can extract a larger share of both incremental and total profit. This approach is not very rewarding, however, because it says nothing about the causes of the buyer's bargaining power. In fact, there are no theoretical fundations to support such a simple model. We could argue that the powers in the Nash product be interpreted as a representation of the negotiating parties' relative time valuation.[15] Yet, no theory supports the notion that larger buyers are more patient than smaller ones.

It may very well be that big buyers have more bargaining power. However, any economic model that attempts to assess the consequences of strong buyers, should first and foremost try to endogenize the buyers' bargaining power and the process in which the buyers become strong. The recent literature has come up with a number of suggestions. The articles reviewed below shows that big buyers may receive discounts, e.g. if sellers and/ or buyers are risk averse (DeGraba (2003), Chae and Heidhues (2004)), if larger buyers can generate more credible outside options than smaller ones (Inderst and Wey (2005a)), or if total industry profit is strictly concave in the number of buyers served – e.g., when the supplier's costs

[15] See the section on bargaining with impatient players in chapter 3.

are strictly convex (Inderst and Wey (2003, 2005b)). The welfare implications are not clear cut, however. Whenever big buyers can generate credible outside options, they might spur suppliers' incentives to reduce unit costs in production. Furthermore, if manufacturers have production costs that are strictly convex, facing a bigger buyer might induce them to switch to a less convex and more efficient technology.

Yet, a series of articles point to possible negative effects of strong buyers. Inderst and Shaffer (2007) show that a big buyer, facing two competing suppliers, can get a discount by committing to stocking the same brand in all its stores. Hence, a merger could results in an undesirable reduction in product variety. Chen (2004) shows, using ANS, that an exogenous increase in a dominant retailer's bargaining power may cause the supplier to shift sales towards more inefficient and weaker fringe competitors. Furthermore, he demonstrates that it could result in the manufacturer reducing the number of products supplied.

Size may not be the most important cause of buyer power, however. Some authors point to downstream *market power* (not *size* per se), obtained through merger between competing stores, as a crucial factor. Mazzarotto (2004), e.g., asserts that a merger between *neighbouring* stores will result in a discount for the new merged firm, whereas a merger between remote stores might not have any effect.

In this section I will examine all of the abovementioned theories in turn. The first part looks to models dealing with buyers' effects on upstream process innovation, whereas the second part considers effects on product variety.[16] Process innovation is defined as the introduction of new and improved production technologies. It implies altering the firm's cost structure – e.g., by reducing marginal production costs. Product innovation, on the other hand, comprises of both the introduction of new products and the modification of existing ones.

4.1 Process Innovation

Market Power and Buyer Countervailing Power

In this first section, I will consider market power, and not size per se, as a source of buyer power. The idea that buyers may gain leverage vis-à-vis suppliers as their market power increases, is immediately intuitive.

[16] This division is natural, since there no doubt are important differences between product and process innovation. Yet, some of the models could easily apply to both types.

When competing stores merge, total market profit increases. This is the positive effect for both the supplier and the downstream firms. However, a merger between competing stores may also lower the value of the supplier's disagreement payoff, which is expected to weaken the supplier's position when he is negotiating his share of the revenue with the buyer. We can illustrate this in the following simple model.[17]

Assumptions The economy consists of a monopolist supplier selling its product to two retail stores operating in the downstream market. The supplier produces the product at a constant unit cost of c. The manufacturer can reduce the unit cost c, however, by investing some amount I in research. It is assumed that $c'(I) < 0$ and that $c''(I) > 0$.

The retail outlets, denoted $i = a, b$, are assumed to be horizontally differentiated, and they compete Cournot to serve final consumers. I will apply a representative consumer approach, and assume that the direct demand of retailer i can be represented by the simple inverse demand function $P_i = 1 - Q_i - \gamma Q_j$, where $i, j = a, b$, $i \neq j$ and $0 \leqslant \gamma \leqslant 1$. For $\gamma = 0$, the outlets are located in separate markets.

The supplier and the retailers negotiate two-part tariffs on the form $T_i = w_i Q_i + F_i$, where w_i is the wholesale price and F_i is the fixed fee paid by retailer i.

The retailers have no costs other than T_i.

The Bargaining Framework The supplier negotiates the two-part tariffs simultaneously and privately with the retailers, by using perfect agents. Hence, to find the unique contracting equilibrium, we have to impose the condition of pairwise proofness. That is, the equilibrium we are looking for is the one where there is no joint incentive for the supplier and any individual retailer to alter the terms of their contract (see the section on multilateral bargaining in Section 3).

I will assume a form of the alternating offer game with no risk of breakdown. Hence, as the time between any offer and counteroffer goes to zero, we can resort to NBS to determine the outcome of the negotiations at the limit. I will assume that the players are equal with respect to time valuation.

The supplier negotiates contracts with the buyers for every possible market outcome. That is, when bargaining with retailer i, the supplier negotiates a contract both for the event

[17] Mazarotto (2004) uses the adress approach to illustrate the effect of increased downstream market power on the buyer's buying power vis-a-vis its supplier. The following model differs from Mazarotto in that it applies the representative consumer approach.

where both retailer i and j are active, *and* the event where he can not reach an agreement with retailer j.

The agents have no outside options in the negotiations.

Analysis

Conside the following three-stage game: At stage one the supplier decides on the amount I to invest to reduce the unit cost c. At stage two the retailers and the supplier negotiate supply contracts. At stage three, the retailers buy products from the supplier, and then compete for final consumers in the downstream market. Finally, the supplier can collect his revenue as specified in the contracts.

We can analyse the game backward, starting at stage three. Assume that the retailers are separated. We denote this state by s.

Outlet i's maximization problem at stage three is

$$Q_i^s(w_i, w_j) = \arg\max \left\{ \left(P_i(Q_i, Q_j) - w_i\right) Q_i \right\}, \quad i = a, b. \tag{30}$$

The FOC for (30) is

$$P_i - w_i + \frac{\partial P_i\left(Q_i, Q_j\right)}{\partial Q_i} Q_i = 0, \quad i = a, b, \tag{31}$$

which, by symmetry, we can solve for Q_i to find the equilibrium quantity $Q_i^s\left(w_i, w_j\right)$ and the unique Cournot profit $\Pi_i^s\left(w_i, w_j\right)$ for retailer i whenever both outlets are active.

Now, if the supplier is in a state of disagreement with retailer j, the maximization problem of retailer i at stage three reduces to

$$Q_i^s\left(w_i\right)\Big|_{Q_j=0} = \arg\max \left\{ \left(P_i(Q_i) - w_i\right) Q_i \right\}, \quad i = a, b, \tag{32}$$

which gives the FOC

$$P_i - w_i + \frac{\partial P_i\left(Q_i\right)}{\partial Q_i} Q_i = 0, \quad i = a, b. \tag{33}$$

Hence, when the supplier is in a state of disagreement with retailer j, i can realize the monopoly profit *at his location*, $\Pi_i^s\left(w_i\right)\big|_{Q_j=0}$.

As long as $\gamma > 0$, we find that $Q_i^s(w_i)\big|_{Q_j=0} > Q_i^s(w_i, w_j)$, and that $\Pi_i^s\left(w_i\right)\big|_{Q_j=0} > \Pi_i^s\left(w_i, w_j\right)$.

At stage two, the supplier and the retailers negotiate contracts. Since the players negotiate two-part tariffs, we can take advantage of the fact that, in equilibrium, the players set the wholesale prices equal to marginal costs, $w_i = w_j = c$, so that the bargain problems reduces to splitting the realized surplus through the fixed fees. Hence, we can write NBS to the bargaining problem of retailer i and the manufacturer as

$$F_i^s = \arg\max \left\{ \left(\Pi_i^s - F_i\right) \left(F_i + F_j^s - F_j^d\right) \right\}, \quad \text{where} \quad i, j = a, b \quad \text{and} \quad i \neq j. \tag{34}$$

where F_j^d is the supplier's disagreement payoff – i.e., his revenue from j when he is in a state of disagreement with retailer i.

First we have to find the supplier's disagreement profit F_j^d, which, since $w_j = c$ in equilibrium, is

$$F_j^d = \arg\max \left\{ \left(\Pi_j^s\big|_{Q_i=0} - F_j \right) F_j \right\}. \tag{35}$$

Solving the FOC of (35) for F_j, we find that

$$F_j^d = \frac{\Pi_j^s\big|_{Q_i=0}}{2}. \tag{36}$$

(36) says that whenever retailer i is in a state of disagreement with the supplier, retailer j and the manufacturer splits the realized monopoly profit at location j, $\Pi_j^s\big|_{Q_i=0}$, equally.

Now we can move on to find the supplier's equilibrium contract with i, derived from the FOC of (34) with respect to F_i, which is

$$\Pi_i^s - 2F_i - F_j + F_j^d = 0, \quad i, j = a, b \quad \text{and} \quad i \neq j. \tag{37}$$

By substituting (36) into (37), and using symmetry, we can solve for F_i to find that

$$F_i^s = \frac{2\Pi_i^s + \Pi_j^s\big|_{Q_i=0}}{6}, \quad i, j = a, b \quad \text{and} \quad i \neq j. \tag{38}$$

We can conclude that the supplier's profit when both retailers are active but separated, amounts to

$$F_a^s + F_b^s = \frac{2\Pi_i^s + \Pi_j^s\big|_{Q_i=0}}{3}. \tag{39}$$

Now consider the situation where the two downstream retailers are merged into a single firm, denoted ab, and denote this state by m. Again, we analyse the game backward. Starting at stage three, the merged firm's maximization problem is

$$\{Q_a^m, Q_b^m\} = \arg\max \left\{ \left(P_a(Q_a, Q_b) - w_{ab}\right) Q_a + \left(P_b(Q_b, Q_a) - w_{ab}\right) Q_b \right\}. \tag{40}$$

The FOC for (40) is

$$P_i - w_{ab} + \frac{\partial P_i\,(Q_i, Q_j)}{\partial Q_i} Q_i + \frac{\partial P_j\,(Q_j, Q_i)}{\partial Q_i} Q_j = 0, \quad i = a, b \text{ and } i \neq j. \tag{41}$$

From (41) we can derive the equilibrium quantities $Q_a^m(w_{ab}) = Q_b^m(w_{ab})$ and the equilibrium profits $\Pi_a^m(w_{ab}) = \Pi_b^m(w_{ab})$ realized at the two locations, as functions of the wholesale price w_{ab} charged by the supplier.

In comparing the FOCs (31) and (41), we can see that $Q_i^m(c) < Q_i^s(c)$ and $\Pi_i^m(c) > \Pi_i^s(c)$ as long as $\gamma > 0$ – which says that, as long as there is some degree of competition in the downstream market, the merged firm will reduce the quantities and increase the realized profit at the two locations a and b.

As we move on to consider the bargaining problem at stage two, we can see that, since the supplier receives nothing as long as he is in a state of disagreement with ab, NBS simplifies to

$$F_{ab}^m = \arg\max \left\{ \left(\Pi_a^m + \Pi_b^m - F_{ab}\right) F_{ab} \right\}. \tag{42}$$

Again we use the fact that $w_{ab} = c$ in equilibrium. We can solve the FOC of (42) for F_{ab} to find that

$$F_{ab}^m = \frac{\Pi_a^m + \Pi_b^m}{2}, \tag{43}$$

which is the supplier's equilibrium profit when the outlets are merged.

In comparing the two outcomes, (39) and (43), we can identify under which conditions the merged firm will receive a discount. Specifically, we have that $F_{ab}^m < F_a^s + F_b^s$ as long as

$$\Pi_j^s\big|_{Q_i=0} > 3\Pi_i^m - 2\Pi_i^s, \quad i = a, b.$$

By using the linear inverse demand functions, we find that the condition becomes

$$\frac{(1-c)^2}{4} > 3\frac{(1-c)^2}{4\,(1+\gamma)} - 2\left(\frac{1-c}{2+\gamma}\right)^2,$$

which is true as long as $\gamma > 0$. The conclusion is that there is no size discount per se; as long as the retailers are located in separate markets, which is the case for $\gamma = 0$, the manufacturer will receive the same whether the retailers are merged or separated. When $\gamma > 0$, however, the buyers will increase their market power when they merge, which further will improve their position vis-à-vis the supplier in the negotiations. If this is the case, the merged firm will recieve a discount.

Welfare Consequences

What remains, is to assess the oucome at stage one, where the supplier decides on how much to invest to reduce the marginal cost c.

Consider firste the state of downstream separation. From the results above, we can write the supplier's maximization problem at stage one as

$$I_s^* = \arg\max \left\{ \frac{2\Pi_i^s\left(c(I)\right) + \Pi_j^s\left(c(I)\right)\big|_{Q_i=0}}{3} - I \right\}, \tag{44}$$

The FOC for (44) is

$$\frac{1}{3}\left(2\frac{\partial \Pi_i^s}{\partial c} + \frac{\partial\, \Pi_j^s\big|_{Q_i=0}}{\partial c}\right) c'(I) - 1 = 0. \tag{45}$$

If the retailers are merged, the supplier will invest the amount

$$I_m^* = \arg\max \left\{ \frac{\Pi_a^m\left(c(I)\right) + \Pi_b^m\left(c(I)\right)}{2} - I \right\}, \tag{46}$$

which gives us the FOC

$$\frac{\partial \Pi_i^m}{\partial c} c'(I) - 1 = 0. \tag{47}$$

In comparing (45) and (47) it is easy to see that $I_s^* > I_m^*$, and hence $c_s < c_m$, as long as

$$\frac{1}{3}\left(2\frac{\partial \Pi_i^s}{\partial c} + \frac{\partial\, \Pi_j^s\big|_{Q_i=0}}{\partial c}\right) > \frac{\partial \Pi_i^m}{\partial c},$$

which is true for $\gamma > 0$. Hence, the supplier will reduce the marginal cost c more under downstream separation than under downstream merger, as long as there is some degree of competition between the retail stores. This occurs simply because the supplier receives a smaller part of both incremental and total surplus when the retailers are merged than when they are separated, and therefore he also receives a smaller part of the gain from reducing the unit cost c.

However, note that there are *two* effects of downstream merger on consumer welfare. First, the direct monopolization effect: Whenever $\gamma > 0$, the stores will rise the final prices P_a and P_b when they merge, ceteris paribus. Second, there is the effect of the amount invested by the supplier at stage one, which will exacerbate the first effect on final prices.

Conclusion

What we can we conclude from this simple model is that, in a standard framework of constant unit costs and risk neutral players, there are no size discounts per se; if the downstream firms are located in separate markets, they will not increase their countervailing power if they decide to merge. If buyers compete, however, both their market power and their bargaining position vis-à-vis the supplier will be strengthened by merger. The effect of increased buyer power arises because the supplier's status quo position, or disagreement point, is affected by merger: If the buyers are separated, there are effectively two markets, and the supplier's status quo points in each market is unaffected by merger. If the buyers compete in the same market, however, the supplier's status quo profit in this market is reduced when outlets merge.

The intuition behind the result is that, when outlets compete in the same market, a merged buyer's per unit contribution to the supplier's profit is higher than the per unit contribution of a single outlet. Hence, a "big" buyer should recieve more than a "small" buyer.

As for the welfare consequences, we found that the supplier will reduce the amount invested in new technology when the downstream market is concentrated. Because of the monopolization effect, total industry profit will increase, ceteris paribus. This effect is mitigated, however, by a higher unit cost in production.

Considerations The model showed that market power, obtained through local mergers, may be a more important source of buyer power than size per se. Yet, there may also be reasons for size to contribute to buyer power – e.g., if buyers and/ or suppliers are risk averse, or if suppliers face increasing unit costs in production. These assumptions are investigated below.

It may also be that the effects of merger are more severe than those predicted by the model above: A supplier negotiating with two competing retailers may want to supply only one of them – this to create an outside option for himself. If he resorts to this strategy, the outlets are forced to compete for the contract, and hence the supplier may be able to extract all of the realized profit from the retailer who wins. This effect will disappear all at once if the outlets decide to merge.

Finally, the model could be extended to consider endogenous mergers, by introducing a stage either pre- or post-investment (stage one) where the stores are allowed to merge. If this stage appears before the investment stage, the stores will have to take into account the effect of their choice on the supplier's investment decision.

Bargaining With a Risk Averse Supplier

The previous model investigated effects of increasing the buyers' market power, by allowing competing stores to merge, on their bargaining power vis-à-vis the supplier. We found that the the buyers did not obtain size discounts by merging cross border. Instead we found merger between competing stores to be the primary source of buyer power. However, this is only a part of the story, as we will see.

In this section I will assess the effects of cross-border downstream merger on a risk averse supplier's incentives to reduce unit costs in production. The implications of risk aversion on buyer power are investigated by Chae and Heidhues (2004) and DeGraba (2003), among others. Chae and Heidhues utilize NBS, whereas DeGraba assumes that the seller can offer the buyers take-it-or-leave-it contracts. Furthermore, in DeGraba's model the buyers are final customers.

The following is a version of the Chae-Heidhues-model.

Assumptions The economy consists of a manufacturer supplying its product to $N = 2$ downstream markets. The supplier produces the product at a constant marginal cost, c.

In each market a retailer operates as a monopolist, reselling the product to final consumers. Denote a market (or a retail outlet) by $i = a, b$. The retailers face identical demand functions, $D_a(\cdot) = D_b(\cdot) = D(\cdot)$, and demand is falling in the retail price, P_i.

Outlets are allowed to merge, so that a buyer comprises of at least one outlet, and at most two.

The supplier engages in simultaneous private negotiations over two-part tariffs, on the form $T_i = D_i w_i + F_i$, with each of the buyers, where w_i is the wholsale price, D_i is the quantity demanded by buyer i, and F_i is a fixed fee. The buyers have no costs other than T_i.

Finally, it is assumed that both the supplier and the buyers are (equally) risk averse. Specifically, it is assumed that firm i's payoff is represented by the utility function $V_i = U(x_i)$, where x_i represents the firm's profit. Furthermore, it is assumed that $U'(x_i) > 0$ and $U''(x_i) < 0$ for all $x_i \geqslant 0$.

The Bargaining Framework The supplier negotiates simultaneously and privately with each of the buyers by using perfect agents.

The bargaining game is a form of the Rubinstein alternating offers game with risk of breakdown. Specifically we have that in any period between an offer and a counteroffer there is a probability, $q = \lambda\Delta$, that the negotiations will break down, where Δ represents the length of the period, and $\lambda > 0$. The players do not care about the time of settlement, however. As shown by Binmore, Rubinstein and Wolinsky (1986), the outcome of this game will approach NBS as $\Delta \to 0$.

Analysis

Consider the following three-stage game: At stage one the supplier considers how much to invest to reduce the unit cost c. Denote the amount invested by I. It is assumed that $c'(I) < 0$ and $c''(I) > 0$.

At stage two the the buyers and the supplier negotiates supply contracts, as specified by the bargaining framework above. At stage three the retail stores set prices and sell products to final consumers. The supplier can then collect his revenue, as set out in the contracts.

In the following, two cases are considered. First, the case of separation, where each buyer owns one outlet only. Second, the case of concentration, where a single buyer owns both outlets.

1) Separation We can find the SPNE by using backward induction. Starting at stage three, we have that each buyer sets the retail price

$$P_i^* = \arg\max \{D(P_i) P_i - D(P_i)w_i\}, \quad i = a, b. \tag{48}$$

Each buyer then earns the net profit

$$\Pi^* (w_i) = R_i [P_i^* (w_i)] - F_i, \quad i = a, b \tag{49}$$

where $R_i(\cdot)$ is his revenue gross of fixed costs, and F_i is the fixed fee paid to the manufacturer.

In examining the outcome at stage two, again we can use the fact that the parties negotiate two-part tariffs, which removes the problem of double marginalization. In negotiating T_i, the buyer and the seller will simply maximize the total market profit, $R_i(w_i) - D_i c$, with respect to w_i, which implies setting $w_i^* = c$, and then negotiate the splitting of the realized profit through the fixed fee F_i. Using this, we can write the Nash solution as

$$F_i^* = \arg\max \left\{ U\left(R_i^* - F_i\right)\left(U\left(F_i + F_j^*\right) - U\left(d\right)\right)\right\}, \quad i, j = a, b \text{ and } i \neq j, \tag{50}$$

where d is the supplier's breakdown profit, or the fixed fee that outlet j must pay if the negotiations between the supplier and retailer i break down. Let us assume $d = F_j^*$, which says that the supplier receives the same from j whether or not he reaches an agreement with i.

The outcome of the negotiations is implicitly determined by the FOC for (50), which we can write

$$\frac{U'\left(F_i + F_j^*\right)}{U\left(F_i + F_j^*\right) - U\left(F_j^*\right)} = \frac{U'\left(R_i^* - F_i\right)}{U\left(R_i^* - F_i\right)}. \tag{51}$$

Since the markets and the retailers are identical, we know that $R_i^* = R_j^* = R^*$ and $F_i^* = F_j^* = F^*$ in equilibrium. Hence, we can simplify (51) and assert that F^* is implicitly determined by the condition

$$\frac{U'\left(2F^*\right)}{U\left(2F^*\right) - U\left(F^*\right)} = \frac{U'\left(R^* - F^*\right)}{U\left(R^* - F^*\right)}. \tag{52}$$

Already we can evaluate the consequence of risk aversion and size. When the actors are risk neutral, (52) simplifies to

$$\frac{1}{F^*} = \frac{1}{R^* - F^*},$$

which implies that the supplier and the buyer should split the realized market profit equally, $F^* = R^*/2$. When $U''(\cdot) < 0$, however, the bigger party (here: the supplier) gains leverage in the negotiations, and we find that $F^* > R^*/2$. This because the supplier's breakdown payoff is positive, which positively affects the amount of risk he can take in the negotiations.

Let us assume $U(x_i) = x_i^{\alpha}$, where $0 < \alpha \leqslant 1$. Then we can solve (52) for F^* to find that

$$F^* = f(\alpha)R^* = \frac{2^{\alpha}}{3 \times 2^{\alpha} - 2}R^*,$$

which is falling in α – or, put differently, rising in the degree of risk aversion.

2) Concentration Now consider the case of concentration. Since the outlets are located in separate markets, the outcome at stage three is not altered if they decide to merge. The bargaining outcome at stage two is affected, however. The supplier now engages in negotiations with the new merged buyer only, and hence the Nash solution is simply

$$F_i^* = \arg\max \left\{ U\left(R_i^* + R_j^* - F_i - F_j^*\right) U\left(F_i + F_j^*\right) \right\}, \quad i = a, b \text{ and } i \neq j \tag{53}$$

The FOC for (53) is

$$\frac{U'\left(F_i + F_j^*\right)}{U(F_i + F_j^*)} = \frac{U'\left(R_i^* + R_j^* - F_i - F_j^*\right)}{U\left(R_i^* + R_j^* - F_i - F_j^*\right)}. \tag{54}$$

Again, using symmetry, (54) simplifies to

$$\frac{U'\left(2F^*\right)}{U\left(2F^*\right)} = \frac{U'\left(2\left(R^* - F^*\right)\right)}{U\left(2\left(R^* - F^*\right)\right)}, \tag{55}$$

which implies $F^* = R^*/2$ irrespective of the form of $U(\cdot)$. From this we can conclude that the buyers will gain leverage in the negotiations by merging, or by forming an alliance of buyers.

Welfare Consequences

Finally, let us look at the supplier's innovation incentives at stage one. From the outcome of the bargaining game at stage two, we know that the supplier will receive

$$\Pi_s^S = 2f\left(\alpha\right) R^* \tag{56}$$

if he negotiates with the buyers separately, where his share of the market profit is a increasing function of the players' risk aversion. From the analysis above, we have that $f(1) = 1/2$ and $f(\alpha) > 1/2$ for $0 < \alpha < 1$.

When the manufacturer instead negotiates with a big buyer, he receives

$$\Pi_c^S = R^*. \tag{57}$$

From this we can write the supplier's maximization problem at stage one as

$$I_s^* = \arg\max \left\{ 2f\left(\alpha\right) R^*\left(c\left(I\right)\right) - I \right\} \tag{58}$$

in the case of separation, and

$$I_c^* = \arg\max \left\{ R^* \left(c \left(I \right) \right) - I \right\} \tag{59}$$

in the case of concentration. The FOCs of (58) and (59) are

$$2f\left(\alpha\right) R^{*\prime}(\cdot)c'(I) - 1 = 0, \tag{60}$$

and

$$R^{*\prime}(\cdot)c'(I) - 1 = 0, \tag{61}$$

which means that $I_s^* > I_c^*$, and hence $c_s < c_c$, as long as $f(\alpha) > 1/2$. The conclusion is that the supplier will reduce the marginal cost more under separation than under concentration, as long as market actors are risk averse. Therefore, both total industry profit and consumer welfare may fall if buyers merge cross-border.

Conclusion In this section we have established that if sellers and/ or buyers are risk averse, big buyers may gain leverage in the negotiations with their manufacturers. This occurs because a big buyer's per-unit contribution to the seller's utility, is higher than the per-unit contribution of a small buyer. Thus, the supplier is willing to give up more to strike a deal with a big buyer.

Furthermore, because big buyers receive greater shares of both incremental and final profit, the supplier will reduce the amount invested in technology. Hence, both total industry profit and consumer welfare might fall.

Convex Technologies and Buyer Power

The result in the previous section arose from the fact that the supplier's utility function was assumed to be strictly concave in the number of buyers supplied, because of the presence of risk aversion. Whenever this is the case, a big buyer will receive a discount because its average (per unit sold) contribution to the supplier's utility is larger than the per unit contribution of smaller buyers.

Yet, there are other reasons as to why a supplier's payoff function might be concave. An apparent example is if the supplier's costs are strictly convex. If this is the case, we should be able to observe the same effects of downstream merger as in the previous model, ceteris paribus.

The consequences of convex costs for both buyer power and the suppliers' choice of technology, are investigated by Inderst and Wey (2003, 2005b)), I&W hereafter. They find that the presence of big buyers may strengthen a manufacturer's incentives to invest in a (less convex) technology that reduces unit costs but simultaneously increases operational costs in production. They also endogenize the horizontal mergers, and among other things they find that retailers may merge to affect upstream choice of technology.

This summary will concentrate on the articles' discussion of suppliers' incentives to invest.

Assumptions The original model describes a market with two suppliers selling differentiated goods to two retailers $i = a, b$. However, because the main result with respect to the suppliers' investment incentives are not altered by it, I will assume only one supplier, denoted by A.

The retailers operate as monopolists in independent markets. This assumption is included to focus on the buyer's size alone as a factor, and not his market power.

It is assumed that contracts are sufficiently complex to assure efficient negotiations.[18] Specifically it is assumed that the parties maximize the net surplus generated by the transaction, and then that the players simply negotiate the splitting of this net surplus. A bilateral bargaining framework (see below) is used to set out the terms.

Since the retailers are independent monopolists, and accordingly supply and total industry profit stays the same, the only thing affected by a downstream merger is the number of independently negotiating parties, and through this the distribution of profit between suppliers and retailers.

Finally, I&W assume that the supplier can adopt one of two technologies, $t \in \{\alpha, \beta\}$, where α has high marginal costs but low operational costs, while β has low marginal costs but relatively high operational costs. The decision of which technology to use, has to be made up front, and the investment costs will not affect the outcome of the upcoming negotiations with the retailer(s).

The Bargaining Framework Bargaining is carried out between the supplier and one retailer (merged or not merged), and all negotiations are conducted simultaneously and privately through the use of perfect agents. I&W assume that contracts are contingent on market structure, defined as the number of active buyers, and that contracts are negotiated for all contingencies in case the supplier can not reach agreement with some of the buyers.

[18] This is ensured e.g. by assuming non-linear contracts, or simply by assuming "joint-profit maximization".

In the following analysis I will assess the consequences of both contingent and non-contingent contracts.

In their 2003-paper, I&W resort to the axiomatic solution concept known as the Shapley value (see Section 3 on bargaining). They do not, however, support it by specifying a non-cooperative game. Though, in their 2005-paper, they show that other bargaining procedures, e.g. simultaneous Nash bargaining (which is supported by the non-cooperative Rubinstein altering offers game), reproduce their results. More on this below.

Analysis

Convex Costs and Consequences for Buyer Power First we have to identify the total industry profit, and then determine how it is distributed between the players under the different market structures. In this section, I will assume that the bargainig framework is a form of the alternating offers game with no risk of breakdown.

Denote the manufacturer's total costs by $C(Q_a + Q_b)$, and assume that $C'(\cdot) > 0$ and that $C''(\cdot) > 0$. Buyers have no costs other than the per unit price and the fixed fee charged by the supplier.

The buyers face identical market demand functions, $Q_a(\cdot) = Q_b(\cdot) = Q(\cdot)$. Furthermore, it is assumed that market demand is falling in consumer price, p_i. At the final stage of the game, after the contracts have been negotiated, the retailers maximize their profit by setting the monopoly price p_i^m. Hence, total industry profit can be written.

$$\Pi^* = \max_{p_a, p_b} \left\{ Q\left(p_a\right) p_a + Q\left(p_b\right) p_b - C\left[Q(p_a) + Q(p_b) \right] \right\}. \tag{62}$$

Since the supplier's unit costs are rising, $C'' > 0$, it can be shown that the total industry profit $\Pi^*(n)$ is strictly concave in the number n of buyers served. Which implies

$$\Pi^*(1) > \frac{\Pi^*(2)}{2}. \tag{63}$$

As we will see, this has implications for the amount of that a buyer will receive in the negotiations.

Consider first the situation where the buyers are separated. From the assumptions stated above, we have that the bargaining problem reduces to splitting the surplus rent of the transaction. Since it is assumed that the supply contracts are determined by an alternating offers game, we can resort to NBS.

Denote buyer i's share of the profit by x_i. Then we can write the outcome of the negotiations between the supplier and retailer i as

$$x_i^* = \arg\max \left\{ x_i \left(\Pi^*(2) - x_i - x_j - x_j^d \right) \right\}, \quad i,j = a,b \text{ and } i \neq j, \tag{64}$$

where x_j^d is the share that j receives in case there is disagreement in the negotiations with i. Since the players negotiate contracts for all possible contingencies, we know that

$$x_j^d = \arg\max \left\{ x_j \left(\Pi^*(1) - x_j \right) \right\}, \tag{65}$$

which gives

$$x_j^d = \frac{\Pi^*(1)}{2}. \tag{66}$$

Substituting (66) into (64), and using symmetry, we find that the equilibrium shares of the two buyers are

$$x_a^* = x_b^* = \frac{\Pi^*(2)}{3} - \frac{\Pi^*(1)}{6}, \tag{67}$$

which amounts to

$$x_a^* + x_b^* = \frac{2\Pi^*(2) - \Pi^*(1)}{3}. \tag{68}$$

Now, consider the situation where the two downstream firms are merged. Denote the merged firm's share of the profitt as x_{ab}. When negotiating with the merged buyer, the supplier's disagreement payoff is zero, so the outcome of the negotiations reduces to

$$x_{ab}^* = \arg\max \left\{ x_{ab} \left(\Pi^*(2) - x_{ab} \right) \right\}, \tag{69}$$

which simply gives

$$x_{ab}^* = \frac{\Pi^*(2)}{2}. \tag{70}$$

In comparing (68) and (70) we can see under which conditions a big buyer will receive a discount. Specifically, we have that $x_{ab}^* > x_a^* + x_b^*$ as long as

$$\Pi^*(1) > \frac{\Pi^*(2)}{2},$$

i.e., whenever total industry profit is concave in the number of outlets served. This also implies that big buyers are punished if the converse is true – that is, if total industry profit is strictly convex in the number of active buyers. The latter will be the case if unit production costs are falling, $C'' < 0$.

Supplier Incentives

To evaluate the supplier's incentives to invest, we assume that the manufacturer can pay I up front to change from technology α to β.

At the second stage, contracts are negotiated. In this section I will utilize the Shapley value to determine the contracting equilibrium, as in I&W (2003).

Let N denote the grand coalition, while $N\backslash i$ denotes the grand coalition without player i, where $i = A, a, b$. Also, let Π_K^* denote industry profit under coalition K. Total industry profit is identical to that specified in the previous section. However, now the production technology $t = \alpha, \beta$ is endogenously determined:

$$\Pi_N^* = \max_{p_a, p_b} \left\{ Q\left(p_a\right) p_a + Q\left(p_b\right) p_b - C_t \left[Q(p_a) + Q(p_b) \right] \right\}. \tag{71}$$

To be specific, I will assume a simple linear direct demand function on the form $Q_i = 1 - p_i$. Furthermore, as in I&W (2003), I will assume the following about the two technologies: $C_t\left(Q_a + Q_b\right) = F_t + c_t\left(Q_a + Q_b\right)$, $F_\alpha = 0 < F_\beta$ and $c_\beta < c_\alpha$. Note that both technologies are assumed to be linear, not strictly convex, as in the previous section. This is done to focus on the supplier's incentives to switch from a technology with low operational costs and high unit costs ("convex") to one with high operational costs but low unit costs ("less convex").

As mentioned above, to adopt β, the supplier has to make an investment decision I up front. And the size of I does not affect the results of the upcoming negotiations with the retailers. The question is, what are the incentives for incurring I, that allows the firm to innovate and adopt technology β? And how are these incentives affected by a downstream merger? What we have to find, is the individual actors' Shapley values in the settings of downstream separation vs. downstream merger.

First, look at the supplier's share of the surplus when the retailers are separated (see tab. 1 below).

From table 1 and the Shapley value, we have that the supplier's share when the retailers are separated is

$$x_A^s = \frac{\Pi_N + \Pi_{N/i}}{3}. \tag{72}$$

By using the demand and cost functions above, we find that total industry profit with

Prob.	**Coalition**	**Marg. contrib.,** $\Delta_i \Pi(N)$
$\frac{1}{6}$	A, a, b	$0, \Pi_{N\backslash b}, \Pi_N - \Pi_{N\backslash b}$
$\frac{1}{6}$	A, b, a	$0, \Pi_{N\backslash a}, \Pi_N - \Pi_{N\backslash a}$
$\frac{1}{6}$	a, A, b	$0, \Pi_{N\backslash b}, \Pi_N - \Pi_{N\backslash b}$
$\frac{1}{6}$	b, A, a	$0, \Pi_{N\backslash a}, \Pi_N - \Pi_{N\backslash a}$
$\frac{1}{6}$	a, b, A	$0, 0, \Pi_N$
$\frac{1}{6}$	b, a, A	$0, 0, \Pi_N$

Table 1: All permutations of the grand coalition N, and the players' associated marginal contribution to the coalition when the retailers are not merged.

Prob.	**Coalition**	**Marg. contrib.,** $\Delta_i \Pi(N)$
$\frac{1}{2}$	A, ab	$0, \Pi_N$
$\frac{1}{2}$	ab, A	$0, \Pi_N$

Table 2: All permutations of the grand coalition N, and the players' associated marginal contribution to the coalition when the retailers are merged.

both retailers active is

$$\Pi_N^* = \frac{(1-c_t)^2}{2} - F_t, \tag{73}$$

and that total industry profit with only one active retailer is

$$\Pi_{N\backslash i}^* = \frac{(1-c_t)^2}{4} - F_t. \tag{74}$$

Now, using exp. (72), (73) and (74), we can identify the supplier's share as

$$x_A^s = \frac{(1-c_t)^2}{4} - \frac{2F_t}{3} = \Pi_{N\backslash i}^* + \frac{F_t}{3}. \tag{75}$$

Consider now the situation where the retailers are merged. A will then have only one party to negotiate his share of Π_N with. Denote the merged downstream firm by ab. We set up a table like before (see table 2 above), and discover that the suppliers share simply has changed to

$$x_A^m = \frac{\Pi_N^*}{2} = \frac{(1-c_t)^2}{4} - \frac{F_t}{2} = \Pi_{N\backslash i}^* + \frac{F_t}{2}. \tag{76}$$

From (75) and (76) we see that the supplier receives more under downstream merger than under downstream separation, as long as F_t is positive. With no operational costs, $F_t = 0$, we see that he will receive the same share under both market structures.

What about the incentives to innovate? First, look at the incentives under separation: With use of technology α, the supplier receives

$$x_A^s|_{t=\alpha} = \frac{(1-c_\alpha)^2}{4}.$$

Whereas if he applies technology β, he will receive

$$x_A^s|_{t=\beta} = \frac{(1-c_\beta)^2}{4} - \frac{2F_\beta}{3}.$$

We know that he will innovate as long as

$$x_A^s|_{t=\beta} - x_A^s|_{t=\alpha} \geqslant I,$$

and for $c_\beta = 0$ this is true as long as c_α is higher than

$$\underline{c}_\alpha^s = \frac{3-\sqrt{9-24F_\beta-36I}}{3}. \tag{77}$$

Now, let us look at his incentives when the downstream firms are merged. With technology α, the supplier receives

$$x_A^m|_{t=\alpha} = \frac{(1-c_\alpha)^2}{4}.$$

With technology β, he will get

$$x_A^m|_{t=\beta} = \frac{(1-c_\beta)^2}{4} - \frac{F_\beta}{2}.$$

And we have the condition for the supplier to innovate:

$$x_A^m|_{t=\beta} - x_A^m|_{t=\alpha} \geqslant I$$

If $c_\beta = 0$, this condition is satisfied as long as c_α is higher than

$$\underline{c}_\alpha^m = 1-\sqrt{1-2F_\beta-4I}. \tag{78}$$

From (77) and (78) it is easy to see that, with use of the inefficient technology α, the smallest possible unit cost for which the supplier still will innovate, is lower under downstream merger than under downstream competition: So, as $\underline{c}_{\alpha}^{m} < \underline{c}_{\alpha}^{s}$, it is more likely that an innovation will occur when the downstream firms are merged.

This occurs because big buyers negotiates less "at the margin" compared to smaller buyers, as was demonstrated in the previos section with use of NBS. Hence, the supplier can roll over a larger fraction of the operational costs to the retailers when the retailers are merged than when they are not. And as the operational costs are relatively high with use of β, this technology becomes relatively more profitable under downstream merger.

Simultaneous Nash Bargaining

To clarify the result from above, let us evaluate the investment incentives once again using NBS. As in the first section, I will assume a form of the alternating offers game. However, now the supplier and the buyers are not necessarily equal with respect to "bargaining strength". Hence, we let the powers θ and $1-\theta$ be a reflection of the respective parties' time valuation.

Non-linear prices on the form $\{w_i, S_i\}$, where w_i is the wholesale price and S_i is a fixed fee, are allowed to assure efficiency. Furthermore, in this section I will consider both contingent and non-contingent contracts. This might clarify the intuition behind the results we obtained by using the Shapley value.

With respect to the economy (technologies, demand functions, number of firms, etc.), I will keep all assumptions from above.

Consider the situation where the downstream firms are separated. First we have to identify the Nash product.

Note that, with positive operational (fixed) costs, the two bargaining problems are interdependent, in that the number of active firms determines the splitting of the fixed cost. However, when using technology α, because of the assumption of zero fixed costs, the bargaining problems become independent.

Let us start out by analyzing the bargaining outcome when $t = \alpha$. Since the negotiations are independent, the problem reduces to splitting the monopoly profit in each market. The Nash solution is

$$\{w_i^*, S_i^*\} = \arg\max \left\{ \left(\Pi_{N\backslash j} - S_i\right)^{\theta} \left(Q_i \left(w_i - c_\alpha\right) + S_i\right)^{1-\theta} \right\}, \quad i = a, b, \tag{79}$$

where $\Pi_{N\backslash j}$ is the monopoly profit of retailer i. The FOCs of (79) are

$$(1-\theta)\frac{Q_i+\frac{\partial Q_i}{\partial w_i}(w_i-c_\alpha)}{S_i+Q_i(w_i-c_\alpha)}+\theta\frac{\partial\Pi_{N\backslash j}/\partial w_i}{\Pi_{N\backslash j}-S_i}=0,\quad i=a,b, \tag{80}$$

and

$$\frac{1-\theta}{S_i+Q_i(w_i-c_\alpha)}-\frac{\theta}{\Pi_{N\backslash j}-S_i}=0,\quad i=a,b. \tag{81}$$

(80) and (81) dictate that the wholesale price be set equal to the unit cost, $w_i^*=c_\alpha$, avoiding double marginalization, and that the fixed fee is set so that the realized profit is split between the retailer and the supplier according to their bargaining powers, that is

$$S_i^*\big|_{t=\alpha}=S_j^*\big|_{t=\alpha}=S^*\big|_{t=\alpha}=(1-\theta)\,\Pi_{N\backslash j}^*(c_\alpha)\,,\quad i,j=a,b. \tag{82}$$

We can conclude that the supplier will receive a total of

$$x_A^s\big|_{t=\alpha}=x_A^m\big|_{t=\alpha}=2\,S^*\big|_{t=\alpha}=(1-\theta)\,\Pi_N^*(c_\alpha)\,.$$

Because of the fact that the bargaining problems are independent (zero operational costs), the supplier's total profit will be the same when negotiating with a large buyer.

Now, if $t=\beta$, we have to subtract the fixed cost F_β from the supplier's gross profit (zero marginal costs). The Nash solution in negotiating with retailer i, when the outlets are separated, then becomes

$$\begin{aligned}\{w_i^*,S_i^*\} &= \arg\max\left\{\left(\Pi_{N\backslash j}-S_i\right)^\theta\left(Q_iw_i+S_i+Q_jw_j+S_j-F_\beta-\left(S_d+w_dQ_d-F_\beta\right)\right)^{1-\theta}\right\}\\ &= \arg\max\left\{\Delta P_i^\theta\times\Delta P_A^{1-\theta}\right\},\quad i,j=a,b\ \text{ and }\ i\neq j,\end{aligned} \tag{83}$$

where $(S_d+w_dQ_d-F_\beta)$ is the supplier's disagreement payoff. For notational simplicity, ΔP_i and ΔP_A represents the change in the retailer's and the producer's payoff as result of reaching agreement.

The size of the disagreement payoff depends on whether or not the contracts are contingent. Let us assume contingent contracts, like I&W. The disagreement payoff then is determined by

$$\{w_d^*,S_d^*\}=\arg\max\left\{\left(\Pi_{N\backslash i}-S_d\right)^\theta\left(Q_sw_d+S_d-F_\beta\right)^{1-\theta}\right\}. \tag{84}$$

The FOCs for (84) are

$$(1-\theta)\,\frac{Q_j + w_d\frac{\partial Q_j}{\partial w_j}}{S_d - F_\beta + w_d Q_j} + \theta\frac{\partial \Pi_{N\backslash i}/\partial w_d}{\Pi_{N\backslash i} - S_d} = 0, \tag{85}$$

and

$$\frac{(1-\theta)}{S_d - F_\beta + w_d Q_j} - \frac{\theta}{\Pi_{N\backslash i} - S_d} = 0. \tag{86}$$

Eq. (85) and (86) says that the wholesale price should be set equal to marginal costs, $w_d^* = c_\beta = 0$, and again that the fixed fee should split the gross profit, $\Pi_{N\backslash i}(c_\beta)$, and the fixed cost, F_β, between the retailer and the supplier according to their bargaining powers:

$$S_d^* = (1-\theta)\,\Pi_{N\backslash i}^* + \theta F_\beta. \tag{87}$$

From this we find that the supplier's (net) profit in the state of disagreement is

$$S_d^* - F_\beta = (1-\theta)\,\Pi_{N\backslash i}^* + \theta F_\beta - F_\beta = (1-\theta)\left(\Pi_{N\backslash i}^* - F_\beta\right) \tag{88}$$

Now we can proceed to find the FOCs for (83), which are

$$(1-\theta)\,\frac{Q_i + w_i\frac{\partial Q_i}{\partial w_i}}{\Delta P_A} + \theta\frac{\partial \Pi_{N\backslash j}/\partial w_i}{\Delta P_i} = 0, \quad i = a, b, \tag{89}$$

and

$$\frac{1-\theta}{\Delta P_A} - \frac{\theta}{\Delta P_i} = 0, \quad i = a, b. \tag{90}$$

Using symmertry, result (88) from above, and the fact that $w_i^* = w_j^* = 0$, we can solve for S_i^* to find

$$S_i^*|_{t=\beta} = S_j^*\big|_{t=\beta} = S^*|_{t=\beta} = \frac{(1-\theta^2)\Pi_{N\backslash i}^* + \theta^2 F_\beta}{1+\theta}, \quad i = a, b. \tag{91}$$

Hence, the supplier's net profit becomes

$$\begin{aligned} x_A^s\big|_{t=\beta} &= 2\,S^*|_{t=\beta} - F_\beta = 2\frac{(1-\theta^2)\Pi_{N\backslash i}^* + \theta^2 F_\beta}{1+\theta} - F_\beta \\ &= \frac{\theta-1}{1+\theta}\left((1+2\theta)\,F_\beta - (1+\theta)\,2\Pi_{N\backslash i}^*\right), \end{aligned} \tag{92}$$

which is zero for $\theta = 1$ (all bargaining power to the downstream firms) and equal to the total realized net profit, $2\Pi^*_{N\backslash i} - F_\beta$, for $\theta = 0$ (all bargaining power to the supplier).

Note that in using the linear demand function above, and assuming $\theta = 1/2$, we find that the supplier's profit simplifies to

$$x^s_A\big|_{t=\beta,\theta=\frac{1}{2}} = \frac{1}{4} - \frac{2F_\beta}{3}, \tag{93}$$

which is exactly what we found by using the Shapley value.

Now, if the retailers merge, what will be the supplier's profit? NBS is

$$\{w^*_{ab}, S^*_{ab}\} = \arg\max\left\{(\Pi_N - S_{ab})^\theta\,(Q_{ab}w_{ab} + S_{ab} - F_\beta)^{1-\theta}\right\}. \tag{94}$$

The FOCs for (94) are

$$(1-\theta)\,\frac{Q_{ab} + w_{ab}\frac{\partial Q_{ab}}{\partial w_{ab}}}{S_{ab} + w_{ab}Q_{ab} - F_\beta} + \theta\frac{\partial\Pi_N/\partial w_{ab}}{\Pi_N - S_{ab}} = 0, \tag{95}$$

and

$$\frac{1-\theta}{S_{ab} + w_{ab}Q_{ab} - F_\beta} - \frac{\theta}{\Pi_{ab} - S_{ab}} = 0. \tag{96}$$

Solving eq. (95) and (96) for the wholesale price yields $w^*_{ab} = 0$, as before. Furthermore, the fixed fee should be set to

$$S^*_{ab}|_{t=\beta} = (1-\theta)\,\Pi^*_N + \theta F_\beta, \tag{97}$$

so that the supplier's profit becomes

$$x^m_A|_{t=\beta} = S^*_{ab}|_{t=\beta} - F_\beta = (1-\theta)\,(\Pi^*_N - F_\beta)\,. \tag{98}$$

By using the linear demand function from above, and setting $\theta = 1/2$, we find that the supplier's net profit simplifies to

$$x^m_A\big|_{t=\beta,\theta=\frac{1}{2}} = \frac{1}{4} - \frac{F_\beta}{2}. \tag{99}$$

Again, exactly what we found by using the Shapley value. Comparing (92) and (98), we observe that $x^s_A|_{t=\beta} = x^s_A|_{t=\beta}$ if $\theta = 0$ or $\theta = 1$, and that $x^s_A|_{t=\beta} < x^s_A|_{t=\beta}$ if $0 < \theta < 1$.

The conclusion is that the results from the previous section are reproduced when applying simultaneous Nash bargaining – given a proper specification of the disagreement payoffs, and granted that the parties are equal with respect to bargaining power. Furthermore, using NBS helps to clarify the result:

The supplier, in using a technology with high operational costs, will receive more in negotiating with one large buyer compared to what he will receive in negotiating with several small buyers. The reason is that when negotiating with small buyers, the supplier has to pay the operational cost even if he can not reach an agreement with one of buyers; the fixed operational cost appears both in the supplier's disagreement payoff and in his final payoff. In the situation with one large buyer, however, the large buyer's demand is solely responsible for inflicting the fixed cost on the supplier. Hence, he should also be charged for it. That is, a small buyer is to a lesser degree "responsible" for setting off the fixed cost than a large buyer is.

Non-contingent contracts The intuition behind the result becomes particularly clear if we allow the supplier only to sign non-contingent contracts with the buyers. With non-contingent contracts, we can show that the supplier is forced to bear all of the operational cost himself whenever negotiating with small buyers.

When signing non-contingent contracts, the supplier will receive the same from firm j irrespective of what happens in negotiations with i. Hence, for the analysis to be meaningful, we have to assume that the supplier's bargaining power is sufficiently high, and the fixed cost sufficiently small, for the supplier to supply j even if he can not reach agreement with i – that is, we will assume $S_j^* > F_\beta$. The Nash solution when negotiating with i (using $w_i^* = w_j^* = 0$) becomes

$$\begin{aligned} S_i^* &= \arg\max \left\{ \left(\Pi_{N\backslash j}^* - S_i\right)^\theta \left(S_i + S_j - F_\beta - \left(S_j^* - F_\beta\right)\right)^{1-\theta} \right\}, \\ &\quad \text{where} \quad i,j = a,b \quad \text{and} \quad i \neq j \end{aligned} \tag{100}$$

The FOC for (100) is

$$\frac{1-\theta}{S_i + \underbrace{S_j - S_j^*}_{0}} - \frac{\theta}{\Pi_{N\backslash j}^* - S_i} = 0. \tag{101}$$

Note that both the fixed cost and the fixed fee from firm j disappear from (101). Solving for

S_i^* yields

$$S_i^*\big|_{t=\beta} = S_j^*\big|_{t=\beta} = S^*\big|_{t=\beta} = (1-\theta)\,\Pi_{N\backslash i}^*, \tag{102}$$

and hence the supplier's net profit is simply

$$x_A^s\big|_{t=\beta} = (1-\theta)\,\Pi_N^* - F_\beta. \tag{103}$$

That is, with non-contingent contracts, the supplier has to pay all of the fixed cost himself. Note that for this to be an equilibrium, $(1-\theta)\,\Pi_{N\backslash i}^* \geqslant F_\beta$ has to hold.

Again, there are two apparent reasons for this result: 1) The fixed cost has to be payed whether the individual firm chooses to sign a deal with the supplier. 2) Firm j is active and pays the same whether i comes to an agreement with the supplier. The operational cost could therefore be considered as a sunk cost when negotiating with several small buyers, and thus the individual firms should not be charged for it.

Conclusion

The analysis of this section has shown that big buyers will receive discounts as long as total industry profit is strictly concave in the number of buyers served – which is the case if the supplier's unit costs are rising. Also, we found that big buyers are forced to bear more of inframarginal (or fixed production) costs. Hence, it may be more profitable for a supplier facing big buyers to switch from a technology with relatively low fixed production costs and high marginal costs (convex), to a technology with relatively high fixed production costs and low marginal costs (less convex), compared to a supplier facing small buyers.

Considerations The result rests on the inclusion of high operational costs if the firm were to use technology β. With operational costs attached to β, the supplier will roll over a larger fraction of these costs to the retailers when they are merged than when they are not. The result is that when facing a big buyer, the supplier is more concerned with containing marginal costs than reducing operational costs, wheras the opposit is true for downstream separation.

If the new technology were not to include higher inframarginal costs, however, and only entails reducing the marginal costs, the supplier's investment incentives are weakened when facing a big buyer – granted that both α and β are strictly convex.

Finally, we should note that the model could be used to investigate incentives for product innovation. Because a big buyer is able to appropriate more of the surplus when unit costs are rising, the supplier's incremental surplus from introducing a (new) product with a convex production technology, is smaller when he is facing big buyers. Hence, incentives to introduce new products may be lessened as the downstream market becomes more concentrated.

Outside Options and Buyer Power

So far, we have found that size discounts may arise if suppliers and/ or buyers are risk averse, or if suppliers have convex costs. However, there might yet be another reason for cross-border mergers to be profitable for buyers: Big buyers face higher total demand. Hence, it may be reasonable to assume that big buyers more easily than smaller ones can threaten to integrate backwards. If the threat of integrating backwards is credible, then, according to the outside option principle, the bargaining outcome should grant the big buyer a more favourable deal. This is formalized by I&W (2005a). As in their previous model, they find the dynamic welfare effects to be positive.

Assumptions The model assumes one supplier serving $N \geqslant 2$ identical independent downstream markets with a single product. The good is produced at a constant unit cost of c.

There are two retailers $r = a, b$ in each market, so that there exists a total of $2N$ retailers, and they compete in quantities.

To model buyer power, a set I of buyers is introduced, and each buyer $B_{i \in I}$ is allowed to own a maximum of one outlet in each market. (Again this assumption is included to abstract from standard monopolization effects.) The number of firms n_i owned by B_i, is a measure of this buyer's buyer power.

Again, two-part tariffs on the form $T_i = w_i Q_i + S_i$ are allowed to assure efficient contracts. Though not made explicit in their paper, I&W also assume the contracts to be non-contingent. This means that, in any given market, whenever the supplier is in a state of disagreement with retailer a, retailer b will operate at the *anticipated* equilibrium level, and vice versa.

Finally, a buyer B_i can choose to produce the product himself, at a constant unit cost of c_i. To do this, the buyer must pay a fixed cost of F up front.

The Bargaining Framework The supplier engages in simultaneous pairwise negotiations with each buyer, through the use of perfect agents. Every party forms rational expectations about the outcome in all other negotiations.

We resort to NBS to determine the tariffs. It is assumed that the parties are equal in bargaining skills, so that the solution is symmetric. There is no risk of breakdown in the negotiations.

As described above, we have that each buyer has access to an alternative supply option, specifically meaning that the mentioned buyer could voluntary opt out of the negotiations, incur the fixed cost F, and start supplying himself for a unit cost of c_i. According to the outside option principle, the alternative supply option is credible only as long as its value exceeds what the mentioned buyer would receive if he were to continue the negotiations. Therefore it should only operate as a constraint on NBS. Furthermore, whenever the outside option *is* credible, the negotiating parties' share of the pie is fully determined by it.[19]

Analysis

Since the the model allows for two-part tariffs, there exists a unique bargaining equlibrium where the wholesale price is set to $w^* = c$, and where each retailer puts his Cournot-quantity Q^c out on the market, earning the unique Cournot-profit $\Pi^c(c)$ minus the fixed fee S_i. Hence, the bargaining problem is reduced to determining the size of S_i.

Furthermore, since the manufacturer's technology is linear and without fixed operational costs, and as contracts are non-contingent, we can treat the bargaining problems as being independent from each other. Thus, we can write the outcome of the negotiations between the supplier and buyer i as

$$\begin{aligned} S_i^* &= \arg\max \left\{ n_i S_i \left(n_i \Pi^c - n_i S_i \right) \right\}, \\ & \quad \text{s.t.} \quad n_i \left(\Pi^c(c) - S_i \right) \geqslant n_i \Pi_o^c(c_i, c) - F, \end{aligned} \tag{104}$$

where $n_i \Pi_o^c(c_i, c) - F$ represents the value of the buyer's outside supply option. (104) says that B_i pays a fixed fee that amounts to $n_i S_i^*$ – that is, S_i^* in each market he operates.

From (104) we can see that if the outside option of buyer i is not credible, the bargaining outcome is simply

$$S_i^* = \frac{\Pi^c}{2}, \tag{105}$$

which means that the supplier receives half of the buyer's Cournot profit in every market

[19] See the subsections on outside options in the section on bargaining.

where B_i operates. If i's outside option is credible, however, the solution becomes

$$S_i^* = \frac{n_i\left(\Pi^c(c) - \Pi_o^c(c_i, c)\right) + F}{n_i}. \quad (106)$$

Note that it is the buyer's size, together with c_i and F (both exogenously given), which determines the credibility of the outside option. To see this, look at the condition for the outside option to be credible:

$$n_i \frac{\Pi^c(c)}{2} < n_i \Pi_o^c(c_i, c) - F,$$

which we could rearrange to obtain

$$\frac{\Pi^c(c)}{2} < \frac{n_i \Pi_o^c(c_i, c) - F}{n_i}. \quad (107)$$

As we can see, the right hand side of exp. (107) is clearly rising in n_i, so that as the buyer grows, his outside option is more likely to become credible.

Welfare Consequences

Consider now the supplier's incentive to reduce his unit cost c.[20]

First, note that because the retailers compete in quantities, the profit $\Pi_o^c(c_i, c)$ of a retailer owned by a buyer that has invoked his outside supply option, is rising in c and falling in c_i, so that $\partial \Pi_o^c(c_i, c)/\partial c > 0$ and $\partial \Pi_o^c(c_i, c)/\partial c_i < 0$. By the same reasoning we have that the profit $\Pi^c(c, c_i)$ of a retailer that faces a competitor that is "self-supplied", is falling in c and rising in c_i, so that $\partial \Pi^c(c, c_i)/\partial c < 0$ and $\partial \Pi^c(c, c_i)/\partial c_i > 0$.

Now, let us look at an economy with $N = 2$ markets. There are three possible downstream structures to consider: 1) The market structure with four small buyers, denoted ss, 2) a structure with two small buyers and one big buyer, denoted sm, and finally 3) the market structure with two big buyers, denoted mm.

Assume that the fixed cost of resorting to one's outside option lies in the range

$$\Pi_o^c(c_i, c) - \frac{\Pi^c(c)}{2} < F < 2\left(\pi_o^c(c_i, c) - \frac{\Pi^c(c)}{2}\right), \quad (108)$$

[20] Inderst and Wey (2005a) also allow for the buyer to reduce the unit costs of his outside option, which strengthens the derived welfare effects. Here we assume that the unit cost of the outside option is fixed at c_i.

so that the outside option becomes credible for a buyer that owns $n_i = 2$ outlets, but is not so for a small buyer.

Consider first the market structure ss. There exists a total of four buyers, and because their outside options are not credible, the supplier receives $S_i^s = \Pi^c(c)/2$ from each of them. The suppplier's total income, denoted x_{ss}, then is

$$x_{ss} = 2\Pi^c(c). \tag{109}$$

Hence, his incentives to reduce his unit cost is determined by

$$-\frac{\partial x_{ss}}{\partial c} = \underbrace{-2\frac{\partial \Pi^c(c)}{\partial c}}_{+}, \tag{110}$$

which is positive. But what would happen if one of the buyers were to merge with one of the outlets in the opposite market? Because of assumption (108) above, this buyer's outside option now becomes credible, and the fixed fees payed from this buyer's two outlets are determined by

$$S_i^m = \frac{2\left(\Pi^c(c, c_i) - \Pi_o^c(c_i, c)\right) + F}{2}. \tag{111}$$

Since the income from the two separated outlets is not affected by the merger, the supplier's total income now amounts to

$$x_{sm} = 2\left(S_i^s + S_i^m\right) = \Pi^c(c, c_i) + 2\left(\Pi^c(c, c_i) - \Pi_o^c(c_i, c)\right) + F, \tag{112}$$

which for reasonable values of c and c_i is smaller than x_{ss}. To see this, assume $c_i = c$. Then we have $\Pi^c = \Pi_o^c$ and $F < \Pi^c$ (the latter follows from (108)), and therefore $x_{sm} = \Pi^c + F < 2\Pi^c = x_{ss}$.

As before, we determine the supplier's incentives to reduce his unit cost by

$$-\frac{\partial x_{sm}}{\partial c} = \underbrace{-3\frac{\partial \Pi^c(c, c_i)}{\partial c}}_{+} + \underbrace{2\frac{\partial \Pi_o^c(c_i, c)}{\partial c}}_{+}, \tag{113}$$

which clearly is higher than the gain under complete downstream separation, exp. (110).

Now, as the final two outlets merge, all fixed fees are determined by exp. (111), so that the supplier's total income becomes

$$x_{mm} = 4S_i^m = 4\left(\Pi^c(c, c_i) - \Pi_o^c(c_i, c)\right) + 2F.$$

We can easily see that the supplier's total income has been further reduced: If $c_i = c$, then we simply have that $x_{mm} = 2F < \Pi^c + F = x_{sm}$. As for the supplier's incentives, we can see that he will gain

$$-\frac{\partial x_{mm}}{\partial c} = \underbrace{-4\frac{\partial \Pi^c(c, c_i)}{\partial c}}_{+} + \underbrace{4\frac{\partial \Pi_o^c(c_i, c)}{\partial c}}_{+}, \tag{114}$$

from an incremental reduction in c, which clearly is higher than that of exp. (113).

To summarize, we found that $x_{ss} > x_{sm} > x_{mm}$, so that the supplier's total income shrinks as the buyers grow larger. This is immediately intuitive, since, as long as the buyer is large enough and/ or the fixed cost of integrating backwards is low enough, the average (per store) net profit that a large buyer can realize by producing the product himself, exceeds one half of the Cournot profit, which is what any retail store will realize when purchasing the product from the supplier. Hence, to prevent the big buyer from integrating backwards, the supplier simply offers him the value of the outside option – which makes the buyer indifferent between accepting the offer from the supplier and integrating backwards.

Also, we found that $|\partial x_{ss}/\partial c| < |\partial x_{sm}/\partial c| < |\partial x_{mm}/\partial c|$, so that the supplier's gain from reducing the unit cost c increases as the downstream market becomes more concentrated. This is also intuitive, since there is no reason for the supplier to grant the big buyer more of the surplus than what is determined by the buyer's outside option. Hence, the supplier can extract all of the gain from any invention that increases the surplus above the value of the buyer's outside option.

Conclusion

The above analysis showed that big buyers are *more likely* than smaller buyers to receive a discount from the supplier, as is to be expected. However, we also found that the supplier's incentive to reduce his unit cost *increases* as the buyers grow larger – which is not immediately intuitive, since we assumed constant unit costs (not rising, as in the section on convex technologies).

The results came about as a consequence of the fact that big buyers have more valuable alternative supply options, so that the supplier has to give up a larger part of the surplus to strike a deal with them. The reason is that big buyers face higher total demand, and thus they have more units over which they can spread the fixed cost of integrating backwards. Hence, the outside option of a big (small) buyer is more (less) likely to be credible. Furthermore, whenever a big buyer's threat of integrating backwards *is* credible, then, according to the outside option principle, the supplier's income from this buyer is fully determined by the outside option. The supplier simply "buys off" the big buyer, by offering him the exact value of the outside option (or marginally more), and then pockets the full (direct) gain in the surplus rent as he reduces the unit costs, plus the (indirect) gain from reducing the value of the big buyer's outside options.

4.2 Product Innovation

Retail Mergers, Buyer Power and Product Variety

Cross-border retail mergers might make certain strategies, or threats, available to the new merged buyer, which are not available to individual retailers. In the previous model, e.g., we found a big buyer's threat of integrating backwards to be more credible than that of a small buyer. In this section, we will see that large retail chains may also be capable of forcing suppliers to compete harder for contracts. As a consequence, big buyers are provided with a larger share of total industry profit than smaller ones. This is formalized by Inderst and Shaffer (2007), I&S hereafter.

Specifically, the model investigates the effect of cross-border mergers on product variety: Following a downstream merger, the retail chain may want to reduce the number of products it carries. This to enhance its buyer power, by making suppliers "less differentiated", and hence making them compete harder. As a consequence for suppliers' incentives, it can be shown that, if downstream merger can be expected, the suppliers will choose inefficient product characteristics to win the supply contracts.

Assumptions The economy consists of two suppliers $s = A, B$ selling differentiated goods to two retailers $r = a, b$, which operate as monopolists in independent markets. The suppliers produce their products at a constant unit cost c.

It is assumed that each outlet stocks only one good at a time. Capacity problems, limited shelf space, e.g., could be the reason for this – but I&S also show that it may be optimal for strategic reasons for each retailer only to stock one of the goods.

Each product can be represented by its characteristic θ^s, $s = A, B$. And the direct demand D_r for the good at outlet $r = a, b$ is determined both by its price p_r set at outlet r, and by its type θ^s, so that we have $D_r(p_r, \theta^s)$. Conversely, the price (or inverse demand) at outlet r is determined by the quantity sold x and the characteristic of the good, so that $p_r(x, \theta^s)$.

The retailers negotiate efficient contracts with the suppliers, so that double marginalization problems are absent. Thus the total profit to be shared between retailer r and supplier s is simply

$$\Pi_r(\theta^s) = \max_x [p_r(x, \theta^s) - c]\, x. \tag{115}$$

It is assumed that product demand in the respective market reflects the consumers likings in that particular market, and the consumers at location a are different from those at location b. Specifically, we have that

$$\Pi_a(\theta^A) > \Pi_a(\theta^B) \text{ and } \Pi_b(\theta^B) > \Pi_b(\theta^A), \tag{116}$$

so that product A fits better than product B to the consumer base at outlet a, and vice versa.

The Bargaining Framework To determine which supplier gets to serve which outlet, and to decide the terms of the contracts, both auctions and bilateral negotiations are considered.

The auction is a type of "first-price" sealed bid auction, where the suppliers are bidding on the right so sell their products at the specific outlet. This results in a Bertrand-type competition between the suppliers.

In determining the outcome of the negotiations, I&S utilize ANS, where each supplier has bargaining power β and each retailer has bargaining power $1 - \beta$.

All negotiations proceed simultaneously and privately through the use of perfect agents, and all agents form rational expectations about the outcomes of the other negotiations. It is unclear what is the underlying assumptions about the negotiations, however. Do they comprise of a series of alternating offers? Is there a risk of breakdown?

I&S identify the individual retailer's disagreement point simply as the surplus that this retailer could obtain by resorting to the other supplier – i.e., it is identified as the retailer's outside option. It should be noted that this is not in accordance with the outside option principle (see Section 3 on bargaining). Furthermore, it is assumed that the other supplier will do his utmost to snatch the contract from the supplier that the retailer is negotiating with, so that this other supplier will offer the retailer all of the surplus from selling his product. Thus, retailer a's disagreement point in negotiations with A is simply $\Pi_a(\theta^B)$.

The suppliers have no outside options, and hence their disagreement points are normalized to zero.

Analysis

Two different scenarios are considered. In the first, the two outlets are separated. In the second, they are merged.

Auctions We first look at the scenario with separated retailers. The outcome of the auctions are straightforward, because of the Bertrand competition between the suppliers: Supplier B can offer retailer a at most $\Pi_a(\theta^B)$, whereas supplier A can offer $\Pi_a(\theta^A) > \Pi_a(\theta^B)$. Hence A wins the auction at location a and pays a total of $\Pi_a(\theta^B)$, or marginally more. By the same reasoning, we find that supplier B wins the auction at location b, and he pays a total of $\Pi_b(\theta^A)$. The outcome is that each outlet is served by the supplier that fits the mentioned outlet's consumer base best. Retailer a stocks product A and earns a total of $\Pi_a(\theta^B)$. Retailer b stocks product B and earns a total of $\Pi_b(\theta^A)$.

Consider now the state where the retailers are merged. The merged firm has two alternative strategies: 1) To continue selling different products at different outlets, or 2) to announce that it is going to stock the same product at both outlets. The outcome of the first strategy would be the same as that in the scenario with separated retailers: The merged firm would stock product A at location a and product B at location B. Through this it would earn a total of $\Pi_a(\theta^B) + \Pi_b(\theta^A)$.

But the outcome of the second strategy would be better for the merged firm: Now the suppliers would have to compete for both markets at the same time. Supplier A is able to pay a maximum of $\Pi_a(\theta^A) + \Pi_b(\theta^A)$, wheras B is capable of paying at most $\Pi_b(\theta^B) + \Pi_a(\theta^B)$. There are three possible outcomes of this auction, depending on the size of $\Pi_a(\theta^A)$, $\Pi_b(\theta^A)$, $\Pi_b(\theta^B)$, and $\Pi_a(\theta^B)$:

- If $\Pi_a(\theta^A) + \Pi_b(\theta^A) > \Pi_b(\theta^B) + \Pi_a(\theta^B)$, supplier A wins the auction. Both retailers stock product A, and the merged firm earns a total of $\Pi_b(\theta^B) + \Pi_a(\theta^B)$.

- If $\Pi_a(\theta^A) + \Pi_b(\theta^A) < \Pi_b(\theta^B) + \Pi_a(\theta^B)$, supplier B wins the auction. Both retailers stock product B, and the merged firm earns a total of $\Pi_a(\theta^A) + \Pi_b(\theta^A)$.

- If $\Pi_a(\theta^A) + \Pi_b(\theta^A) = \Pi_b(\theta^B) + \Pi_a(\theta^B)$, any of the retailers could win.

Regardless of who wins, the merged firm is better off, since both $\Pi_a(\theta^A) + \Pi_b(\theta^A)$ and $\Pi_b(\theta^B) + \Pi_a(\theta^B)$ are strictly higher than $\Pi_a(\theta^B) + \Pi_b(\theta^A)$. Furthermore, we can conclude that the retailers will prefer to merge, and then split the gain from stocking only one of the products. This, under standard assumptions, results in both lower total industry profit and lower consumer welfare.

Negotiations Assuming auctions of the above type, I&S argue, is just another way of saying that the retailers have no bargaining power. This because the suppliers are able to extract all of the excess revenue – e.g., in the situation with separated retailers, supplier A earns $\Pi_a(\theta^A) - \Pi_a(\theta^B)$. Therefore, to say more about the dynamics in the model, I&S allow for a more equal distribution of bargaining power:

We start by investigating the scenario where the retailers are separated. From the bargaining framework described above, we have that the result of the negotiations between retailer r and supplier s is simply the division

$$\begin{aligned} y_r^* &= \arg\max \left\{ \left(\Pi_r(\theta^s) - y_r\right)^\beta \left(y_r - \Pi_r(\theta^{\sim s})\right)^{1-\beta} \right\}, \\ & \quad \text{where} \quad r = a, b \quad \text{and} \quad s = A, B \end{aligned} \tag{117}$$

where y^* represents the retailers share of the surplus and $\Pi_r(\theta^{\sim s})$ is his disagreement point.

From before we have that A will serve a and B will serve b in equilibrium. And from (117) we have that retailer a's share of the surplus becomes

$$y_a^* = (1-\beta)\,\Pi_a(\theta^A) + \beta\Pi_a(\theta^B), \tag{118}$$

whereas retailer b's share is

$$y_b^* = (1-\beta)\,\Pi_b(\theta^B) + \beta\Pi_b(\theta^A). \tag{119}$$

We can easily see that each retailer, under downstream separation, extracts more of the surplus when they negotiate than when they arrange auctions, as long as $\beta < 1$. For $\beta = 1$, we are back to the outcome of the auctions.

But what will happen if the retailers merge and announce that they will sell the same product from both outlets? Now the merged firm's share of the surplus, denoted ab, becomes

$$y_{ab}^{*} = \arg\max\left\{\left(\Pi_r(\theta^s) + \Pi_{\sim r}(\theta^s) - y_{ab}\right)^{\beta}\left(y_{ab} - \Pi_{\sim r}(\theta^{\sim s}) - \Pi_r(\theta^{\sim s})\right)^{1-\beta}\right\}, \quad \text{where } r = a, b \text{ and } s = A, B, \tag{120}$$

which yields

$$y_{ab}^{*} = (1-\beta)\left(\Pi_r(\theta^s) + \Pi_{\sim r}(\theta^s)\right) + \beta\left(\Pi_{\sim r}(\theta^{\sim s}) + \Pi_r(\theta^{\sim s})\right). \tag{121}$$

From this we have that three different outcomes are possible, as with the auction:

- If $\Pi_a(\theta^A) + \Pi_b(\theta^A) > \Pi_b(\theta^B) + \Pi_a(\theta^B)$, supplier A gets to serve both markets, and the merged firm earns a total of

$$(1-\beta)\left[\Pi_a(\theta^A) + \Pi_b(\theta^A)\right] + \beta\left[\Pi_b(\theta^B) + \Pi_a(\theta^B)\right].$$

- If $\Pi_a(\theta^A) + \Pi_b(\theta^A) < \Pi_b(\theta^B) + \Pi_a(\theta^B)$, supplier B gets to serve both markets, and the merged firm earns a total of

$$(1-\beta)\left[\Pi_b(\theta^B) + \Pi_a(\theta^B)\right] + \beta\left[\Pi_a(\theta^A) + \Pi_b(\theta^A)\right].$$

- If $\Pi_a(\theta^A) + \Pi_b(\theta^A) = \Pi_b(\theta^B) + \Pi_a(\theta^B)$, any of the retailers could serve the markets.

If the firm were to sell different products at the two locations, it would earn a total of

$$(1-\beta)\,\Pi_r(\theta^s) + \beta\Pi_r(\theta^{\sim s}) + (1-\beta)\,\Pi_{\sim r}(\theta^{\sim s}) + \beta\Pi_{\sim r}(\theta^s),$$

which is less than y_{ab}^{*} only as long as $\beta > \frac{1}{2}$. This stems from the fact that a strategy of selling the same product at both locations, will reduce total industry profit. This is the negative effect. But for the merged firm there is also a positive effect, in that it forces the suppliers to compete harder for the contracts. However, if $\beta < \frac{1}{2}$, i.e., the suppliers are weak negotiators, the former effect dominates. This because the merged retailer would be able to extract a larger share of total industry profit if the suppliers were weak, and hence he would be foolish to reduce it. Whereas if the merged retailer had little bargaining power, he would gain by making the suppliers compete harder for his contract.

Finally, whenever $\beta > \frac{1}{2}$, there is an incentive for the retailers to merge and split the gain from their single sourcing strategy.

As mentioned, there is a problem with this approach, because the retailer's disagreement point, or status quo point, is set to be the profit that he will realize by accepting the offer from the other supplier. The attentive reader will note that this is actually an outside option, not a disagreement point. Hence, the results derived above are not in accordance with the outside option principle. To see this, consider the situation where the retailers are separated, and where retailer a is negotiating a contract with supplier A. ANS tells us that, if supplier B does not exist, the retailer will receive $y_a^A = (1-\beta)\,\Pi_a(\theta^A)$ from A. If supplier B exist, however, he will offer $y_a^B = \Pi_a(\theta^B)$ to snatch the contract from supplier A – and retailer a will accept this offer as long as $(1-\beta)\,\Pi_a(\theta^A) < \Pi_a(\theta^B)$. Therefore, if the latter is the case, supplier A will have to increase its offer to match the offer from B, which implies $y_a^A = \Pi_a(\theta^B)$. The conclusion is that if $(1-\beta)\,\Pi_a(\theta^A) < \Pi_a(\theta^B)$, a will simply receive $\Pi_a(\theta^B)$ (or marginally more) from supplier A. Yet, if $(1-\beta)\,\Pi_a(\theta^A) > \Pi_a(\theta^B)$, the offer from B will not affect the outcome, so that a will receive $(1-\beta)\,\Pi_a(\theta^A)$. The same logic applies to the other market.

If we apply this reasoning to the model of I&S, how will it affect the derived results? Assume that the markets (and the suppliers) are symmetrical – specifically, let us assume that

$$\Pi_a\left(\theta^A\right) = \Pi_b\left(\theta^B\right) = 1, \tag{122}$$

and that

$$\Pi_a\left(\theta^B\right) = \Pi_b\left(\theta^A\right) = \alpha. \tag{123}$$

α is here a measure of how large a share of the maximum obtainable profit any individual retailer will earn when selling a product that does not fit the consumer base at his location.

We would like to find when it is profitable for the retailers to merge and conduct a strategy of stocking the same product at both locations. If they do not conduct the single sourcing strategy, the merged firm will earn a total of

$$\Pi_a\left(\theta^B\right) + \Pi_b\left(\theta^A\right) = 2\alpha \quad \text{if} \quad \alpha \geqslant 1-\beta, \tag{124}$$

or

$$(1-\beta)\left[\Pi_a\left(\theta^A\right) + \Pi_b\left(\theta^B\right)\right] = 2\,(1-\beta) \quad \text{if} \quad \alpha < 1-\beta \tag{125}$$

If they stock one product only, they will earn

$$\Pi_a\left(\theta^s\right) + \Pi_b\left(\theta^s\right) = 1+\alpha, \quad \text{where} \quad s = A, B. \tag{126}$$

We see that result (126) is the same as what we found in the case of auctions.

From (124), (125) and (126) we find that the single sourcing strategy is profitable as long as

$$\beta \geqslant \frac{\Pi_r(\theta^s) - \Pi_r(\theta^{\sim s})}{\Pi_r(\theta^s) + \Pi_{\sim r}(\theta^{\sim s})} = \frac{1-\alpha}{2} = \underline{\beta}. \qquad (127)$$

From (127) we can see that the likelihood for the single sourcing strategy (and mergers) to be profitable, is increasing in α – which is reasonable: If α is high, the single sourcing strategy carries only a minor reduction in total industry profit. The suppliers then do not need to be particularly hard bargainers for this strategy to be profitable.

The Suppliers' Incentives

We now analyse the suppliers' choice of product characteristic. Given the results above, what is the individual supplier's up front choice of product type?

As before, when the characteristics were given exogenously, in each market there are certain product types that generate more profit than others. That is, at each location there exists an optimal choice of θ. Let θ_r^* denote the optimal choice of product characteristic at location r. Further, it is assumed that $\theta_a^* < \theta_b^*$.

Case 1: No merger In the situation where no downstream merger is anticipated, there exists two pure strategy equilibria. In each of them one of the suppliers choose the product characteristic that fits outlet a best, and the other choose the type that fits outlet b best.

Case 2: Merger What if a downstream merger could be expected? Now the suppliers would have to taylor their product to win the global contract, wich is done by choosing

$$\widetilde{\theta^s} = \arg\max \left\{ \Pi_a(\theta^s) + \Pi_b(\theta^s) \right\}, \qquad s = A, B,$$

i.e., picking the product type that best balance the preferences at the two outlets. It is straightforward to see that $\theta_a^* < \widetilde{\theta^s} < \theta_b^*$. Hence, suppliers will choose to produce less differentiated products, which per se is undesirable from a consumer perspective.

Conclusion

With heterogenous preferences across borders, and several suppliers producing differentiated goods (taylored to suit different markets), it might be profitable for retailers to merge and conduct a strategy of supplying the same product at each location. This because the strategy forces the producers to compete harder for the contract (it makes them less differentiated): The producers' supply options are reduced, each gets to serve either all or no markets. Hence the one who acquires the contract has to pay more.

Furthermore, when a downstream merger could be anticipated, the producers will taylor their products to best balance the preferences in the different markets.

Considerations The way I&S set up the bargaining problem, is questionable; in the negotiations, the disagreement points are identified as the buyers' outside options. As established in Section 3, this is not the way to do it – at least if we assume the underlying bargaining framework to be a game of alternating offers. Outside options should only be included as constraints on NBS or ANS. By applying the outside option principle, we found that the outcome of the negotiations agrees with the outcome of the auctions.

Dominant Buyers and Product Diversity

So far, under various assumption about the economy, we have derived the buyers' countervailing power from first principles; it has been endogenously determined, and obtained by merger between competing stores, or by cross-border mergers. In the following model, formalized by Chen (2004), we utilize a different approach, to show that an *exogenous* rise in a retailer's bargaining power could result in an undesirable reduction in product variety on the supplier side.

The Chen-article considers an economy where a (monopolist) producer sells several differentiated products to a (large) dominant retailer and a competitive fringe respectively. The competitive retailers have no countervailing power, so that the producer can offer them take-it-or leave-it contracts. The large retailer, however, can excercise buyer power, so that the contracts are determined by bargaining, using ANS. The powers in the Nash product are assumed to be a measure of the dominant retailer's countervailing power vis-à-vis the supplier.

Assumptions The economy consists of a single producer, P, producing a set of differentiated goods to a dominant retailer, denoted d, and a competitive fringe, denoted f. The retailers are located at the ends of a line with length 1, the dominant retailer at adress 0 and the competitive fringe at adress 1. Consumers are distributed evenly along the line. Each consumer has to incur a transportation cost, $T_i = t\,|a - r_i|$, to shop at retailer $i = d, f$, where r_i is the adress of retailer i and a is the adress of the consumer.

Consumers have heterogenous preferences over the set of products produced by the supplier. The consumers preferences are represented by points along a Salop circle with a perimeter of 1. The consumers are evenly distributed around the circle ex ante – that is, before the producer chooses how many products to produce and before he decides on where to locate them on the Salop circle. To buy a product j that is different from his most preferred product, the consumer has to incur a mismatch cost, $M_j = \tau\,|v - x_j|$, where x_j is the location of product j and v is the location of the consumer's most preffered product. It is assumed that each consumer buys *one* product and *one* unit only.

A consumer at adress a with a most preferred product v, can be represented by the utility function

$$\begin{aligned} U_{ai} &= V - T_i - M_j - P_{j,i} \\ &= V - t\,|a - r_i| - \tau\,|v - x_j| - P_{j,i}, \end{aligned} \tag{128}$$

where $P_{j,i}$ is the product price for product j at location $i = d, f$. Since both d and f offer the same set of products, the consumer chooses to shop at the location which charges the lowest "total price", $t\,|a - r_i| + P_{j,i}$, for the product. That is, the decision of which location to shop at can be made separately from the decision of which product to buy.

The supplier produces each product at zero marginal costs. However, he has to incur a fixed cost θ for each product he chooses to produce. Hence, if he produce a total of m products, he has to incur a total cost of $m\theta$.

The retailers have to pay a retailing cost, c_i, $i = d, f$, for each unit sold. Furthermore, it is assumed that $c_d < c_f$, so that the dominant retailer is more efficient.

Given the assumptions stated above, the supplier first chooses the number and the locations of products on the Salop circle. At stage two he offers take-it-or-leave-it contracts to the fringe retailers. And finally he negotiates a supply contract with the dominant retailer.

The Bargaining Framework Chen utilizes the asymmetric Nash bargaining solution in determining the outcome of the negotiations with the dominant retailer, d. α is a measure of d's bargaining power, whereas the supplier's bargaining power is $1 - \alpha$. The supplier has all bargaining power in negotiations with the fringe retailers, so that he can offer them whatever contracts he prefers.

Two-part tariffs, $\{w_{j,i}, F_{j,i}\}$, are allowed, where $w_{j,i}$ is the wholsale price and $F_{j,i}$ is the fixed fee paid for product j by retailer $i = d, f$.

It should be noted that Chen does not support the bargaining solution by specifying a non-cooperative game.

Analysis

Several equilibria could be investigated, as situations where not all consumers are served, and situations where only one type of retailer is active, could arise. However, in the following I will focus only on situations where all consumers are served and all retailers are active.

With respect to the supplier's decision of where to locate the products around the Salop circle, we can take advantage of the fact that, in equilibrium, he will distribute the m products equidistant around the circle, irrespective of number of products he chooses to produce. Furthermore, in signing contracts with $i = d, f$, he will charge the same wholesale price and fixed fee for all products. Hence, we can focus the analysis on one representative product and drop the product subscripts from the fixed fees and wholesale prices.

Now, to solve the model, first we have to find the market share of f and d respectively. This is done by finding the median consumer, the consumer who is indifferent between buying from d or f. As noted above, the consumer buys from the location which entails the lowest total cost, $t\,|a - r_i| + P_{i,j}$. Hence, for the median consumer, located at a_m, it must hold that $ta_m + P_{j,d} = t\,(1 - a_m) + P_{j,f}$, which we can solve for a_m to find

$$a_m = \frac{1}{2} + \frac{P_{j,f} - P_{j,d}}{2t}. \tag{129}$$

a_m represents the market share of d, whereas $1 - a_m$ represents the market share f.

Now, with respect to the demand for a specific product, we can note that a consumer, if prices are the same, will buy the product which lies closest to his most preferred point on the Salop circle. Specifically, the consumer will buy the product which entails the lowest sum of mismatch cost and product price. Hence, for the consumer that is indifferent between buying product x_j and x_{j+1}, located at v_m^+ on the Salop circle, it must hold that $\tau\,(v_m^+ - x_j) + P_j = \tau\,(x_{j+1} - v_m^+) + P_{j+1}$, which we can solve for v_m^+ to find

$$v_m^+ = \frac{x_j + x_{j+1}}{2} + \frac{P_{j+1} - P_j}{2\tau}. \tag{130}$$

v_m^+ is the median buyer on the right hand market side of x_j. Hence, the right hand market share of x_j is

$$v_m^+ - x_j = \frac{x_{j+1} - x_j}{2} + \frac{P_{j+1} - P_j}{2\tau}. \tag{131}$$

By the same reasoning the left hand market share of x_j is

$$x_j - v_m^- = \frac{x_j - x_{j-1}}{2} + \frac{P_{j-1} - P_j}{2\tau}, \tag{132}$$

where v_m^- is the preferred point of the median consumer on the left hand side. From this we find that the total demand for product j facing d is

$$Q_{j,d} = \underbrace{\left(\frac{1}{2} + \frac{P_{j,f} - P_{j,d}}{2t}\right)}_{d\text{'s market share.}} \underbrace{\left(\frac{P_{(j+1),d} + P_{(j-1),d} - 2P_{j,d}}{2\tau} + \frac{x_{j+1} - x_{j-1}}{2}\right)}_{\text{Demand for product } j.}. \tag{133}$$

We can simplify by setting $(x_{j+1} - x_{j-1})/2 = 1/m$, because the supplier will locate the m products equidistant around the circle. Using the same logic, the total demand for product j facing the fringe is

$$Q_{j,f} = \left(\frac{1}{2} + \frac{P_{j,d} - P_{j,f}}{2t}\right)\left(\frac{P_{(j+1),f} + P_{(j-1),f} - 2P_{j,f}}{2\tau} + \frac{1}{m}\right). \tag{134}$$

We know that, because the fringe is competitive, the price set at location 1 will be equal to fringe marginal costs: $P_{j,f}^* = P_f^* = w_f + c_f$. Hence we can write d's maximization problem as

$$\begin{aligned} \max_{P_{j,d}} \Pi_d &= \textstyle\sum_{j=1}^m \{Q_{d,j}(P_{j,d} - c_d - w_d) - F_d\} \\ &= \textstyle\sum_{j=1}^m \left\{\left(\frac{1}{2} + \frac{w_f + c_f - P_{j,d}}{2t}\right) \times \right. \\ & \left. \left(\frac{P_{(j+1),d} + P_{(j-1),d} - 2P_{j,d}}{2\tau} + \frac{1}{m}\right)(P_{j,d} - c_d - w_d) - F_d\right\} \end{aligned} \tag{135}$$

Solving the FOCs for (135) for $P_{j,d}$ yields

$$P_{j,d}^* = P_d^* = \frac{t + w_f + c_f + w_d + c_d}{2}. \tag{136}$$

From (136) and (133) we find that the demand for a representative product at retailer d

is

$$Q^*_{j,d} = Q^*_d = \frac{(t - c_d + c_f - w_d + w_f)}{4t}. \tag{137}$$

Furthermore, from (136) and (137) we find that d's profit as a function of wholsale prices and marginal costs, is

$$\Pi^*_d = mQ^*_d (P^*_d - c_d) - mF_d = \frac{1}{8t}\left[(t - c_d + c_f + w_f)^2 - w_d^2\right] - mF_d. \tag{138}$$

Using the results from above, we can write the outcome of the negotiations between the dominant retailer and the supplier as

$$\{w^*_d, F^*_d\} = \arg\max \left[Q^*_d (P^*_d - c_d) - F_d\right]^\alpha \left[Q^*_d w_d + F_d\right]^{1-\alpha}. \tag{139}$$

The FOCs for (139) are

$$(1-\alpha)\frac{Q^*_d + w_d \frac{\partial Q^*_d}{\partial w_d}}{F_d + w_d Q^*_d} + \alpha \frac{Q^*_d \frac{\partial P^*_d}{\partial w_d} + \frac{\partial Q^*_d}{\partial w_d}(P^*_d - c_d)}{Q^*_d (P^*_d - c_d) - F_d} = 0, \tag{140}$$

and

$$\frac{(1-\alpha)}{F_d + w_d Q^*_d} - \frac{\alpha}{Q^*_d (P^*_d - c_d) - F_d} = 0. \tag{141}$$

(140) and (141) says that the wholsale price should be set equal to the producer's marginal cost, which is assumed to be zero, and that the fixed fee should split the realized surplus between the dominant retailer and the supplier according to the bargaining powers, α and $1-\alpha$:

$$w^*_d = c = 0, \tag{142}$$

$$F^*_d = (1-\alpha)\frac{(t - c_d + c_f + w_f)^2}{8mt}. \tag{143}$$

Since the fringe retailers are competitive, there exists no double marginalization problem at location 1. Hence, in the contracts offered to f, the supplier sets the fixed fee F_f to zero and extracts all the surplus through the wholsale price, w_f. The supplier's profit maximization problem, by combining the maximization problems at the two locations, is then

$$\begin{aligned}\max_{w_f} \Pi_p &= \left(\frac{1}{2} + \frac{P_d^* - w_f - c_f}{2t}\right) w_f + mF_d^* - m\theta \\ &= \frac{1}{8t}\left[(3t + c_d - c_f - w_f)\, 2w_f + (1-\alpha)(t - c_d + c_f + w_f)^2\right] - m\theta \qquad (144)\end{aligned}$$

Solving the FOC for (144) for w_f yields

$$w_f^* = \frac{(4-\alpha)\,t - \alpha\,(c_f - c_d)}{(1+\alpha)}. \qquad (145)$$

Now we can use the results to find the equilibrium product prices set at the two locations:

$$P_d^* = \frac{5t + c_f + (1+2\alpha)\,c_d}{2\,(1+\alpha)}, \qquad (146)$$

$$P_f^* = w_f^* + c_f = \frac{(4-\alpha)\,t + c_f + \alpha c_d}{(1+\alpha)}. \qquad (147)$$

Finally, substituting (145) and (146) into (144), we find the supplier's equilibrium profit:

$$\Pi_p^* = \frac{(c_f - c_d)\,(2t - 8t\alpha - c_d + c_f) + t^2\,(17 - 8\alpha)}{8t\,(1+\alpha)} - m\theta \qquad (148)$$

From (148) we can see that the supplier's profit is decreasing in the number of products, m. Hence, the supplier will choose the smallest possible m, given that all customers are to be served. To do this, the supplier sets m such that the customer located at a_m, with the preferred point $v_m^{\pm}$ on the Salop circle, has utility close to zero:

$$V - \tau\left|v_m^{\pm} - x_j\right| - ta_m^* - P_d^* \geqslant 0. \qquad (149)$$

From (131) and (132) we have that $|v_m^{\pm} - x_j| = 1/(2m)$, and from (129) we have that $a_m^* = (5t - c_d + c_f)\,/\,[4t\,(1+\alpha)]$. Substituting into (149) and solving for m, gives

$$m^* \geqslant \frac{2\,(1+\alpha)\,\tau}{4V\,(1+\alpha) - 15t - (1+4\alpha)\,c_d - 3c_f}. \qquad (150)$$

Comparative Statics

Immediately we can notice the effect of the dominant retailer's countervailing power, α, on the fringe wholesale price, w_f^*, and on the prices set at the two locations. When α rises, the supplier's marginal revenue at location 0 falls, $MR_0 < MR_1$, so that he has to reoptimize by boosting the sales through the fringe retailers at location 1 and reducing sales through the dominant retailer. The supplier does this by cutting the wholesale prices paid at location f:

$$\frac{\partial w_f^*}{\partial \alpha} = \frac{c_d - c_f - 5t}{(1+\alpha)^2} < 0. \tag{151}$$

This will further reduce the final prices set at both locations:

$$\frac{\partial P_f^*}{\partial \alpha} = \frac{\partial w_f^*}{\partial \alpha}, \tag{152}$$

$$\frac{\partial P_d^*}{\partial \alpha} = \frac{c_d - c_f - 5t}{2(1+\alpha)^2} < 0. \tag{153}$$

We can see that $\partial P_f^* / \partial \alpha < \partial P_d^* / \partial \alpha$, so that the market share of the fringe will increase.

Since all retail prices will fall as the dominant retailer's bargaining power increases, utility will rise for all customers – which is the positive effect. However, this also opens up the possibility for the supplier to reduce the number of products he carries. Remeber, given that all customers are to be served, the supplier will minimize costs by providing the lowest possible number of goods. It is straightforward to see this from (150). If we treat m as a continuous variable, which it is not, we can write

$$\frac{\partial m^*}{\partial \alpha} = \frac{-6\tau (c_f - c_d + 5t)}{(4V(1+\alpha) - 15t - (1+4\alpha) c_d - 3c_f)^2}, \tag{154}$$

which clearly is negative as long as $c_f - c_d + 5t > 0$. Hence, a large enough increase in α might make it profitable for the supplier to reduce product variety – which might partially or fully neutralize the positive welfare effect of lower final prices.

As noted above, other equilibria could be investigated. Specifically there are two alternative equilibria to the one described above: 1) It could be profitable for the producer to supply only the large retailer. 2) It could be profitable to supply all retailers, but not to serve all customers. I will not commit a thorough investigation here. However, we can note that the first alternative occurs when the dominant retailer's bargaining power is low enough. We can see this by substituting the equilibrium retail prices into (129):

$$a_m^* = \frac{1}{2} + \frac{3t - 2t\alpha - c_d + c_f}{4t(1+\alpha)}. \tag{155}$$

Let us assume that $c_d = 0$. Then $1 - a_m^* > 0$, which means that the fringe is supplied, only as long as $\alpha > (t + c_f) / (4t)$. If $\alpha < (t + c_f) / (4t)$, we have that $a_m^* = 1$. If this is the case, some customers will not be served, because the transportation costs become to high. Furthermore, a rise in d's bargaining power will reduce the supplier's marginal profit from introducing a new product. Thus it will tend to reduce product varity (more directly) by increasing the dominant retailer's share of the joint surplus.

The case where all retailers are active and some customers are not served, combines the effect of the two equilibria from above: When α rises, w_f^* is reduced, and this gives rise to the first effect investigated above in (154). The second effect stems from the fact that the marginal profit from introducing a new product is reduced, as argued.

Conclusion

The model in this section showed that an exogenous increase in the countervailing power of a dominant retailer may cause a monopolist supplier to shift sales towards a competitive fringe of less powerful retailers. To do this, the manufacturer cuts the wholesale prices paid by the fringe. Hence, consumer prices will fall at both the location of the fringe and at the location of the dominant retailer. This is the positive effect on consumer welfare. However, the primary insight of this analysis is that the latter effect of reduced consumer prices might be mitigated by the manufacturer reducing the number of products supplied in equilibrium, which per se is undesirable from a consumer perspective.

Considerations Chen does not justify the use of ANS and the powers in the Nash product as a measure of the dominant retailer's countervailing power. He simply states that

> ...It is reasonable to expect that the large retailer will receive a larger share of the surplus if it gains more countervailing power against the manufacturer. The parameter [α], therefore, measures the amount of countervailing power of the large retailer. (p. 10)

This approach is hardly justified, however, and an explanation of the large retailer's increased countervailing power is called for. If we are to adress the problem of increased buyer power, we first have to say something about how it arises. As such, the previous models in this section seems better fitted to give some kind of policy advice.

4.3 Summary

This section has provided a number of predictions for when and how buyers might obtain countervailing power against suppliers.

In the first section, we found that stores may gain leverage in the negotiations with the manufacturer if they merge locally – that is, if they merge with competing stores. This because the supplier's status quo position in the negotiations with a merged buyer is weakened compared to when bargaining with the stores individually. We also found that the supplier's response, when facing a merged buyer, is to reduce his effort to bring down the unit production cost.

We then went on to find also that buyers may gain by merging cross-border, the condition being that buyers and/ or suppliers are risk averse. This because, if the the supplier is risk averse, its utility function is concave in the amount of profit earned, and hence the per-unit contribution of a big buyer to the supplier's utility is higher than the per-unit contribution of a small buyer. A big buyer should therefore receive a discount. Stated differently, since the supplier is risk averse, he is willing to pay more to strike a deal with a buyer whose per-unit contribution to the supplier's utility is higher. Also here we found the dynamic welfare effects of big buyers to be negative, as the supplier's incentives to reduce his unit costs are weakened.

In the third section we reviewed the model of I&W (2003), which links the supplier's production technology to the presence of downstream buyer power and incentives for merger. We found that a big buyer, comprising of multiple independent stores, will obtain a discount if total industry profit is strictly concave in the number of active stores. The latter will be the case, e.g., if the supplier's marginal costs are rising in quantity. As in the section on risk aversion, big buyers receive discounts because their per-unit contribution to the supplier's profit is higher than the per-unit contribution of individual stores. Perhaps surprising, however, we found the dynamic welfare effects to be positive, as the supplier's incentives to switch to a less convex technology may be strengthened by the presence of large buyers.

In the final section on process innovation, we reviewed the model of I&W (2005a). With assumptions of constant unit production costs and multiple downstream markets, they consider cross-border mergers, and find a big buyer's threat of integrating backwards to be more credible than the threat of a small buyer. Hence, big buyers are more likely to receive discounts. However, again the welfare effects are found to be positive; since the supplier can pocket the full direct gain from any invention whenever it is facing buyers with credible threats, the supplier's incentives to reduce its unit costs will increase as the buyers grow larger.

In the second part of this section, we reviewed two models that consider buyer power and incentives for product innovation. In the first, by I&S (2007), we found cross-border mergers to be profitable for retailers, because they then can commit to stocking the same product at all locations and hence make the suppliers compete harder for the contracts. Since the merged buyer find it profitable to reduce the number of products supplied, however, the welfare effect is negative. Furthermore, the suppliers might find it optimal to choose inefficient product characteristics when they face big buyers.

The final model, by Chen (2004), stands out, as it fails to provide any explanation for how buyers might obtain countervailing power. However, in evaluating the consequences of increased buyer power, simply defined as the share of the incremental surplus that the buyers obtain in the negotiations, Chen finds that it may be profitable for the supplier to divert sales from the dominant retailer towards a fringe of competitive retailers. In doing so, the supplier reduces the wholsale prices paid by the fringe retailers, and hence retail prices will fall at all locations. However, Chen also finds that the latter effect might be mitigated by the supplier reducing the number of products manufactured in equilibrium, which is undesirable from a consumer perspective.

In all of the models above, with the exception of I&S (2007), suppliers are considered to be monopolists. Hence, there remains some work to be done on the sources and consequences of buyer power when the upstream market is competitive. It seems reasonable to belive that the consequences for the suppliers of facing big buyers are mitigated if manufacturers compete fiercely. This should be investigated.

Furthermore, we found no effects of cross-border mergers as long as 1) market actors are risk neutral, 2) outside supply options are absent and 3) unit production costs are constant. This also ought to be questioned. In the next section, we will see that, under certain conditions of local competition, incentives for cross-border mergers might exist even under assumptions 1-3.

5 A New Model of Buyer Power

In the previous section we reviewed parts of the literature on buyer power and suppliers' incentives to invest. We found that buyer power may arise from cross-border mergers 1) if the market actors are risk averse, 2) if big buyers have more credible outside options, or 3) if total industry profit is concave in the number of buyers served (e.g., if the suppliers' unit costs are rising). Conversely, we found that the buyer power effect is absent whenever these assumptions are not satisfied.

The following analysis will show that that the countervailing power effect may arise after all, even if assumptions 1-3 are not fulfilled. Furthermore, we find that downstream cross-border mergers may reduce the suppliers' incentives to engage in R&D activities.

We build a model where a manufacturer supplies its product in N local markets, where horizontally differentiated outlets compete for final consumers. Then we will show how it may be optimal for the manufacturer to commit to a policy of not supplying all outlets – this even though it prevents the supplier from reaching all final consumers, and hence reduces total industry profit. The analysis shows that large buyers or retail chains may excercise buyer power by acting as gate keepers to parts of the local markets where the mentioned chain operates. Through this they reduce the supplier's share of total industry profit. Furthermore, large buyers may reduce the supplier's incentives to innovate. This effect is stronger the larger the retail chain.

The Model

The Economy The economy consists of one upstream manufacturer supplying a single product in N independent but identical downstream markets. The supplier produces its product at a constant marginal cost $c < 1$.

In each market, two retailers $r = a, b$ compete Cournot to serve final consumers. The two outlets are differentiated locally, so that in the situation where outlet r in market j ceases to exist, we will find that total demand in market j will fall. I will utilize a representative consumer approach: The inverse demand function facing retailer r in market j can be written $P_{r,j} = 1 - Q_{r,j} - \gamma Q_{s,j}$, where $0 \leqslant \gamma < 1$. The parameter γ represents the degree of competition between the outlets.

The retailers can be further differentiated, e.g. by introducing differences in unit costs. But this is not important to the analysis. For simplicity I will assume that the retailers are identical with respect to costs and all other characteristics.

To model buyer size, I follow Inderst and Wey (2005a) in assuming that the $2N$ retailers are owned by a number $I \geqslant 2$ buyers. I will consider cross border mergers only, so that the same buyer, B_i, is allowed to own only one outlet in each market. This is reasonable, because competition authorities may prevent outlets from merging in the local market.

Each buyer's buyer power then is measured in the number of firms, n_i, that B_i owns. As I will show, being bigger allows B_i to extract a better deal from the supplier.

The assumptions stated above makes it possible to express the following about the total profit in each of the N markets:

Market Power In each of the N markets, we have that

$$\max \{\Pi_a + \Pi_b\} = 2\Pi^* > \Pi^m,$$

where Π^m is the profit from an outlet which operates alone (as a monopolist) in the local market. That is, total maximized industry profit is strictly higher whenever both outlets are active, which means that they can exercise market power. Note that it may also be the case that

$$\max \Pi_a + \max \Pi_b = 2\Pi^c > \Pi^m,$$

where Π^c is the retailers' Cournot profit. This will be the case as long as competition is weak enough, specifically when $\gamma < 2\left(\sqrt{2} - 1\right)$, which I will assume to be the case in the following.

Competition In each of the N markets, we have that

$$\frac{\max \Pi_a + \max \Pi_b}{2} < \Pi^m,$$

i.e., outlet r can realize strictly higher profit whenever it is operating alone in the local market.

The Bargaining Framework To determine the supply contracts, the manufacturer engages in simultaneous private negotiations with each of the $I \geqslant 2$ buyers, by using perfect agents. The agents form rational expectations about the outcome in all other negotiations.

Non-linear prices are allowed to avoid double marginalization.

In addition, each contract specifies a "planned market structure", defined as the number of firms the supplier intends to supply, and the locations of these outlets in the economy. When bargaining with the buyers, the manufacturer negotiate contracts for all possible contingencies, that is, for all possible market structures.

Formally, a single contract then consists of

1. a two-part tariff $T_i = (\mathbf{w}_i, S_i)$, where S_i is a fixed fee and $\mathbf{w}_i = (w_{r,j})$ represents the wholesale prices paid by all of the mentioned buyer's outlets, and

2. a planned market structure $m = (k, L)$ where k is the number of outlets the manufacturer intends to supply and L denotes the locations of these outlets.
   To take an example of a market structure, consider an economy with $N = 2$ markets. The producer intends to supply both outlets in market 1, but only outlet a in market 2. The planned market structure then is denoted $m = (3, \{ab, a\})$.

Contracts could also be contingent on whether or not the supplier reaches agreement with all buyers in m. However, since the main result is not affected by it, and because it simplifies the mathematical notation, let us assume they are not.

The underlying bargaining structure is a form of the alternating offers game with no risk of breakdown. Every agent has the possibility to resort to his outside option, if any of the sort is available to him, by voluntarily opting out of the negotiations. I will assume that all agents are equal with respect to time preferences.

As shown by Binmore, Rubinstein and Wolinsky (1986), the outcome of this game approaches NBS whenever the time between every offer and counteroffer approaches zero.

The solution is constrained by the respective players' outside options. However, these constraints become binding only whenever they are credible – that is, only when they yield the players more than they would have received by continuing the negotiations without the outside option.

The implications of these assumptions are that the players will split the surplus equally whenever there are no outside options available to them. As a credible outside option becomes available to one of the players, however, he will receive exactly the value of this option in the negotiations.

Analysis

I will consider the following four-stage game. At the first stage, the producer determines whether or not to incur an investment I that will reduce unit costs in production. At stage two, the manufacturer and the buyers engage in simultaneous pairwise negotiations to determine supply contracts. At stage three, the supplier selects market structure. The game then proceeds to the fourth and final stage, the pricing stage, where the manufacturer supplies the buyers, and the buyers sell products to final consumers. The game ends and payments can be collected.

In the following, I will consider the outcome of the game under different *buyer structures*. First under complete separation, i.e., when each buyer owns one outlet only, and subsequently under beginning concentration, specifically when at least one buyer B_i owns a total of $n_i \geqslant 2$ outlets.

Complete Separation The outcome of the game can be found by using backward induction. From the assumptions about the economy stated above, we already know the possible equilibria at the pricing stage. In every market where both retailers are active, the outlets compete in quantities and realize their Cournot-profit, $\Pi_r^c(w_r, w_s)$, where $r, s = a, b$ and $r \neq s$. In every market with only one active retailer r, the monopoly profit $\Pi_r^m(w_r)$ is realized.

Think of an economy with $N = 2$ markets. Let us first take the history where the producer, at stage three, has decided to supply all $2N = 4$ outlets.

If the supplier reaches agreement with all buyers, and in equilibrium there are no disagreements, every outlet will realize their Cournot profit at stage four. The total industry profit then is equal to

$$R_{2N} = \sum_j \sum_r \Pi_{r,j}^c(w_r, w_s), \quad \text{where } j = 1, 2, \text{ and } r, s = a, b, \ r \neq s. \tag{156}$$

In negotiating the contracts for the eventuality $m = (4, \{ab, ab\})$, the manufacturer has no outside options. That is, no buyer is left out. Hence we know that the solution to the bargaining problem is

$$\begin{aligned} \left\{w_{r,j}^*, S_{r,j}^*\right\} &= \arg\max \left\{Q_{r,j}\left(P_{r,j} - w_{r,j}\right) \times \right. \\ &\quad \left. \left[Q_{r,j}\left(w_{r,j} - c\right) + S_{r,j} + Q_{s,j}^*\left(w_{s,j}^* - c\right) + S_{s,j}^* - d_{r,j}\right]\right\}, \\ &\quad \text{where } \ r, s = a, b, \ r \neq s \ \text{ and } \ j = 1, 2. \end{aligned} \tag{157}$$

$d_{r,j}$ represents the manufacturer's disagreement payoff when bargaining with outlet r in market j. Since contracts are not contingent on whether or not the supplier reaches agreement with all buyers in m, the producer's disagreement payoff is simply

$$d_{r,j} = Q_{s,j}^{*}\left(w_{s,j}^{*} - c\right) + S_{s,j}^{*}. \tag{158}$$

As repeated many times throughout this paper, the FOCs of this familiar maximization problem says that the parties should maximize the surplus, here $Q_{r,j}\left(P_{r,j} - w_{r,j}\right)$, by setting the wholsale price equal to the marginal cost, c. Furthermore, the fixed fee should split the realized surplus equally between the parties. The manufacturer's gain from a single transaction then is

$$S_{r,j}^{*}\big|_{m=4,\cdot} = S_{2N}^{*} = \frac{\Pi^{c}}{2}, \quad r = a, b, \quad j = 1, 2, \tag{159}$$

and his total revenue from choosing $m = (4, \{ab, ab\})$ is

$$Y^{A}\big|_{m=2N,\cdot} = 2NS_{2N}^{*} = N\Pi^{c}. \tag{160}$$

Consider now the history where the producer at stage three chooses to supply only one outlet in each market, $m = (2, \cdot)$. Total industry profit is reduced to

$$R_{N} = \textstyle\sum_{j} \Pi_{j,r}^{m}(w_{r}), \quad \text{where } j = 1, 2, \text{ and } r = a, b. \tag{161}$$

Now the manufacturer gains leverage in the negotiations, because the stores have to compete for the contracts. Stated differently, the manufacturer now has outside options, one in each market. As noted, the outside options determines the outcome of the negotiations. Yet, what is the value of these outside options?

Think of the situation where store a in market 1 offers the producer $S_{a,1} = \Pi^{m}/2$, i.e., half the monopoly profit, to choose any given market structure on the form $m = (2, \{a, \cdot\})$. Outlet b's best response then is to offer $S_{b,1} = \Pi^{m}/2 + \Delta$, where Δ is an infinitesimal value. Hence, store b wins the contract in market 1. However, now store a's best response is to offer $\Pi^{m}/2 + \Delta < S_{a,1} < \Pi^{m}$, and so on. This results in a type of "first-price" sealed bid auction, and the only pure-strategy Nash equlibrium is the one where the outlets offer the manufacturer

$$\left(S_{r,j}^{*}, S_{s,j}^{*}\right)\big|_{m=2,\{r,\cdot\}} = \left(S_{N}^{*}, 0\right) = \left(\Pi^{m}, 0\right), \quad \text{where } r, s = a, b, \quad r \neq s \text{ and } j = 1, 2, \tag{162}$$

to select a market structure $m = (2, \{r, \cdot\})$. Hence, the supplier's payoff is

$$Y^A\big|_{m=N,\cdot} = NS_N^* = N\Pi^m. \tag{163}$$

Clearly $Y^A\big|_{m=N,\cdot} > Y^A\big|_{m=2N,\cdot}$, so the producer will prefer any $m = (2, \cdot)$ to $m = (4, \cdot)$ at stage three. Note that by conducting this strategy the manufacturer will acquire all of the realized profit.

Yet, there are other market configurations from which the supplier can choose from. Specifically, what is left to find is the producer's payoff from choosing a market structure on the form $m = (3, \cdot)$. Total industry profit summarizes to

$$\begin{aligned} R_{2N-1} &= \textstyle\sum_j \sum_r \Pi^c_{r,j}(w_r, w_s) + \Pi^m_{r,k}(w_r), \\ \text{where } j,k &= 1, 2,\ \ j \neq k,\ \text{ and } r, s = a, b,\ \ r \neq s. \end{aligned} \tag{164}$$

By the same reasoning as before, we have that store r in market 1 will offer the manufacturer $S_{r,1} = \Pi^m$ to choose the market structure $m = (3, \{r, ab\})$. However, it is also a part of store r's equilibrium strategy to offer the supplier $S_{r,1} = \Pi^c$ to pick the configuration $m = (3, \{ab, \cdot\})$. Thus, as part of the pure-strategy Nash equilibrium, the outlets in market j will offer the producer

$$\left(S^*_{r,j}, S^*_{s,j}\right)\big|_{m=3,\{r,ab\}} = \left(S^m_{2N-1}, 0\right) = (\Pi^m, 0) \tag{165}$$

to choose $m = (3, \{r, \cdot\})$, and

$$\left(S^*_{a,j}, S^*_{b,j}\right)\big|_{m=3,\{ab,\cdot\}} = \left(S^c_{2N-1}, S^c_{2N-1}\right) = (\Pi^c, \Pi^c) \tag{166}$$

to choose $m = (3, \{ab, \cdot\})$ .So, by picking any market configuration $m = (3, \cdot)$ at stage three, where he supplies $2N - 1$ of the outlets, the manufacturer gains a total of

$$Y^A\big|_{m=2N-1,\cdot} = S^m_{2N-1} + 2\,(N-1)\,S^c_{2N-1} = \Pi^m + 2\,(N-1)\,\Pi^c. \tag{167}$$

Again the producer takes all of the realized profit, and since $Y^A\big|_{m=2N-1,\cdot} > Y^A\big|_{m=N,\cdot}$, he will prefer any $m = (3, \cdot)$ to $m = (2, \cdot)$ at stage three.

We can conclude that, when the retailers are separated, the only SPNE is the one where the supplier selects $m = (2N - 1, \cdot)$ at stage three.

Beginning Concentration Think now of the situation where a single buyer, B_i, owns a total of $n_i \geqslant 2$ outlets. Will the SPNE and/ or the supplier's payoff change? Now it is necessary to abstract from the assumption of $N = 2$ markets. Specifically, let us assume $N > n_i$.

In the following, every retailer that is not a part of the retail chain will be called *independent* stores (outlets), denoted by IS. Any outlet that is part of the retail chain will be called a chain store, denoted CS.

The fact that stores merge to create a retail chain, will not affect total industry profit per se. This because outlets are only allowed to merge cross borders. However, in the SPNE of the game, being bigger allows the buyer to extract a better deal from the supplier. The intuition is that when bargaining with a large buyer, the supplier needs a "large" outside option if it is to extract all of the big buyer's profit. However, it is not necessarily optimal to exclude a large number of outlets to generate an outside option of high value.

The conclusion from above is that the supplier will gain by excluding some buyers to gain leverage in the negotiations with the remaining buyers. Furthermore, when outlets are separated, it is sufficient to exclude one of them only. When facing a large buyer of size $n_i > 2$, however, the supplier must decide on whether or not to exclude more than one outlet to gain an advantage in negotiations with the retail chain.

To extract all of the big buyer's profit, the manufacturer has to exclude n_i outlets. As before, we have that excluded outlets are willing to pay Π^c each to enter a market together with a competitor. Furthermore, they are willing to pay Π^m to become monopolists. Hence, the supplier will acquire

$$Y^B\big|_{m=2N-n_i,\cdot} = n_i S^m_{2N-n_i} + 2\left(N-n_i\right) S^c_{2N-n_i} = n_i \Pi^m + 2\left(N-n_i\right)\Pi^c \tag{168}$$

by selecting any market structure on the form $m = (2N - n_i, \cdot)$ at stage three.

Now, what if the supplier decides on a market structure $m = (2N - 1, \cdot)$ instead, as is the SPNE when outlets are separated? As before, if the exclusive contract is signed in a market where the retail chain does not operate, the supplier will receive Π^m from the retailer that gets to become a monopolist. This because the excluded retailer is willing to pay Π^m to replace him. Furthermore, in accordance with the results from above, the supplier will receive Π^c from every independent retailer that face another independent competitor. That is, the supplier extracts $2\Pi^c$ from every market where the chain does not operate and where both stores are active.

What remaines to decide is what the supplier will receive in all the n_i markets where the retail chain operates. In all of these markets there exists both a chain store and an independent store, and the manufacturer will not receive the same from the two: Knowing that the supplier will leave out one retailer only, the chain knows that the supplier can not be without it. That is, the left out retailer does not constitute a credible outside option when bargaining with the retail chain. Hence, in accordance with the Nash bargaining solution, the manufacturer will simply receive half of the total profit realized by the large buyer. However, when negotiating with an independent retailer in a market where the retail chain operates, the supplier *has* a credible outside option. He can threaten to exclude the independent outlet, which will make the chain-store in this market a monopolist. The already left out independent retailer is willing to pay Π^c for this to happen. To consider the situation, note that if the supplier were to carry out this outside option, in the two affected markets he would extract half of the monopoly profit from the affected chain-store and all of the realized Cournot profit in the market where the supplier pursued the offer from the left out retailer, that is $\Pi^m/2 + 2\Pi^c$. Hence, the independent retailer facing a chain-store has to pay a share S satisfying the condition

$$\underbrace{\frac{\Pi^c}{2} + S + \Pi^m}_{\substack{\text{profit from letting the independent} \\ \text{retailer stay in the chain-store market}}} - \underbrace{\left(\frac{\Pi^m}{2} + 2\Pi^c\right)}_{\substack{\text{profit from pursuing} \\ \text{the outside option}}} = 0 \tag{169}$$

to get to stay in the market. The condition simply states that, in equilibrium, the supplier's incremental profit from pursuing his outside option should be zero. It can be concluded that all the independent retailers facing chain-stores have to pay the supplier

$$S_{2N-1}^{IS} = \frac{3\Pi^c - \Pi^m}{2} > \frac{\Pi^c}{2} \text{ (credible)}, \tag{170}$$

and that the supplier receives a total of

$$S_{2N-1}^{CS} + S_{2N-1}^{IS} = \underbrace{\frac{\Pi^c}{2}}_{\substack{\text{share from} \\ \text{the chain store}}} + \underbrace{\frac{3\Pi^c - \Pi^m}{2}}_{\substack{\text{share from the} \\ \text{independent store}}} = \frac{4\Pi^c - \Pi^m}{2} \tag{171}$$

from the transactions in each chain-store market. Note that independent retailers gains leverage when competing with chain stores. The intuition is that the supplier will try to prevent the evenetuality where a chain store gets to become a monopolist, because the manufacurer then will have to split the higher monopoly profit in stead of the Cournot profit.

From this we have that the supplier's total profit from choosing any market structure $m = (2N-1, \cdot)$ at stage three, amounts to

$$\begin{aligned} Y^B\Big|_{m=2N-1,\cdot} &= n_i\left(S_{2N-1}^{CS} + S_{2N-1}^{IS}\right) + 2\left(N - n_i - 1\right) S_{2N-1}^{c} + S_{2N-1}^{m} \\ &= \underbrace{n_i \frac{4\Pi^c - \Pi^m}{2}}_{\substack{\text{share from the } n_i \\ \text{chain store markets}}} + \underbrace{2\left(N - n_i - 1\right)\Pi^c}_{\substack{\text{share from all of the} \\ \text{markets where the chain} \\ \text{does not operate}}} + \underbrace{\Pi^m}_{\substack{\text{share from the} \\ \text{market where one} \\ \text{retailer is left out}}} \end{aligned} \tag{172}$$

Even though the supplier does not extract all the realized profit by conducting the $2N-1$ strategy, it is more profitable than pursuing the $2N-n_i$ or the N strategy if local competition is weak enough – that is, if γ is below some critical value, $\overline{\gamma} > 0$. Formally, the $2N-1$ strategy is better than the $2N - n_i$ strategy as long as

$$\Pi^c > \frac{(3n_i - 2)}{4\left(n_i - 1\right)}\Pi^m, \text{ for } 2 < n_i < N. \tag{173}$$

We can solve (173) for γ to find that the $2N-1$ strategy is optimal as long as

$$\gamma < \frac{4\sqrt{-5n_i + 3n_i^2 + 2}}{3n_i - 2} - 2 = \overline{\gamma}, \text{ for } 2 < n_i < N. \tag{174}$$

The intuition behind the result is simple. If each store is "valuable" for the supplier (γ is low), the supplier would like to avoid the scenario where many outlets are excluded. Hence, if local competition is weak, it may be more profitable to give a discount to the big buyer than to exclude him to gain leverage in the negotiations with the remaining buyers.

The implication is that it may be profitable for buyers to take over stores that are valuable to the supplier – because the buyers then might avoid exclusion, and hence they will gain leverage in the negotiations with the supplier. Conversely, if $\gamma > \overline{\gamma}$, i.e. if local competition is sufficiently strong, there are no incentives for cross-border mergers.

We can also see that as B_i grows, it becomes more likely that he will receive a discount. To give a numerical example: If $\gamma = 0.2$, then $n_i \geqslant 5$ if B_i is to receive a discount.

Finally, we should note that if B_i owns a store in every market, $n_i = N$, the remaining stores becomes less differentiated – as they all face a chain store in their respective markets. Hence, if the supplier chooses $m = (2N-1, \cdot)$, then every independent store must pay Π^c to remain active. The supplier's profit now becomes

$$Y^C\Big|_{m=2N-1,\cdot} = \frac{(N-1)\,3\Pi^c + \Pi^m}{2}, \tag{175}$$

which is more profitable than choosing $m = (N, \cdot)$ as long as

$$\Pi^c > \frac{(2N-1)}{3(N-1)}\Pi^m. \tag{176}$$

The Supplier's Incentives

What remains is to look at the supplier's incentives to reduce his unit cost at stage one. From the analysis above, it is easy to see that the manufacturer's incentives are reduced when there exist at least one buyer that owns a sizeable number of stores.

Consider first the situation when the downstream market structure is completely separated. The supplier will choose the market structure $m = (2N-1, \cdot)$ at stage three, and from this he will receive

$$Y^A\Big|_{m=2N-1,\cdot} = \Pi^m + 2(N-1)\,\Pi^c. \tag{177}$$

His gain from an incremental reduction in c then is

$$-\frac{\partial\, Y^A\big|_{m=2N-1,\cdot}}{\partial c} = \underbrace{2(1-N)\frac{\partial \Pi^c}{\partial c}}_{+} \underbrace{-\frac{\partial \Pi^m}{\partial c}}_{+}. \tag{178}$$

Consider now the situation where one buyer owns a number n_i of stores, where $2 < n_i < N$. If local competition is weak enough, the supplier will again choose $m = (2N-1, \cdot)$ at stage three. Hence, he will receive

$$Y^B\Big|_{m=2N-1,\cdot} = n_i\frac{4\Pi^c - \Pi^m}{2} + 2(N-n_i-1)\,\Pi^c + \Pi^m. \tag{179}$$

His gain from an incremental reduction in c is now

$$-\frac{\partial\, Y^B\big|_{m=2N-1,\cdot}}{\partial c} = \underbrace{2\left(n_i+1-N\right)\frac{\partial \Pi^c}{\partial c}}_{+} \underbrace{-n_i\frac{4\frac{\partial \Pi^c}{\partial c}-\frac{\partial \Pi^m}{\partial c}}{2}}_{+} \underbrace{-\frac{\partial \Pi^m}{\partial c}}_{+}, \tag{180}$$

for $2 < n_i < N$,

We can see that (180) is falling in n_i, and further that

$$-\frac{\partial\, Y^A\big|_{m=2N-1,\cdot}}{\partial c} > -\frac{\partial\, Y^B\big|_{m=2N-1,\cdot}}{\partial c}. \tag{181}$$

The conclusion is that the supplier's incentives will diminish as the buyer grows larger.

Possible Extensions

The model derived above shows that when local competition is weak, the buyer's size matters, as the supplier then would like to reach as many stores as possible. A big buyer might therefore receive a discount, simply because it is unprofitable for the supplier to substitute away from this buyer.

We have limited the analysis to show under which conditions it is profitable for a buyer to merge. The model could, however, be extended to consider endogenous mergers, by introducing a new stage (either pre or post stage one) where the buyers are allowed to merge cross borders. E.g, we could consider the situation where there are certain costs attached to the merger process.

We have only considered efficient negotiations, where double marginalization problems are absent. If we allow for linear tariffs only, we will see that a strong buyer will receive his discounts in form of lower wholesale prices. A merger could therefore result in lower prices for the final consumers in the short run, which would mitigate the long-term negative effect that follows from reduced innovation.

Finally, we should note that the countervailing power of a big buyer stems alone from the fact that the buyer is controlling a sizeable number of stores. Hence, for the supplier, both total and incremental profit is reduced as the buyer grows. Following I&W (2005a), we could include the possibility for the buyer to integrate backwards. We would then find that as the buyer's outside option becomes credible, the supplier's incentives will increase again. Hence, it could be that "medium-sized" buyers will lessen the supplier's incentives, and that sufficiently big buyers, with credible outside options, will promote them.

Conclusion

The above analysis showed that, when local competition is weak and the market structure is characterized by complete separation, buyers may find it profitable to merge cross borders. This because, when local competition is weak, the supplier would like to reach as many outlets as possible. Hence, if one of the buyers is big, it might be difficult for the supplier to substitute away from this buyer. The result is that the big buyer receives a cosiderable discount.

Since both total and incremental profit of the supplier is reduced when facing a big buyer, his incentives to reduce his unit cost will diminish as the buyer grows. The effect on long-term welfare may therefore be negative.

Our result highlights the importance of strong competition in promoting both short-term and long-term welfare; if local competition is strong, the buyer power effect, and hence also the incentives for cross-border mergers, disappears all at once.

We have not considered endogenous mergers, inefficient negotiations or the presence of outside options for the buyers. If the tariffs consist of linear prices only, the negative long-term effect of increased buyer power might be mitigated by lower prices in the short run. By allowing the possibility for outside options, we might find that "medium-sized" buyers will lessen the supplier's incentives, whereas sufficiently big buyers will promote them.

6 Discussion

Five out of the seven models explored and developed in this thesis have found the dynamic welfare effects of countervailing power to be negative. As such, we could conclude that mergers between buyers, even if they occur cross-border, ought to be viewed with scepticism.

Our review in Section 4, together with the model developed in Section 5, showed that countervailing power may come about as a result of a variety of reasons. To translate these theories into a single workable concept for how to measure buyer power in real life markets, might be difficult. Rather, the amount of buyer power, its sources, and its effect on welfare, ought to be investigated on a case-to-case basis.

In product markets were technology and competence diffuses quickly and easily, which often is the case in retailing, buyer power might be a good thing. In these markets, countervailing power might arises from the fact that big buyers more easily can produce the mentioned goods themself. Hence, an increase in buyer power might induce the supplier to increase his effort to reduce production costs. The supplier simply buys off the buyer to prevent entry, and then extracts all of the gain from any invention, as shown by I&W (2005a).

When comeptence does not diffuse easily, however, big buyers might seriously weaken the manufacturers incentives. In this thesis, the only exception is Inderst and Wey's model (2003, 2005b), where the presence of big buyers might increase the seller's incentive to switch to a less convex technology. Yet, even here, cross-border mergers will lessen the manufacturer's incentives if the new technology entails a reduction in marginal costs only. Furthermore, if we were to extend the model to assess incentives for product innovation, we will find that the presence of big buyers might lessen the supplier's incremental surplus from introducing a new product with increasing unit costs in production.

As noted, an interesting progression from our analysis in the previous sections would be to synthesise our approach in Section 5 with that of Inderst and Wey (2005a) in Section 4. In doing so, we will find that, if the fixed cost of integrating backwards is sufficiently high, cross-border mergers might lessen the supplier's incentives up to a certain point, above which, because of the credibility of the buyers' outside options, they will start to increase. Hence, it might be that "medium-sized" buyers will hurt the supplier's incentives, whereas sufficiently large buyers will promote them.

Empirically, however, there are some problems with the approach of I&W, as we can observe that retailers often prefer to sell their (low-price) own-brands anyway.[21] Hence, it might be that we should treat the big buyers' outside options as "inside options" instead.[22] If big buyers prefer to produce and supply these store-brands, then, instead of having more credible outside options, these buyers will have more favourable disagreement points – as they can increase the supply of their store-brands whenever they are in a state of disagreement with the supplier. How these inside options affects short-term and long-term welfare remains to be investigated.

There remains also some work to be done on how the "bargaining power" parameters in the Nash product might change as the buyers grow larger. It should be questioned if it is reasonable to believe that these parameters are equal for both small and large buyers, as is assumed in several of the models investigated in this thesis:

We have seen that the players' bargaining strength, in a game of alternating offers, is affected by their relative (im)patience. Therefore, if there are economies of scope in bargaining, so that the "bargaining costs", or the opportunity costs of bargaining, are relatively lower for big buyers than for smaller ones, one could expect large buyers to behave more patient in the negotiations.

Furthermore, as put forward by Inderst and Shaffer (2005a), if the manufacturer is financially fragile

> "...even only a temporary loss of the respective revenues may seriously endanger the supplier's financial viability." (p. 9)

Hence, a financially vulnerable supplier should behave more impatient when negotiating with a buyer that accounts for a large fraction of his profit.

These arguments are yet to be formalized. If they hold, however, then big buyers could be expected to extract more of both incremental and total profits – which will reduce the suppliers' incentives, ceteris paribus.

[21] Sometimes store managers argue that in order to obtain discounts from the suppliers, the mere threat of introducing a store-brand is not enough – the retailers need to actually introduce store-brands for it to constitute a credible threat (Gabrielsen and Sørgard (2007) p. 415).

[22] In the bargaining literature, a player's inside option is the same as his disagreement point.

Finally, we should note that additional welfare effects migth arise as both buyers and suppliers seek to increase their relative "power". E.g., if both suppliers and buyers can invest in activities that will increase their bargaining strength, a form of rent-dissipation in the intermediary market might occur. How these "rent-seeking" activities, if they exist, will affect the consumers in the final market, should be investigated; even if both suppliers and buyers will suffer, the total welfare effect might be either positive or negative.

7 Summary and Concluding Remarks

This thesis set out to analyse the creation of buyer power in intermediary markets and its effects on the suppliers incentives to engage in welfare enhancing activities.

Intermediary markets are characterized by bilateral oligopoly, as often both buyers and suppliers are few. Hence, contracts are more likely to be determined by bargaining. Game-theoretic models of bargaining are therefore a natural starting point for identifying potential sources of buyer power. Both axiomatic and non-cooperative models of bargaining, and the interdependence between these models, were investigated in Section 3 of this dissertation.

In Section 4 we examined parts of the growing yet small literature that seeks to explain the sources and log-term welfare effects of buyer power. We found that size discounts may arise from a variety of reasons:

(i) Buyers with significant market power contributes relatively more to total market profit than buyers with less market power. These buyers may therefore be able to extract more of total market profit when negotiating with the suppliers. Mergers between competing buyers are thus a likely source of buyer power. Furthermore, as these buyers can extract more of both total and incremental profit, they may hurt the suppliers' incentives.

(ii) If the supplier is risk-averse, a large buyer will contribute more per-unit to the supplier's utility than a small buyer. He should therefore receive more in the negotiations. Stated differently, the supplier's absolute risk aversion is higher when negotiating with a big buyer, because this buyer accounts for a relatively large fraction of the supplier's total profits. Hence, the supplier is willing to pay more to strike a deal with this buyer. Moreover, because big buyers also receives more of incremental profits when negotiating with risk averse suppliers, again they are likely to reduce the suppliers' incentives.

(iii) The same reasoning applies if the supplier has increasing unit costs in production. Whenever this is the case, the supplier's profit is concave in the number of buyers served, and again the per-unit contribution of a big buyer to the supplier's profit is higher than the contribution of any small buyer. Size discounts are thus likely to arise. Now the dynamic welfare effects might be positive, however, as the presence of big buyers could increase the supplier's incentives to switch to a "less convex" production technology. The latter stems from the fact that, even though big buyers are charged less for marginal costs, they may be forced to bear more of "inframarginal" or fixed production costs. The presence of big buyers might therefore make it more profitable to change from a technology with low inframarginal costs and relatively high marginal costs, to a technology with high fixed production costs and relatively low marginal costs.

The results are not clear-cut, however, as the impact on long-term welfare depends heavily on which type of welfare enhancing activity we are dealing with. We should note that the dynamic effects may be negative, a) if the new technology entails a reduction in marginal costs only, or b) if the supplier considers to introduce a new product with increasing unit costs in production.

(iv) Size discounts may also arise if big buyers have more valuable outside options. This will be the case if the buyers have the option to sponsor entry into the upstream industry, or to pay a fixed cost to integrate backwards and start producing the goods themselves. Since big buyers face higher total demand than small buyers, and as they therefore have more units over which they can spread the fixed cost, their gain from integrating backwards is higher. The threat of integrating backwards is therefore more likely to be credible for a big buyer. Furthermore, when this threat is credible, the buyer will receive more in the negotiations, as the supplier simply will buy him off to prevent him from invoking his outside option. From the latter, we can conclude that the dynamic effects are positive, as the supplier now can extract all of the gain from any invention that increases the surplus above the value of the buyer's outside option.

We pointed to problems with this set-up, however, as we can observe that buyers often prefer to start inhouse production anyway. Hence, in some instances it may be that the buyers' outside options are better treated as "inside options". Retailing is here an apparent example, as large retail chains often supplement the sale of branded goods with the sale of low-price (low-quality) store-brands.

(v) The second part of Section 4 assessed the effects of cross-border mergers on product variety specifically. Again we found size discounts to arise, as big buyers profitably can reduce the number of products they hold. This strategy makes producers less differentiated when competing for the buyers' contracts – and hence they will have to give up a larger share of their surplus to win the contract(s). Moreover, it reduces long-term welfare, as the suppliers will choose to produce less differentiated products to win the contracts of big buyers.

The final article reviewed in Section 4 utilized the adress approach to analyze the effect of an exogenous increase in buyer power on the supplier's choice of product variety. As such, this model stands out, because it fails to provide an explanation for the increase in buyer power. The dynamic welfare effects were again found to be negative, however, as an increase in buyer power reduces the number of products supplied in equilibrium. The latter effect were mitigated by a reduction in both wholesale and final prices.

On the grounds of the results cited above, we concluded that no effects of cross-border mergers on buyer power are found as long as 1) market actors are risk neutral, 2) outside options are absent, and 3) unit production costs are constant. We then derived a new model in Section 5 to show that, under certain conditions of local competition, cross-border downtream mergers may lead to a significant increase in buyer power, even under assumptions 1-3. The intuition behind the result is that, if each store has significant regional market power, then it may be unprofitable and hence difficult for the buyer to substitute away from a buyer that controls stores in many markets. By contrast, it may be profitable to exclude, or substitute away from a buyer that operates in only a few markets – this to gain leverage in the negotiations with the remaining (small) buyers.

Our model predicts the long-term welfare effects of cross-border mergers to be quite severe, as the supplier can extract all the profit from a small buyer but only half the profit from a buyer that controls a sizeable number of stores. Furthermore, the manufacturer's incentives are steadily diminishing as the buyers grow larger.

The analysis highlights the importance of downstream competition in promoting both short-term and long-term welfare; with a certain degree of downstream competition, the buyer power effect disappears all at once, as the buyers then will not gain leverage by merging cross-borders.

A tentative conclusion from both the literature review and our own contribution in Section 5, is that buyer power, obtained by either local or cross-border mergers, ought to be viewed with scepticism, as it is likely to reduce long-term welfare. The only clear exception is when big buyers have more valuable outside options.

Yet, more research needs to be done before we can claim a comrehensive understanding of both the sources of buyer power and its dynamic effects. An interesting progression would be to investigate how buyer power may manifest itself and affect the suppliers' incentives when the buyers supplement the sale of branded goods with the sale of low-quality store-brands. E.g., will it increase or lessen the suppliers' incentives to increase product quality and/ or reduce production costs?

Finally, we should ask whether additional welfare effects may arise as both buyers and suppliers seek to increase their bargaining power. As noted, if both suppliers and buyers invest in activities that will contribute to their relative strength, a form of rent-dissipation might occur in the intermediary market. It should be investigated how these "rent-seeking" activities, if they exist, will affect the final market, as the effect on total welfare could be either positive or negative.

Bibliography

Battigalli, P., Fumagalli, C. and Polo, M. (2006), Buyer Power and Quality Improvements, CEPR Discussion Paper 5814.

Binmore, K.G. (1985), Bargaining and Coalitions, in Roth, A. (ed.) Game Theoretic Models of Bargaining, Cambridge: Cambridge University Press.

Binmore, K., Rubinstein, A., and Wolinsky, A. (1986), The Nash Bargaining Solution in Economic Modelling, RAND Journal of Economics 17: 176-188.

Binmore, K.G. (1987), Nash Bargaining Theory II, in Binmore, K.G. and Dasgupta, P. (eds.) The Economics of Bargaining, Oxford: Blackwell.

Binmore, K., Osborne, M.J. and Rubinstein, A. (1992), Noncooperative Models of Bargaining, in Aumann, R.J. and Hart, S. Handbook of Game Theory Volume 1, Amsterdam: Elsevier.

Chae, S. and Heidhues, P. (2004), Buyers' Alliances for Bargaining Power, Journal of Economics & Management Strategy 13: 731–754.

Chen, Z. (2004), Countervailing Power and Product Diversity, mimeo., presented at the 2004 North American Winter Meeting of the Econometrics Society.

Cremer, J. and Riordan, M.H. (1987), On Governing Multilateral Transactions with Bilateral Contracts, The RAND Journal of Economics 18: 436-451.

Davidson, C. (1988), Multiunit Bargaining in Oligopolistic Industries, Journal of Labor Economics 6: 397-422.

DeGraba, P. (2003), Quantity Discounts from Risk Averse Sellers, Federal Trade Commission, mimeo.

European Commission (1999), Buyer Power and its Impact on Competition in the Food Retail Distribution Sector of the European Union, Report produced for the European Commission, DG IV, Brussels.

Fumagalli, C. and Motta, M. (2000), Buyers' Coordination, CEPR Discussion Paper 2908.

Gabrielsen, T.S. and Sørgard, L. (2007), Private Labels, Price Rivalry, and Public Policy, European Economic Review 51: 403-424.

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

Hart, O. and Tirole, J. (1990), Vertical Integration and Market Foreclosure, Brookings Papers on Economic Activity. Microeconomics 1990: 205-286.

Horn, H. and Wolinsky, A. (1988), Bilateral Monopolies and Incentives for Merger, The RAND Journal of Economics 19: 408-419.

Inderst, R. and Shaffer, G. (2007), Retail Mergers, Buyer Power and Product Variety, The Economic Journal 117: 45-67.

Inderst, R. and Shaffer, G. (2005), The Role of Buyer Power in Merger Control, manuscript prepared for the new ABA Handbook.

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

Inderst, R. and Wey, C. (2005a), How Strong Buyers Spur Upstream Innovation, CEPR Discussion Papers 5365.

Inderst, R. and Wey, C. (2005b), Buyer Power and Supplier Incentives, Discussion Papers of DIW Berlin 464.

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

Mazzarotto, N. (2004), Retail Mergers and Buyer Power, CCR Working Paper 04-3.

McAfee, R.P. and Schwartz, M. (1994), Opportunism in Multilateral Vertical Contracting: Nondiscrimination, Exclusivity, and Uniformity, The American Economic Review 84: 210-230.

McAfee, R.P. and Schwartz, M. (1995), The Non-Existence of Pairwise-proof Equilibrium, Economics Letters 49: 251-259.

Nash, J.F. (1950), The Bargaining Problem, Econometrica 18: 155-162.

Nash, J.F. (1953), Two-Person Cooperative Games, Econometrica 21: 128-140.

Nordic Competition Authorities (2005), Nordic Food Markets - A Taste for Competition, Report from the Nordic competition authorities No. 1/2005, Norway: Norwegian Competition Authority.

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.

OECD (1999), Buying Power of Multiproduct Retailers, Series Roundtables on Competition Policy DAFFE/CLP(99)21, OECD, Paris.

Retail Institute Scandinavia (1997), Skandinavisk dagligvarehandel 2003-2008.

Roth, A.E. (1979), Axiomatic Models of Bargaining, Lecture Notes in Economics and Mathematical Systems No. 170, New York: Springer-Verlag.

Rubinstein, A. (1982), Perfect Equilibrium in a Bargaining Model, Econometrica 50: 97-109.

Shaked, A. and Sutton, J. (1984), The Semi-Walrasian Economy, ICERD Discussion Paper 98, London School of Economics.

Shapley (1953), A Value for N-Person Games, in Kuhn, H.W. and Tucker, A.W. (eds.) Contributions to the Theory of Games II, Princeton: Princeton University Press.

Stigler, G.J. (1954), The Economist Plays with Blocs, American Economic Review 44: 7-14.

Staahl, I. (1972), Bargaining Theory, Economic Research Institute, Stockholm School of Economics.

Sutton, J. (1986), Non-Cooperative Bargaining Theory: An Introduction, The Review of Economic Studies 53: 709-724.

Whitney, S.N. (1953), Errors in the Concept of Countervailing Power, Journal of Business 26: 238-253.

Winter, E. (2002), The Shapley Value, in Aumann, R. and Hart, S. (eds.) Handbook of Game Theory Volume 3, Amsterdam: Elsevier.