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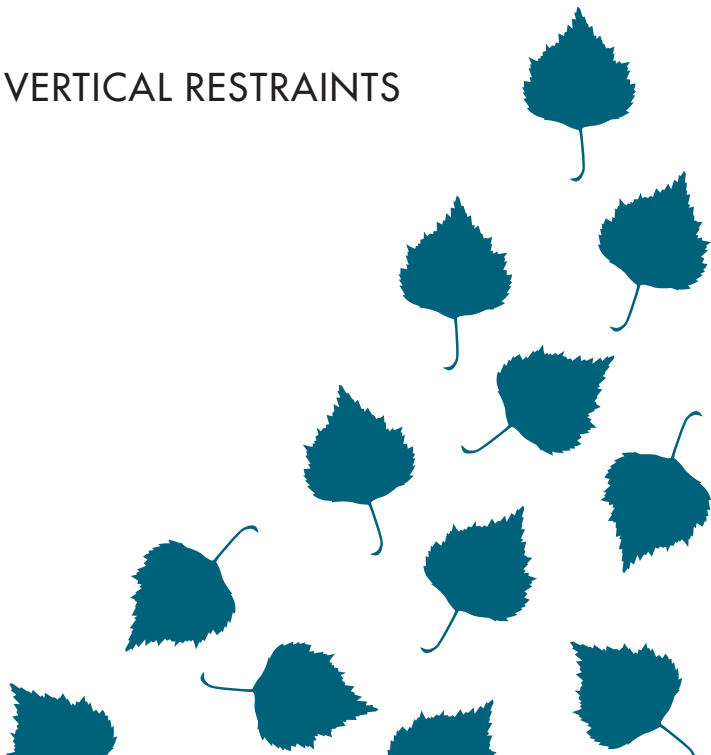
ESSAYS ON THE ECONOMICS OF RETAILING

PAYMENTS, FINANCE AND VERTICAL RESTRAINTS

FRANS SAXÉN



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Frans Saxén

Essays on the Economics of Retailing

Payments, Finance and Vertical Restraints

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Essays on the Economics of Retailing: Payments, Finance and Vertical Restraints

Key words: Vertical relations, vertical restraints, supply chain finance, intermediate goods, contracting, cooperative investments, limited liability, loyalty discounts, market share contracts, bargaining, buyer groups, no surcharge rule, retail financial services, payment card networks, debit cards, credit cards, surcharging.

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To Karolina

PREFACE

And so it is time to put the last words to the dissertation project. Four years ago I sat in my office at the department, preparing for the coming years as a PhD student. I had little idea about what the upcoming years held in store for me. On the other hand, when do you really have it? Be that as it may, now I've reached the final steps of this journey.

It has been a long journey, with ups and downs. There have been moments of joy: Getting published; receiving good and encouraging feedback; discovering new things and reading great articles. The odd moment of despair and self-doubt has also been around.

While the work has felt solitary at times, there have been many people around helping me along the way. Below some of the most important people are named. Many more are not, for reasons of space.

First and foremost, a big thank you goes to my supervisor, professor Rune Stenbacka, for having the patience to read through my sometimes less than polished drafts and finding what I really tried to say. And sometimes finding more than I knew myself was in my text. In addition to insightful comments, the advice on all matters related to academia has been indispensable. Rune's excellent supervision also ensured my steady progress over the course of the journey.

I am deeply grateful to my pre-examiners, professors Tommy Staahl Gabrielsen and Michael Waterson. Their thoughtful comments disclosed a careful reading of my manuscript, with many excellent suggestions for further improvements.

A number of people at the department have helped make my journey smoother. Staffan Ringbom has not only been the head of the department, but also as pointed out in an earlier PhD thesis, the heart and soul of the department. Sharing an office with Mikaela Carlström has been a lot of fun, with many discussions on important and non-important topics. Other PhD students in the Economicum building have also been important in many different ways. When it comes to cooperating on coursework, Naufal Alimov, Susanna Sten Gahmberg, Tuomas Mäkelä, and Rinat Mukminov all deserve big thank yous. A thank you for great discussions on all topics, big and small, goes to James Corbishley and Robin Stitzing. There are numerous others in the building who also have contributed in one form or another to my endeavors.

The feedback at various seminars and workshops has been most valuable. In particular the detailed and well motivated feedback that Mikko Leppämäki patiently provided is much appreciated. Joacim Tåg deserves a big thank you for academic feedback, practical hints, and inspiration. The inspirational courses delivered by professor Greg Shaffer during his visits at the Norwegian School of Economics provided inspiration for the topics covered in this thesis. The Norwegian School of Economics is also fondly remembered for arranging these courses and welcoming me as a visiting participant.

Financial support from the Hanken Funds and the FDPE is gratefully acknowledged.

While support within academia has been important, life outside academia has been essential. Doing things completely unrelated to the thesis work has been a form of mental recharging which at times has been sorely needed. So a big thank you goes to all

of my friends and family, who have provided me with understanding as well as great relaxation in my sparetime. Last but not least, my wife Karolina deserves the biggest of thank yous, for all her support, love, and understanding.

Helsinki August 24, 2013

Frans Saxén

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PART 1

1 INTRODUCTION

"Much of the literature on industrial organization implicitly assumes that firms sell their products directly to final consumers. However, the reality is that many firms sell their products through intermediaries (e.g. wholesalers and retailers) who then resell to final consumers" (Shaffer, 2011). This quotation is taken from a course description for a course on vertical contracting and vertical restraints. It is also an apt introduction to the topics covered by this dissertation. The topics are important, since "retailers and wholesalers are important, and [that] their presence significantly modifies the market equilibrium" (Rey and Stiglitz, 1995). Needless to say, vertical contracts, that is contracts between sellers and resellers, are ubiquitous. As such, the study of these contracts is worthy of attention. Moreover, these contracts are typically devised by sophisticated contracting parties, and as such we can expect that the contents of these contracts is not purely random. Rather, we may suspect that contract clauses may also have strategic objectives. In the words of the by now classic Industrial Organization textbook: "Vertical relationships among firms are often much richer and more complex than those between a firm and its customers," one reason being that the intermediaries make decisions that affect the original seller's profit (Tirole, 1988, p. 169).

The word "strategic" is used in all sorts of contexts today. Nevertheless, economists have a very specific meaning in mind. Namely, economists refer to the expectation that the outcome of a given set of actions is dependent not only on one agent's choices, but also on how other agents react to these choices. Rather than taking the market situation "as given," as the model of perfect competition in an Economics 101 course, the market participants realize that they can influence the market interactions and outcomes through their own choices.

With the notion that economic agents actively try to shape the playing field to their advantage through the setting of contract terms, it is clear that including the relevant players and institutions in our models of the market is important to tease out the outcomes of market interactions. It is in particular important to study the vertical relationships between sellers and intermediaries, to the extent that there is a lot of strategic action here that affects final consumers, as well as producers.

In this dissertation I focus on three distinct aspects of vertical relations. I look at how providers of payment cards affect competition between retailers, through the no surcharge rule; how suppliers can expand their output by financing the establishment of new retailers; and how buyer alliances can extract surplus from suppliers through the use of market share contracts.

Common to these essays is the strategic behavior by agents on one level affecting market outcomes at another vertical level.

I analyze these issues by extending the theoretical literature relevant for each of these questions.

1.1. Policy issues addressed

1.1.1. Card payments

The topic of the first essay of this thesis is the no surcharge rule (NSR), a regulation commonly used in the payment card[1] market, restricting card accepting merchants from charging a fee for card use. A typical concern has been that the NSR may lead to inefficiencies, in that consumers do not face price signals steering them to the most efficient choice of payment method (cf. Frankel, 1998, Leinonen, 2011). This concern has made the NSR highly topical. The recent EU directive on payment services forbids NSR-clauses, but leaves open the possibility for national legislation to impose NSRs, or constraints on surcharging (European Commission, 2007).

In the US, the Department of Justice sued American Express, MasterCard, and Visa, for their use of NSRs in 2010. The Department of Justice reached a settlement with MasterCard and Visa, whereby cash discounts would be allowed (US Department of Justice, 2010). While the settlement gained court approval in 2011 (Schuh et al., 2011), American Express is fighting the suit in court, a fact that limits merchants' ability to steer customers choice of payment method.

The fees paid by merchants for payment card processing constitute the second largest operating cost for many businesses in the US according to lobbyists (cf. Merchant Payments Coalition, 2012). The US Department of Justice estimates that credit card acceptance costs US merchants 35 billion dollar annually (US Department of Justice, 2010). This constitutes only part of the magnitude of the issue, as debit cards are typically also subject to NSRs.

Australia has been a forerunner in regulating payment cards. NSRs were outlawed in 2002 (Chakravorti, 2010), but recently concern over surcharging has increased, as some merchants have imposed surcharges well in excess of actual cost (MarketWatch, 2011). Already Epstein (2005) suggested that some merchants in Australia used excessive surcharges as a way to price discriminate, exploiting credit card customers' higher willingness to pay. More recent studies have cited further evidence, leading the regulator to consider reregulating surcharges, or to allow card companies to constrain surcharging (cf. MarketWatch 2011, Reserve Bank of Australia 2011). In the UK the government has committed to ban "excessive surcharges" (Hayashi, 2012).

Thus, in much of the western world regulators and lawmakers have been concerned with the NSR, and typically over its effects on consumers' incentives to use the most efficient payment method.[2] While this concern over the NSR is valid, my thesis raises another issue. It shows that in addition to dulling price signals, leading to inefficient choices of payment method, the NSR also softens competition between retailers.

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1 A payment card is here defined as any card that can be used for payments, be it a charge, credit, or debit card.

2 As opposed to using the payment method giving the consumer the highest rewards, financed through the fee merchants pay to card companies.

1.1.2. Strategic supply chain financing

In the second essay of my dissertation I cover the strategic use of supply chain financing. This is a topical issue in that so called "alternative financing," that is financing from sources other than financial markets and banks play an increasingly important role in corporate finance today, as pointed out in for example Allen et al. (2012). In terms of magnitudes, in the US non-bank financial companies had 467.4 billion dollars in outstanding receivables from business borrowers in 2011, compared to 1.27 trillion dollars for banks' commercial lending (Federal Reserve System, 2012a,b). Supply chain financing, or the financing of trading partners in the same supply chain is a specific case of alternative financing, which is recognized as being increasingly important (Hofmann et al., 2011).

Recent examples of supply chain financing include Amazon and Google moving into extending credit to their business customers (Financial Times, 2012a), or Starbucks providing financing to coffee growers to enable them to invest in better yielding plants (Financial Times, 2012b). As the Financial Times (2012a) put it in their report on the issue "the biggest internet companies... ...turn to their balance sheets as a source of competitive advantage." In the same article, a Google representative is quoted as saying that Google is "not trying to run the financing business as a profit centre," with the clear implication that credit extension is driven by its effect on sales. Amazon's extension of credit is motivated by a desire to enable sellers on Amazon.com to purchase inventory and thus increase their sales on Amazon.com (EcommerceBytes, 2012).

Common to the three examples given above is that extending credit is not only a matter of earning a return on capital through the interest paid on the loan, but the companies extending credit also expect to benefit from the investments made by the debtor. In this dissertation I analyze how the lending relationship is affected by this additional benefit to the lender.

While there are prominent examples of supply chain financing, the issue is not uncontroversial. In the US a long lasting debate on the separation of banking and commerce is still ongoing. The concern is that mixing lending decisions with other commercial concerns may have negative effects (cf. Baradaran, 2011 or Government Accountability Office, 2012 for a recent overview of the arguments). My results indicate that there are also positive effects from mixing lending and commerce, in that it may lead to more retailers in business, thus providing for more competition among them, leading to greater variety and potentially lower prices.

1.1.3. Market share contracts and buyer power in grocery retailing

In the third essay I cover the use, and creation of buyer power in food retailing.

Buyer power and marketing practices in food retailing have caused concern in many economies lately. In the US, the Federal Trade Commission (2001, 2003) reports on marketing practices, raising concerns about the potential abuse of buyers' monopsony power. Reports by the OECD (1998, 2008) highlight issues raised in a number of countries. The European Commission has published a detailed study on buyer power in EU food retailing (Dobson Consulting, 1999). In December 2012 the Commission launched a study on "choice and innovation in food sector," prompted by concerns over "the impact of unfair trading practices in the food supply chain." The study is a

preparatory step taken before the launch of an "impact assessment that the Commission plans to launch on unfair trading practices." (European Commission, 2012).

In the UK, a detailed study of the buyer power of buyer alliances was carried out by the Office of Fair Trading (2007). A position as Groceries Code Adjudicator is currently created through new legislation (cf. Seely, 2013). The Groceries Code Adjudicator will act as an ombudsman who, according to the UK Coalition government's programme will "enforce the Grocery Supply Code of Practice and curb abuses of power, which undermine [our] farmers and act against the long-term interest of consumers." (HM Government, 2010).

In Finland, the Competition Authority published in 2012 and 2013 investigations into retailer-producer relationships (Björkroth et al., 2012, 2013), focusing on issues of buyer power and unfair practices. Currently, the competition law is being amended as a result of concerns over buyer power (Finnish Government, 2012).

The German competition authority is conducting an inquiry into buyer power of retailers (Die Welt, 2013), while in Norway an official report (Gabrielsen et al., 2013) on the issue was recently handed over to the government.

Given the above inquiries and legislative activity, it is fair to say that buyer power is a topical issue. In the third essay I demonstrate that buyer power is not something completely exogenous, but rather something that retailers can actively affect through their own actions.

This introductory chapter is structured as follows. Following this introduction is a literature review, reviewing some of the studies most central to my research. The literature review is followed by a section summarizing the three essays of this dissertation, followed by some concluding comments.

1.2. Literature review

Students taking an introductory course in economics will initially be familiarized with the concept of perfect competition. When there are numerous firms selling a homogeneous product, firms act as price takers, taking the market price as given. This yields prices equaling marginal cost, and firms make zero profits (Cf. Mankiw and Taylor, 2011, pp. 69 and 300-301). Bertrand competition with homogeneous products and identical producers also results in the competitive outcome, that is prices equal marginal cost and firms make zero profit, even if there are only two firms competing. This slightly surprising result is dubbed the Bertrand paradox (cf. Tirole, 1988, pp. 209-211), after Joseph Bertrand who formulated the model in 1883.

One explanation for observing firms acting as price setters, making positive profits is that firms may be capacity constrained, as suggested by Edgeworth (in French in 1897 and in English in 1925). Another explanation, put forward by Hotelling (1929), is that of horizontal differentiation. It has become a workhorse of the industrial organization analysis. This despite Hotelling in the introduction to his article suggesting that "one may doubt that anything further can be said on the theory of competition among a small number of entrepreneurs" after Edgeworth's contribution. In Hotelling's model, the market is represented by a line, along which buyers are distributed. In the baseline model, there are two sellers, located at given positions on the line. The buyers face a

transportation cost of transporting his purchases from the seller. Thus if the two sellers set the same price, then a buyer will buy from the seller closer to him, as this minimizes the transportation cost. The transportation cost symbolizes any of a number of potential causes for some buyers favoring one seller over another. Hotelling suggests this preference may be a matter of geographic location, but just as well because a seller's "mode of doing business is more to their liking," or the buyer and seller sharing religious beliefs. The conclusion of Hotelling is that each seller as a result will be a "monopolist within a limited class and region," thus able to raise prices above cost, without losing all customers.

The model of Hotelling has become widely used in the analysis of horizontal differentiation. While Hotelling (1929) mainly considered uniform pricing, that is firms charging the same price to all customers, others extended the model to analyze the effects of price discrimination, that is the possibility of firms to charge different prices to different customers. Thisse and Vives (1988) studied in detail the incentives to price discriminate, a theme that Hotelling (1929) only briefly touched upon in the concluding remarks, suggesting that price discrimination may lead to fierce competition for some customers. Thisse and Vives (1988) formalize the argument, pointing out that the decision on whether to price discriminate may be a sort of prisoner's dilemma, where each firm will choose to price discriminate, even though they collectively would be better off were they not to discriminate. Extending this argument, Gehrig and Stenbacka (2005) show how price discrimination can intensify competition, for example in the presence of switching costs. Stole (2007) provides a broad survey of the literature on price discrimination. In the first essay of my dissertation, I utilize the model of Hotelling (1929) as a starting point, applying the ideas of Thisse and Vives (1988) and Gehrig and Stenbacka (2005) to a setting where retailers differentiate themselves from each other through their choice of accepted payment methods.

Whereas price discrimination in a setting of horizontal differentiation provides one of the founding blocks of the first essay in my dissertation, another foundation is provided by the general literature on payment cards. Verdier (2011) and Prager et al. (2009) provide two recent surveys of this literature.

The literature started with Baxter (1983), who analyzed how a so called open, four-party payment card network[3] functions. Baxter (1983) is an early, seminal study in the literature on payment cards, but for the rest of the 1980s and much of the 1990s academics showed scant interest in payment cards. However, litigation in the US slowly reinvigorated interest in the topic. Most of the contributions discussed whether the multilateral interchange fee (MIF) was necessary or not. The interchange fee (IF) is a fee flowing from so called "acquiring banks" (banks of card accepting merchants) to "issuing banks" (banks of consumers paying with cards). Baxter (1983) rationalized this by explaining that if the sum of card-user and merchant benefits from a card transaction exceeded total costs, but a large share of the costs occurred at the issuer (card-user) side, then without a sidepayment in the form of the IF flowing from the acquirer to the issuer, the transaction might not occur.

After Baxter's rationalization, Carlton and Frankel (1995b,c) came with an early critique of the system, noting that the MIF is problematic, in that it can be seen as a result of the exercise of joint market power of members of a card association,[4] and as a

3 Examples of open card networks include MasterCard and Visa, where there are separate issuers of cards and acquirers of card payments. An example of a closed, three-party card network would be American Express, where the same entity provides issuance and acquiring services.

4 At this stage, Visa and MasterCard were still associations of banks, that only later became independent

result of the members' collective market power, the MIF may be set too high from a socially optimal point of view. Evans and Schmalensee (1995) responded to Carlton and Frankel's critique, emphasizing among other things that the MIF was present well before Visa and MasterCard had any kind of market power. Following this Frankel (1998) provided a historic overview of the development of payments in the US, again raising anti-trust issues with the MIF, in particular due to the way fees are set multilaterally by competitors.[5]

During the 2000s, the literature took off, growing considerably, largely based on the two-sided market framework. Here Rochet and Tirole (2003b, 2004, 2006b) and Wright (2004b) are among the seminal contributions in the literature on two-sided markets[6] in general. A two-sided market, or platform, enables two (or more) separate groups of customers to interact with one another. There are many examples of these kinds of platforms, such as mass media (which joins audiences and advertisers), operating systems (joins users and developers), intermediaries (such as real estate agents, who joins buyers and sellers), as well as payment card networks (joins buyers/cardholders and sellers/merchants).

Along with the literature on two-sided markets in general, a literature specifically focusing on card payments started to emerge. Rochet and Tirole (2002, 2003a, 2006a, 2011) and Wright (2003, 2004a) amount to highly influential works, addressing various issues relating to the MIF.

The strategic aspects of card acceptance were already noted by Carlton and Frankel (1995a), who point out that merchants might find it hard not to accept cards, as this would mean lost sales. Rochet and Tirole (2002) also point to card acceptance as a strategic decision for merchants, used to attract customers. Rochet and Tirole (2006a) point to card acceptance as a way of charging higher prices from card users.

Gans and King (2003), analyze conditions under which the IF is neutral, that is doesn't affect the number of transactions completed with payment cards, and therein develops the concept of payment separation. Payment separation means that a consumer facing a "card price" of a good always pays using a card, rather than cash. This may occur through merchants' surcharging. Alternatively, under a no surcharge rule (NSR), with perfectly competitive merchants, merchants will split into those who do and those who do not accept cards. Under these circumstances, merchants that do not accept cards charge lower prices than card accepting merchants. This results in consumers wishing to pay by card buying from the card accepting merchants, while consumers with a low valuation for card payment services buy from cash-only merchants (more or less simultaneously, Wright 2003 reached the same conclusion). In their analysis, Gans and King (2003) thus briefly touch upon the effects of a NSR on merchant competition, the topic of the first essay of my dissertation. However, the result of their brief analysis is that the NSR will not have an impact on the intensity of competition between

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companies after going public.

5 The multilateral setting of the IF has been motivated by the desire to reduce transaction costs and holdup problems. The alternative, given that an IF is necessary, would be to have each pair of issuer and acquirer negotiate bilateral IFs. Baxter (1983) notes that if there is a large number of banks, bilateral IFs will become "excessively cumbersome," facilitating the need for a "uniform understanding" in the form of a MIF.

6 Later renamed multi-sided markets, reflecting that many of these markets cater to more than two groups of customers.

merchants, unlike the results in my dissertation, where the NSR is a device for creating the kind of differentiation that Hotelling (1929) talks about.

While horizontal differentiation is one way for firms to raise their profits, so is the strategic shaping of the competitive environment, through the use of rules, pricing, and structures, as demonstrated above in the payment card context. These structures also include the vertical structures of firms involved in the production of goods and selling them to consumers. An example of the decision with respect to vertical structure is the manufacturer's choice of selling through independent retailers, or integrating vertically and operating its own retail stores. This choice affects profits and welfare.

This kind of shaping of the environment has at times been contentious. In response to what he saw as an overtly hostile attitude to integration, be it horizontal[7] or vertical, Spengler (1950) showed that vertical integration can increase both profits and consumer surplus, thus benefiting both producers and consumers. Absent vertical integration, for each step the product moved from one firm to another, before finally reaching the consumer, a markup, or margin would be applied. Spengler (1950) showed that a vertically integrated firm would set a lower markup than the sum of markups applied by independent firms, and would thus not only sell more, at a lower price, but also make a higher profit. The result, that separate profit maximization of an independent upstream (manufacturer) and downstream (retailer) firm leads to lower profits than joint profit maximization of a vertically integrated entity, became later known as the double marginalization problem.

While Spengler's suggestion of vertical integration as a solution to the double marginalization problem is valid, it is not without problems. Telser (1960) points out that while vertical integration allows a manufacturer to control the retail price, the "cost disadvantages of such an arrangement may outweigh the advantages." The implicit assumption is that retailers have a competitive advantage when it comes to retailing.[8] Instead, Telser (1960) points to resale price maintenance (RPM) as a way for the manufacturer to control the retail price. By controlling the retail price, the manufacturer avoids the double marginalization problem pointed out by Spengler (1950).

In his analysis of RPM, Telser (1960) points to two reasons why manufacturers may want to use RPM. The special services argument, guaranteeing retailers who provide costly services get a return on their investment is efficiency enhancing and pro-competitive. Absent RPM, a retailer incurring the costs of providing service would see customers obtain service from them, but then purchasing the product from other retailers. The cartel argument on the other hand, suggests that RPM makes it easier for manufacturers to collude, as prices are then more directly observable, and is thus anti-competitive. Thus Telser (1960) set the stage for an ever growing literature detailing pro- and anti-competitive effects of so called vertical restraints, contract clauses restricting the independence of firms at another vertical level.

Mathewson and Winter (1984) provide an early formalization of the analysis of vertical restraints. They analyze RPM; territorial protection or exclusive territories (ET),[9] the

7 Horizontal integration can be interpreted as a firm taking over the functions of another firm at the same level in the supply chain, e.g. a manufacturer taking over another manufacturer.

8 This has been elaborated on later on. For example Rey and Stiglitz (1995) suggest that retailers and wholesalers have specialized information that manufacturers lack.

9 Mathewson and Winter (1984) use the term closed territory distribution.

assigning of all customers of a territory to a single retailer; quantity forcing, requiring a retailer to sell a minimum quantity; and two-part tariffs or franchise fees. Mathewson and Winter (1984) note that two characteristics are typical for retail markets: They are spatially differentiated and retailers have an important role in informing consumers about products. When these characteristics are in place, the retail markets are no longer perfectly competitive, and thus a manufacturer wanting to maximize profits needs vertical restraints to ensure that retailers do not make suboptimal decisions. Thus, while Hotelling (1929) showed that retailers benefit from being horizontally (spatial) differentiated, Mathewson and Winter (1984) point out that absent restraints, manufacturers may suffer from retailers' differentiation, as the differentiation increases the retailers' market power. The stronger the retailers are, the greater the vertical externality they impose on the manufacturer, in the form of reduced profits (for example through double marginalization). On the other hand, Mathewson and Winter (1984) point out that intense retail competition, which may be a result of too little differentiation, can also be a problem. Retailers will then have too strong incentives to lower their own prices, without taking into account the horizontal externality they impose on each other. This reduces the profit that can be made in the retail market. The restraints may then be used to alleviate the externalities, raising manufacturer and/or industry profits.

Extending the analysis of vertical restraints to a setting where the retailer may be better informed than the manufacturer, Rey and Tirole (1986) show that vertical restraints may simultaneously be privately profitable, while they may lower social surplus. The conflict between private and social surplus arises, as the vertical restraints increase the profits of those who sign the agreement (i.e. retailer and manufacturer), while consumers are not party to agreement, but are affected by it.

Similarly to Telser's special services argument, Winter (1993) shows formally how RPM can induce service provision among competing retailers, such that industry profits[10] are maximized. Absent RPM, retailers competing both in services and prices will focus excessively on the inter-retailer margin, or stealing customers from each other by lowering prices, rather than on the product margin, that is expanding the over all market by providing services. RPM can be used by the manufacturer to correct for this, making the retailers focus on the product margin.

Another motivation for RPM is given by O'Brien and Shaffer (1992), who show that RPM can be used to protect individual retailers against opportunism by the manufacturer and other retailers. By imposing a RPM, the manufacturer can alleviate individual retailers' fears that they will be undercut by other retailers, receiving better terms from the manufacturer. Jullien and Rey (2007), on the other, hand demonstrate in a dynamic framework that RPM can under certain settings facilitate collusion between manufacturers. Asker and Bar-Isaac (2013) show that RPM, along with two part tariffs can help an incumbent manufacturer exclude potential entrants, if the pool of retailers stays fixed. Gabrielsen and Johansen (2013) show that RPM in some circumstances even can induce monopoly prices when a manufacturer faces a competitive fringe of manufacturers upstream and duopoly downstream.

While the previous studies analyzed various aspects of the double marginalization problem that arises from multiple firms in the supply chain each optimizing separately, Fershtman and Judd (1987) laid the foundations for the strategic delegation literature, showing that the delegation of decisions to other agents can increase profits. In their

10 The joint profits of manufacturer and retailers.

seminal study, the authors analyze the equilibrium incentives principals of a duopoly provide to their agents. The incentives are based on a linear combination of sales and profits. Fershtman and Judd (1987) show that in this situation, if the duopolists' agents compete á la Cournot, equilibrium output is greater and profit is smaller than under regular Cournot competition between profit maximizing agents. On the other hand, if the duopolists compete á la differentiated Bertrand, then the equilibrium incentivized agents will set higher prices than when maximizing profits.

In contrast to the Fershtman and Judd (1987) result that Cournot competition becomes more intense under delegation, Fershtman et al. (1991) show how the collusive outcome can be achieved under delegation. By making compensation conditional on achieving the collusive outcome, agents can be induced to choose the collusive quantities. Producing more will in this case not be in the agents interest, as they would not earn more from this.

While the Fershtman and Judd (1987) idea was presented as dealing with the interaction of firms' internal incentives with their external environment, it had also other applications. Where Fershtman and Judd (1987) had principals committing to incentive schemes for their agents, Bonanno and Vickers (1988) show that duopolist manufacturers have incentives to commit to vertical separation. Vertical separation in this case means having retailers (one each), rather than operating in a vertically integrated fashion. The manufacturers use a two-part tariff, extracting all the profits from their retailers. Similarly to Fershtman and Judd (1987), the manufacturers of Bonanno and Vickers (1988) distort the retailers' incentives by setting the unit wholesale price higher than variable cost. This provokes a milder response from the differentiated Bertrand competitor, raising overall prices and profits.

While Bonanno and Vickers (1988) show how strong manufacturers can increase profits by distorting incentives, Shaffer (1991) shows how strong duopolist retailers could commit to higher wholesale prices by requiring competitive manufacturers to pay slotting allowances to get their products onto retailer shelves. This is shown in a setting where manufacturers are competitive, while retailers have market power. In this setting, the manufacturers have to charge a wholesale price per unit that is above cost, as they otherwise couldn't afford the slotting fee. The higher wholesale prices act as a signal that the retailer will not be aggressive in retail pricing. With differentiated Bertrand retailers, this induces other retailers to raise their prices. The result is that retailers make larger profits when slotting allowances are feasible, and consumers are worse off. This is in itself remarkable, as the general intuition on fixed fees, or two part tariffs is that they only redistribute profits, but do not affect the total sum of profits. In this case, the slotting allowance affects overall profits as well. Thus, the pricing structure used in the vertical relationship affects profitability and consumer surplus. Here the retailer actually has an incentive to create double marginalization, unlike in the Spengler (1950) case. The crucial difference that creates the incentives for double marginalization is the strategic response elicited by the markups. This response is absent in Spengler (1950), as the producers and retailers there are monopolists.

Slotting allowances have proved a contentious topic in retailing. Shaffer (1991) gives an interpretation of them as a device for raising prices and retail profits. There are, however, also other interpretations. Chu (1992) interprets the manufacturer's willingness to pay the retailer a slotting allowance as a signal of product profitability. This is similar to the signaling theory of advertising, i.e. the manufacturer's spending on advertisement is a signal to retailers of high demand for the product (Milgrom and Roberts, 1986). In contrast, in Lariviere and Padmanabhan (1997), the slotting

allowance is used to cover the fixed costs of the retailer for stocking a product. The retailer only just breaks even. Secrieru (2006) describes slotting fees as "manufacturers basically provide cheap loans and technology… …to encourage them to carry a new product or allocate minimum shelf space to a product."

Similarly to Shaffer (1991), Rey and Stiglitz (1995) demonstrate another configuration where producers benefit from double marginalization. The authors show that manufacturers could raise equilibrium prices and profits through the use of exclusive territories, whereby one retailer is granted a territorial monopoly. In their model, exclusive territories would result in a strategic response from differentiated Bertrand competitors, and this response would offset the negative effects of double marginalization. More generally, Rey and Stiglitz (1995) note that their approach, like that used by other studies focusing on vertical relations, can be described in the following way: "by choosing an adequate time structure (for instance, choose the x's first, and then the y's given the x's), one induces certain responses that facilitate cooperative behavior."

The results of Fershtman and Judd (1987), Bonanno and Vickers (1988), Shaffer (1991) and Rey and Stiglitz (1995) rest upon the observability of the contracts that the agents and retailers sign. Without observability, the contract cannot provoke a beneficial reaction from their competitors. Foros and Jarle Kind (2008) note that assuming observability can be dubious in some circumstances. Nevertheless, they point out that sometimes the assumption may be well justified. Foros and Jarle Kind (2008) point out that the practice of different retail chains sharing a common procurement alliance may facilitate the observability of wholesale prices, and thus facilitates the Shaffer (1991) effect. While the analysis of Foros and Jarle Kind (2008) is conducted in a static setting, Doyle and Han (2012) extend the analysis to a dynamic setting, analyzing alliance members' incentives to secretly source outside the alliance.

Above we have seen that there is a rich literature on vertical relations and restraints, providing both pro- and anti-competitive explanations. This fits well with my thesis, where policies adopted by a manufacturer and a wholesaler with regards to their retailers can be seen as both pro- and anti-competitive. However, the anti-competitive aspects of the above studies have been more of a tacit collusion nature, whereby strategic delegation enabled a raising of prices, or RPM facilitated explicit collusion.

Another strand of the literature on vertical relationships focuses on the potentially anti-competitive nature of exclusionary contracts. Exclusionary contracts refer to contracts that may either seek to exclude rivals from the market, and/or contracts that require the buyer to commit to exclusive dealing, or to commit to market share contracts. While excluding rivals from the market is purely anti-competitive, exclusive dealing, that is buyers committing to buy from only one source can be pro- or anti-competitive. Market share contracts can be seen as generalizations of exclusive dealing, conditioning contracting on market shares of less than 100%.

Exclusive dealing and market share contracts can be given three separate interpretations: An efficiency enhancing, pro-competitive interpretation; an exclusionary, anti-competitive interpretation; as well as a rent-shifting interpretation.

Marvel (1982) explains how exclusive dealing can be used by a manufacturer to ensure that its investments in demand generating activities benefiting the retailer also benefit himself. In the absence of exclusive dealing, the retailer might divert the demand to a competing product, robbing the manufacturer of the returns on his investment. The

same motivation for exclusive dealing is also explored in Besanko and Perry (1993). This argument of inducing investment in the relationship is potentially pro-competitive, efficiency enhancing, in that it enables investments which otherwise would not be made. An alternative to exclusive dealing could be vertical integration, as this would remove the conflict of interest between manufacturer and retailer. But if the concern is that exclusive dealing may reduce variety and competition at the retail level, then having manufacturers operate their own retail stores would seem counterproductive.

Mathewson and Winter (1987) show that exclusive dealing contracts can be pro-competitive, in that they induce competition for exclusivity. In their model, a monopolist retailer can induce more competition among manufacturers by accepting offers requiring the retailer to commit to exclusive dealing. This sort of ex ante (before signing of contract) competition can be more intense than the ex post competition (after the contract phase) that it replaces.

Rasmusen et al. (1991) show the potential for anti-competitive effects, in a setting where manufacturing requires a minimum efficient scale. If a large enough share of the buyers can be convinced that all the other buyers will agree to exclusive dealing, then the manufacturer can achieve exclusion. This is showed both when the manufacturer makes simultaneous offers to the buyers, as well as when offers are made sequentially. The results of Rasmusen et al. (1991), as described above are correct, even though Segal and Whinston (2000) later pointed out that the derivations contained some mistakes, affecting the calculated likelihood and cost of achieving exclusion.

Bernheim and Whinston (1998) show a range of outcomes of exclusive dealing contracts: In addition to the pro-competitive outcome, they also show the anti-competitive potential for foreclosure. They show that a manufacturer can foreclose future markets from rivals, when manufacturers must serve more than one market to achieve important economies of scale, and these markets open up sequentially. This is shown in a setting where manufacturers sell their products through one retailer per downstream market. In that case, exclusive dealing in the first market can be used to achieve foreclosure in future markets.

Where Rasmusen et al. (1991), Segal and Whinston (2000), and Bernheim and Whinston (1998) demonstrate the potential for exclusive dealing to cause foreclosure, they do this in settings where buyers have independent demand, that is they are either final consumers or monopolist retailers. Fumagalli and Motta (2006) show that it can be more difficult for an incumbent to achieve foreclosure in a setting where buyers compete, i.e. when manufacturers sell to retailers in the same market. In particular, if retailers compete á la Bertrand, then it can be enough for a more efficient potential entrant to sign up a single retailer to gain entry to the market.

While Rasmusen et al. (1991), Segal and Whinston (2000), Bernheim and Whinston (1998), and Fumagalli and Motta (2006) show how exclusive dealing contracts can be used to achieve foreclosure, Chen and Shaffer (2011) show how it can be achieved using market share contracts. A seller, by convincing buyers that a large enough share of other buyers will sign a market share agreement, can exclude a potential entrant. This is similar to the arguments of Rasmusen et al. (1991), and Segal and Whinston (2000), but the cost of exclusion is lower with a market share requirement than with exclusive dealing. Chen and Shaffer (2011) show that a seller may be able to exclude a potential entrant in situations where exclusion would not be profitable using exclusive dealing contracts. Chen and Shaffer (2011) is thus also an example of how market share

contracts can be used for the same purposes as exclusive dealing, but can be more advantageous for the seller.

A third explanation for exclusive dealing and market share contracts involves rent shifting. This line of argument is closest to the case I explore in my third essay.

Mathewson and Winter (1987) is a seminal study, not only showing the potentially pro-competitive effects of exclusive dealing, but at the same time showing how a retailer can shift rents from manufacturers to retailers. While Mathewson and Winter (1987) show how a buyer can shift rents to itself from suppliers, there is also a strand of the literature where rents are shifted by the contracting parties from suppliers not party to the contract. In these cases, the supplier that enters an agreement of exclusive dealing or a market share contract with a buyer will actually want there to be other suppliers, as there will not be any rents to shift otherwise, as pointed out by Marx and Shaffer (2008).

Aghion and Bolton (1987) provide an example of the above. They show how exclusive dealing can be used by a coalition of an incumbent seller and a buyer to extract profits from a potential entrant. Here the incumbent and seller contract prior to the potential entry. By committing the buyer to pay the incumbent damages in case of breach of contract, the coalition may be able to extract profits from the entrant. Marx and Shaffer (2008) are similar in spirit in that they model the contracting between a seller and a buyer as a device for extracting surplus from a second seller, who negotiates later with the buyer. Where Aghion and Bolton (1987) use an exclusive dealing contract to shift rents, Marx and Shaffer (2008) also allow for market share contracts. Marx and Shaffer (2008) show that a seller facing a competitor and a buyer may use market share contracts to shift rents from his competitor. My third essay shares this theme of contracting parties extracting profits from agents not party to the agreement with Aghion and Bolton (1987), and Marx and Shaffer (2008), even though it occurs in a rather different setting in my case. Further, Aghion and Bolton (1987), and Marx and Shaffer (2008) view the contracts as affecting bargaining power only indirectly, through their reduction of the buyer's gain from trade with other parties, while in my case the contract affects bargaining power directly.

Mills (2010) shows how wholesale price conditional on market share can induce the retailer to provide extra effort, depending on the retailer's type. Majumdar and Shaffer (2009) show that a dominant supplier facing a competitive fringe may have an incentive to condition payments on the market share the retailer gives its products when demand is uncertain. Inderst and Shaffer (2010) show that a dominant supplier may want to use market share contracts, when there are retailers competing downstream, as well as a competitive fringe of suppliers competing with the supplier. In this setting a market share contract will moderate both upstream and downstream competition.

Where Aghion and Bolton (1987), and Marx and Shaffer (2008) focus on how buyer-seller coalitions could shift rents from other sellers, there are other types of coalitions that can also be used for rent shifting. Mathewson and Winter (1997) is an early contribution to the literature on buyer alliances, focusing on the externalities alliance members may impose on buyers not part of the alliance. Dana (2012) shows how horizontally heterogeneous buyers facing horizontally differentiated sellers may benefit from committing to buy jointly from one seller through a buyer alliance. By acting as a single alliance, the buyers appear more indifferent with respect to which seller to choose, thus encouraging more competitive behavior by the sellers. Chen and Li (2013)

analyze when it is optimal for a buyer alliance to commit to buy exclusively from one supplier, allowing for the preferences of the buyers to remain private knowledge.

In a manner similar to Dana (2012), and Chen and Li (2013), Marvel and Yang (2008) analyze how buyers by grouping together can dilute their differences and thus induce more competitive behavior by sellers. Marvel and Yang (2008) show that by grouping together, buyers induce oligopolistic sellers to compete in non-linear pricing, thus competing more fiercely than under linear pricing.

Inderst and Shaffer (2007) show that two horizontally differentiated retailers may have an incentive to merge and commit to exclusive dealing, for similar reasons as retailers might want to group together in the buyer alliances of Dana (2012), and Chen and Li (2013).

While various forms of exclusive dealing or market share contracts can be used to induce upstream competition for access to retailers, Marx and Shaffer (2010) show that retailers can create this competition by reducing the shelf space available for manufacturers. Thus Marx and Shaffer (2010) show that retailers may have an incentive to maintain a shortage of shelf space, in order to make previously unrelated products compete for shelf space.

Summarizing the above review on vertical restraints, the literature identifies efficiency gains, rent shifting, and collusive or exclusive motives. Recent survey articles are provided by Secrieru (2006), Lafontaine and Slade (2007), and Bresnahan and Levin (2012).

While product market structure is an important determinant for profitability, the product market structure is also influenced by financial constraints. Strategic delegation may not be an option if potential agents do not have access to capital. At the same time, product market structure may affect the availability of capital. Thus over the last decades, a literature analyzing the interaction of corporate finance and industrial organization has developed.

Brander and Lewis (1986) show in their seminal study that a firm's financial structure affects its product market behavior. The limited liability effect of debt financing makes firms with more debt prefer more volatile product market strategies. In a Cournot setting, firms with more debt choose higher output levels. Thus Brander and Lewis (1986) find that debt is pro-competitive. Fershtman and Judd (1987), which I already discussed previously is also considered to be a seminal study in this literature.

Where Fershtman and Judd (1987) look at how incentives conditioning pay on a combination of sales and profits affected product market outcomes in duopoly, Aggarwal and Samwick (1999) analyze how incentives based on relative performance affects product market outcomes. If a manager's wage is based on a combination of own profits and rival profits, then the wage should be rising in rival's profits, if competition is á la differentiated Bertrand, as this then leads to less aggressive product market behavior. On the other hand, if competition is á la Cournot, the managers' wage is decreasing in the rival's profits (a form of relative performance evaluation), leading to more aggressive product market behavior.

Maksimovic and Titman (1991) demonstrate that a firm's choice of financial structure can have important implications for its ability to make credible commitments to customers. A company with a high, but sustainable debt level has incentives to keep product quality high, in order to gain a reputation and thus repeat business, so as to be

able to pay off debt, in order to finally be able to ensure equity holders get their returns. On the other hand, if increased debt leads to an increased risk of bankruptcy, then the incentives to invest in long term reputation can be diluted.

Chevalier and Scharfstein (1996) further elaborate on the issues raised by Maksimovic and Titman (1991). In their theoretical model, a financially constrained firm has less incentive to invest in market share, even though the presence of switching costs would mean that this investment would result in returns from locked-in customers in the following period. Thus financially constrained firms compete less vigorously in their model, compared to unconstrained firms. The authors find empirical evidence for this theory in their study of supermarkets. The empirical application was covered in greater depth in Chevalier (1995). For a brief summary of the literature up until the early 2000s, see Riordan (2003).

Bolton and Scharfstein (1990) is a significant contribution to this literature. Not only do the authors characterize the optimal debt contract and show why debt typically is staged and short term rather than long term. They also show that a levered firm is at greater risk of predation than a deep pocketed firm. In their two-period model, a firm needs financing for fixed costs in both periods, but returns are not observable, and thus not contractable. By conditioning second period financing on first period repayment, the financier can induce truthful reporting in the first period. However, if the levered firm's competitor knows this, then it has an incentive to prey on the levered firm, to ensure it can not repay its loan, and thus will be forced to exit. The financier thus faces a tradeoff between deterring predation on the one hand, by making refinancing less sensitive to first period returns; and mitigating incentive problems on the other hand, by making refinancing more sensitive to first period returns. The agency problem here is a result of profit being only partially observable, and there is thus a risk that the entrepreneur receiving financing diverts part of the profit. This feature has given the literature the nickname of "stealing-literature." I use the Bolton and Scharfstein (1990) framework in the second essay of my thesis for analyzing a manufacturer's incentives to finance retailers.

In the literature on corporate finance, the Bolton and Scharfstein (1990) analysis inspired many variations on the optimal debt contract when project returns may be diverted. Snyder (1996) looks at the effect of renegotiation, while Maurer (1999) looks at costly effort provision in the same framework. Hart and Moore (1998) look at the optimal size of the loan and the repayment, while Ellingsen and Kristiansen (2011) is a recent study analyzing the implications of imperfect monitoring. These studies have however little to say on product market aspects, which are more relevant for my thesis.

Povel and Raith (2004), Clayton (2009), and Khanna and Schroder (2010) look more closely at the interaction of capital structure and product markets. Both Povel and Raith (2004), and Clayton (2009) follow in the footsteps of Brander and Lewis (1986), analyzing how debt affects firms' ability to invest in capacity, and thus their ability to compete in the product market. Clayton (2009) notes that the empirical literature has found little evidence for the Brander and Lewis (1986) limited liability effect. As an explanation Clayton (2009) notes that the limited liability effect decreases the incentives of firms to invest in the first place. Taking account of this disincentive effect, Clayton (2009) notes that the overall effect of debt on product market behavior may actually be to make it less, not more aggressive.

Khanna and Schroder (2010) look more closely at the pricing decisions of the levered firm and the incentives for the firm with deep pockets to predate. Where Bolton and

Scharfstein (1990) assume that successful predation would always be beneficial for the predator, Khanna and Schroder (2010) also allow for the possibility that it may be harmful, if it leads to the levered firm being replaced by a more efficient competitor, or if the two share a common supplier, whose viability would be endangered by the exit of one its customers. Valta (2012) studies empirically the sensitivity of borrowing terms to product market competition. He finds that firms facing competition from financially strong competitors have a higher cost of bank borrowing than similar firms in less competitive settings.

Nocke and Thanassoulis (2013) show how credit constraints of a downstream firm, coupled with demand uncertainty affects wholesale and retail prices. The interaction between product markets and financing activities give an upstream firm incentives to lend when a bank with the same access to capital would not find it profitable.

Another theme that the literature on interaction of corporate finance and industrial organization study is that of risk sharing. In Nocke and Thanassoulis (2013) risk is shared through changes in variable payments (e.g. wholesale price), Yang and Birge (2011) also elaborate on financing as risk-sharing. In their case inventory risk of the retailer is shared with the supplier extending trade credit.

While the financial structure of firms is important for their product market behavior, the firms' customers' finances may also be important for the profitability of firms. While my second essay deals with a manufacturer financing fixed costs, or co-investments of its retailers, this is closely related to the literature on trade credit. Trade credit refers to the seller extending credit to the buyer, to enable the buyer to buy the sellers' products.

Nadiri (1969) analyze trade credit as just another expense necessary to increase demand, comparing it to advertising. The foregone profits from denying credit can be substantially higher for a supplier than for a bank, as the supplier will also take into account that sales might be lost if credit is denied. This is a crucial aspect of my argument in essay two. Petersen and Rajan (1997) find some empirical evidence of suppliers having an informational advantage when evaluating credit risk of their buyers. Not paying a supplier may have more adverse effects on a retailer than not repaying a bank. A supplier withholding deliveries may be able to extract a quicker response from the retailer than what an external financier is able to gain. This theme is also explored in Cuñat (2007). Petersen and Rajan (1997) also note that the prospect of future business gives suppliers greater incentives to extend trade credit than a bank might have. Petersen and Rajan (1997) describe this as the supplier having an "implicit equity stake" in their customers. In the model of Cuñat (2007), this leads the buyers not to protect themselves against liquidity shocks, knowing that their supplier will extend them credit if need be. This also helps explain why suppliers rather than external financiers may finance downstream firms, something that already Schwartz (1974) explained theoretically in similar terms. Giannetti et al. (2011) find empirical evidence that suppliers do sustain financially troubled customers with trade credit.

Burkart and Ellingsen (2004) on the other hand explain trade credit with the fact that it is less risky to extend credit in the form of products than cash, as it is harder to divert products than cash. Thus trade credit can mitigate the risk that the debtor behaves opportunistically.

While Petersen and Rajan (1997) predict that a buyer's dependence on the supplier would give the buyer greater incentives to repay a supplier than an external financier,

Wilner (2000) highlights the opposite. In particular, if the buyer is very important to the supplier, then the buyer would be better able to extract concessions from a supplier than from an external financier in case of renegotiation.

A recent theoretical study on trade credit with some similarities to my second essay is Troya-Martinez (2012). Similarly to essay two, Troya-Martinez (2012) uses the manufacturer's threat of terminating the retailer as a device to induce truthful reporting. However, Troya-Martinez (2012) does this in a setting different from mine, modeling a bilateral monopoly, focusing on limiting sales volume to leave surplus to the retailer.

Burkart and Ellingsen (2004) not only point out that inputs (products) are more difficult to divert than cash. They also note a complementarity between trade credit and bank lending. A firm receiving trade credit would also find it easier to receive bank lending. This is the case, as the trade credit is a signal to the bank that the firm is purchasing inputs, and is considered a viable customer by the supplier.

While the economics and finance literature on trade credit is relevant for the second essay, the essay also draws inspiration from the literature on supply chain financing, which has developed in the field of supply chain management. This literature stems from the issues raised in for example Allen et al. (2012). The authors point out the importance of so called "alternative sources" of finance, especially in light of the recent financial crisis. Since bank lending is often procyclical, alternative sources of financing, such as financing from suppliers can play an important role. Randall and Farris II (2009) show how the total cost of capital for a supply chain can be lowered if the company with the lowest cost of capital lends to other companies in the supply chain. Hofmann et al. (2011, chapter 5) further investigate the theme, noting that the financial crisis has highlighted the need to not only build lasting relationships with suppliers, but also support the investments made by suppliers. The authors highlight the example of credit extension from Knorr-Bremse, a braking system manufacturer extending credit to their suppliers to enable them to invest in cost saving technology. Another example is de Hildebrand e Grisi and Puga Ribeiro (2004), who document how Brazilian auto manufacturers finance their suppliers.

1.3. Summary of the essays

1.3.1. Essay 1: The no surcharge rule and merchant competition

In the introduction of this chapter I highlighted the topicality of card payments, and the rules surrounding them. In all major western economies, regulators and/or legislators have taken an active interest in the rules and prices governing card payments. In the first essay of my dissertation, I discuss a so far neglected effect of card payments regulations, namely the impact of the no surcharge rule (NSR) on merchant competition.[11]

The purpose of the article is to analyze the NSR's effect on competition between merchants. NSRs are rules forbidding merchants to charge different prices to customers paying with different payment methods, e.g. cash or card. NSRs are typically

[11] This essay is forthcoming as an article in Journal of Industry, Competition and Trade (available online as of this writing).

found in agreements between merchants and payment card processors. Thus far, the NSR has mainly been analyzed for its effect on competition between and pricing of different payment methods. In this article, I analyze how a NSR may affect competition between merchants, given that acceptance of specific payment cards is used as a strategic device for differentiation and to attract customers.

I carry out my theoretical analysis in a framework of price discrimination in a horizontally differentiated setting. Methodologically I thus draw upon Hotelling (1929) for the horizontal differentiation, Thisse and Vives (1988) and Gehrig and Stenbacka (2005) for the price discrimination theory, while for institutional details I draw upon the card payment literature, among others Baxter (1983), Gans and King (2003), Rochet and Tirole (2002, 2006a, 2011), Wright (2004a), Levitin (2008), Chakravorti (2010), and Hayashi (2012).

I show that any constraint on surcharging, in particular a NSR, is a competition-softening device, with a potential for increasing merchant profits. I do this by comparing equilibria under three different settings: A setting with a NSR in force, a setting with no constraints on surcharging, and a setting with some constraints on surcharging. The results from this comparison constitute the major contribution of the article.

The reason that the NSR has a competition-softening effect is the following. If one merchant chooses to accept card payments, while its competitor does not, and card acceptance entails an additional cost, then the card accepting merchant will need to raise his prices above those he would charge if he only accepted cash. If there was no NSR, then the card accepting merchant could charge a lower price to cash users, and a higher price to card users. Without the NSR, there would be intense competition for cash users. With the NSR, the card accepting merchant sets his price so as to attract the card users, paying less attention to cash users. As a result, competition for cash users is less intense under the NSR. Thus a NSR can be beneficial for retailers, in that it makes competition less intense.

In addition to looking at the intensity of competition, I also study how changes in the costs and benefits of card use affect prices under different settings. When a NSR is in place, cash using consumers will suffer if merchants' cost of card acceptance increases. This even happens when the cash users shop at a retailer who does not accept card payments. This happens since the increase in costs causes the card accepting merchant to increase his prices, and the cash only merchant in the shadow of this can increases his own prices. For similar reasons, an increase in card user rewards causes cash users to pay higher prices under the NSR, or when surcharges are constrained.

My results are contingent on merchants using their card accepting policies as strategic tools for attracting customers. This assumption is warranted, based on both the previous literature on payment cards (cf. Rochet and Tirole, 2006a), and on the way card companies market card acceptance (cf. American Express, 2011). My results are particularly relevant in view of recent developments, whereby NSRs on the one hand are being repealed in much of Europe and the US, while Australia and the UK are considering constraining surcharging in response to the effects of previous reforms.

1.3.2. Essay 2: Strategic supply chain financing

In the second essay of my dissertation I cover the topic of strategic supply chain financing. As pointed out in the introduction, this is an increasingly topical subject. As some firms find it increasingly difficult to get access to capital from traditional sources, so called alternative sources are becoming increasingly important (Allen et al., 2012). One source of such alternative financing can be firms within the same supply chain. This kind of financing is known as supply chain financing.

In the essay, I analyze supply chain financing in the context of a manufacturer financing a retailer. While there exists a considerable literature on trade credit, that is sellers allowing buyers to take delivery of goods and paying later, the context in my essay is rather different from this. In my model, the manufacturer finances a retailer's investment in fixed costs. My analysis is based on the framework established by Bolton and Scharfstein (1990). While I thus make a contribution to the literature on the interaction of corporate finance and industrial organization, I also contribute towards an understanding of the motives for supply chain financing. While the literature on supply chain financing (e.g. Randall and Farris II 2009, Hofmann et al. 2011) have mainly focused on supply chain finance as a way of reducing financing cost, I analyze the strategic motives for supply chain finance. Here the term "strategic" refers to the effects of financing on the product market.

In the words of Tirole (1999), I analyze a "game with cooperative investments," where the term cooperative investment reflects the fact that it is not only the retailer who makes the investment who benefits from it, but the investment also affects the manufacturer. In my model, the retailer depends on the manufacturer for financing. If the retailer can not get access to finance, this has a detrimental effect on the manufacturer, as the retailer will provide access to some customers the manufacturer could not access without the retailer. Furthermore, signing up the retailer may increase competition downstream, i.e. among retailers. This increase in competition reduces the problem of double marginalization, discussed in the literature review.

While I cast my model as one where the manufacturer (upstream firm) finances the retailer (downstream firm), the model could just as well be inverted into one where a retailer finances a manufacturer.

For these strategic reasons, the manufacturer's incentives to lend to the retailer are greater than the incentives of an external financier. This helps explain why we increasingly observe supply chain financing, as pointed out in the introduction.

If the manufacturer can extend financing to retailers in situations where an external financier would decline to do it, this implies that there can be social benefits from this type of financing, in the sense that it might enable downstream competition where it otherwise might be absent. However, there is a catch to this. The additional incentives of the manufacturer to finance the retailer result in there being a risk of hold-up, not present when an external financier is the creditor.

The retailer, aware of the manufacturer's incentives to keep him signed up, might report low profits in a situation of high profits, in order to limit his repayment. An external financier might cut off funding in this case. A manufacturer may have too high incentives to maintain the relationship, and may thus not be able to credibly commit to the termination threat. To counter this, the manufacturer may invest in an outside option, such as the ability to more easily sign up alternative retailers, for example by

maintaining an active channel management organization to assist potential new retailers. This can make the manufacturer's threat to terminate the relationship with the retailer more credible, which in turn can help to insure that the retailer reports truthfully.

In this essay I thus contribute to the academic literature on corporate finance and industrial organization, and contribute to an understanding of the strategic product market issues related to supply chain financing. Furthermore, in showing that the manufacturer's financing may contribute to increased downstream competition, I also show the potential social benefits of manufacturer financing.

1.3.3. Essay 3: Market share requirements and buyer groups

In the third essay I analyze buyer power in the context of buyer groups. The specific modeling is based on a setting of grocery retailing, looking at some of the institutional arrangements that can be found there. As pointed out in the introduction of this chapter, this is a topic which has received a lot of interest from competition authorities and politicians across the western world over the last years.

Specifically, I look at how market share requirements in the context of buyer groups affect the bargaining power of the buyer group members, when they negotiate with producers. A buyer group is an alliance of buyers, joining together in order to obtain better terms of trade. In my specific case, the buyer alliance is a wholesaler for independent retailers, similar to IGA in the US, ICA in Sweden, or Kesko in Finland. The market share requirement is a contractual term requiring the retailer to purchase a certain share of the products from the wholesaler, or allowing the wholesaler to choose a certain share of the products the retailer carries. The result of this requirement is that the retailer's independence when it comes to choosing the products to carry is curtailed, so that there is only a limited share of the total number of products that the retailer can procure independently. Intuitively, this kind of limitation might seem to be contrary to the retailer's interests. Indeed, Paulamäki (2007) shows that many retailers have been unhappy about their decreasing independence. However, in this essay, I show that it can also benefit the retailers.

The benefit to the retailer comes from an increase in the retailer's bargaining power vis a vis those producers he negotiates with directly. By limiting the number of products the retailer can bargain for directly, the retailer can induce producers of unrelated products (e.g. potatoes and strawberries) to compete for the same limited retailer capacity. The idea is similar to that of Marx and Shaffer (2010), who showed that a retailer may have a unilateral incentive to constrain capacity, in order to make upstream competition for his scarce capacity more intense. However, in my case no individual retailer has an incentive to constrain their capacity in this way, because they are assumed to be too small to affect their terms of trade on their own. However, if they all commit to constrain their capacity, through the signing of a contract containing a market share requirement, they can all benefit from this restraint. The logic is similar to that of a traditional cartel. A concern here might then, of course, be that, similar to the cartel, all retailers are better off if they all stick to the agreement than if they do not, but each member might have an incentive to unilaterally deviate from the agreement. However, the fact that the market share requirement is part of a broader agreement, providing the individual retailers with other benefits from sticking to the agreement (e.g. marketing, low prices on other products, etc.), the incentive to deviate can be overcome.

In the essay I show how the retailers can benefit from the market share requirement by modeling explicitly the effect of the requirement on the bargaining power. I thus do not only provide an explanation for the use of market share requirements different from those used earlier, but I also contribute to different strands of literature. First of all, I contribute to the literature on vertical restraints, as well as the literature on buyer alliances presented earlier on. I further contribute to the literature on strategic delegation, showing how the retailer's delegation of part of the decision making to the wholesaler can be beneficial for him. Further, I also contribute to the literature on bargaining, by explicitly modeling the bargaining power, in the spirit of Stenbacka and Tombak (2012).

One prediction of my model is that there will be producers who will not be able to get their products distributed directly through the retailers. This is compatible with the results from a survey conducted by the Finnish Competition and Consumer Agency, where producers complained that it was impossible to negotiate directly with retailers (Björkroth et al., 2013).

1.4. Concluding remarks

The literature review, as well as the summaries presented above have shown a number of ways whereby firms can escape the Bertrand outcome of zero profits. That retailers and wholesalers are important, and that their presence and strategic behavior, in the words of Rey and Stiglitz (1995), "significantly modifies the market equilibrium," should be in no doubt. Hotelling's suggestion from 1929, that "one may doubt that anything further can be said on the theory of competition among a small number of entrepreneurs" after Edgeworth's contribution should be thoroughly refuted. In this thesis I have shown that a number of contractual details can affect market outcomes, in terms of prices, profitability and consumer welfare.

The evolution of markets, with changing business models and both new and old vertical restraints will provide a rich source of topics for further research. This dissertation should convince researchers, anti-trust professionals, legislators and business people that it is worth paying attention to the institutional settings in which business is carried out, i.e. what vertical restraints might be employed; how is competition affected by these, both upstream and downstream.

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LIST OF ESSAYS

Essay 1:
THE NO SURCHARGE RULE AND MERCHANT COMPETITION
(Forthcoming in Journal of Industry, Competition and Trade).

Essay 2:
STRATEGIC SUPPLY CHAIN FINANCING

Essay 3:
MARKET SHARE REQUIREMENTS AND BUYER GROUPS:
A BARGAINING POWER APPROACH

PART 2

2 ESSAY 1: THE NO SURCHARGE RULE AND MERCHANT COMPETITION

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The No Surcharge Rule and Merchant Competition

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Abstract We analyze the no surcharge rule (NSR) and its impact on merchant competition by comparing different surcharging regimes. Any constraint on surcharging, including the NSR is shown to be a competition-softening device. A NSR may induce socially excessive card use. Allowing imperfectly competitive merchants to surcharge may lead to socially too little card use. Under a NSR, increased cost of card acceptance increases all prices, even the prices of a merchant not accepting cards. Under the NSR cards yielding no social surplus may be viable. This is not the case without the NSR. Card-use rewards may hurt consumers.

Keywords No surcharge rule · Retail financial services · Payment card networks · Debit cards · Credit cards · Surcharging

JEL Classification G21 · E42 · L42

1 Introduction

Academics, legislators, and regulators have recently taken a keen interest in payment card networks. The academic literature on payment card networks can be traced to Baxter (1983), who analyzed how a four-party payment card (the term payment card refers to any kind of card that can be used for making payments, and is as such a generic term covering charge, credit and debit cards) network works. During the 2000s the literature has grown considerably, largely based on the two-sided market framework (cf. Rochet and Tirole 2002, 2003, 2006; Wright 2004). Issues like the multilateral interchange fee (MIF) have received much attention. Another feature of payment networks that has gained attention is the presence of "no surcharge rules"

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(NSRs). NSRs have often been part of agreements between merchants and card associations (or their agents), forbidding the merchant from charging a different price depending on a buyer's choice of payment method (eg. card, check, cash). Such price differences could come about through surcharges on card payments, or alternatively discounts for cash payments.[1] A NSR may also be the result of legislation that forbids surcharging, as is done in some states in the US (Levitin 2008).

In this paper we analyze how the presence (or absence) of a NSR affects merchant competition, a theme that has received scant attention in the literature. This is an interesting question, as it affects how merchants price their products, and how pricing affects card use. Card use may impose additional costs on merchants. These costs are passed on to consumers, and not necessarily only to the card-using consumers. We show that under a NSR, if a card-accepting merchant's card acceptance costs increase, a competitor only accepting cash payments will also raise his prices.

The NSR is highly topical. The recent EU directive on payment services forbids NSR-clauses, but leaves open the possibility for national legislation to impose NSRs, or constraints on surcharging (European Commission 2007).

In the US, the Department of Justice has sued American Express, MasterCard and Visa, for their use of NSRs. The Department of Justice reached a settlement with MasterCard and Visa, whereby cash discounts would be allowed in the future (US Department of Justice 2010). The settlement gained court approval in July 2011 (Schuh et al. 2011). American Express is fighting the suit in court, a fact that limits the ability of merchants to exploit Visa's and MasterCard's concessions.

The fees paid by merchants for payment card processing constitute the second largest operating cost for many businesses in the US according to lobbyists (cf. Merchant Payments Coalition 2012). The US Department of Justice estimates that credit card acceptance costs US merchants 35 billion dollar annually (US Department of Justice 2010). This constitutes only part of the magnitude of the issue, as debit cards are typically also subject to NSRs.

Australia has been a forerunner in regulating payment cards. NSRs were outlawed in 2002 (Chakravorti 2010), but recently concern over surcharging has increased, as some merchants have imposed surcharges well in excess of actual cost (MarketWatch 2011). Already Epstein (2005) suggested that some merchants in Australia used excessive surcharges as a way to price discriminate, exploiting credit card customers' higher willingness to pay. More recent studies have cited further evidence, leading the regulator to consider reregulating surcharges or to allow card companies to constrain surcharging (cf. MarketWatch 2011; Reserve Bank of Australia 2011). In the UK the government has committed to ban "excessive surcharges" (Hayashi 2012).

Thus the NSR is the focus of regulatory intervention in most of the western world. In much of the literature, the NSR is analyzed in conjunction with the interchange fee (IF) and other prices in the payment systems. The main focus has been on the NSR's effect on competition in the market for payment methods. As part of that

[1]The no surcharge rule can take different forms. In this paper we focus on the most stringent form, which forbids any discrimination in the form of surcharges or rebates that are conditional on chosen payment method. This has the benefit that our model can be interpreted generally, with the discrimination being either between cash and card users, or between users of different kinds of cards. Levitin (2008) provides a thorough discussion of the various forms of the NSR.

analysis, the NSR has been analyzed under various modes of merchant competition, but merchant competition has been taken as exogenously given. Prager et al. (2009) is a recent overview of the general literature on payment networks, while Hayashi (2012) provides a recent study of the effects of surcharging on the choice of payment method.

Gans and King (2003) analyze when the IF is neutral, and develop the concept of payment separation. Payment separation means that a consumer facing a "card price" of a good always pay by card, rather than cash. Payment separation may occur through merchants' surcharging. Alternatively, under a NSR, with perfectly competitive merchants, merchants split into those who do and those who do not accept cards. Merchants that do not accept cards will then charge lower prices than card accepting merchants. This results in consumers wishing to pay by card buying from the card accepting merchants, while consumers with low valuations for card payments buy from cash-only merchants (more or less simultaneously, Wright (2003) reached the same conclusion).

In their analysis, Gans and King (2003) thus briefly touch upon the effects of a NSR on merchant competition. However, the result of their brief analysis is that the NSR will not impact the competition between merchants.

The contribution of our paper is that we show that a NSR may soften competition between merchants, and as such a NSR increases merchant profitability. We interpret a NSR as any regulation (be it as a result of regulatory decisions, card association terms, etc.) forbidding merchants to charge different prices based on the customer's choice of payment method. We analyze the NSR in a price discrimination framework, where the NSR constitutes a restriction on a merchant's ability to price discriminate based on customers' choice of payment method. We conduct the analysis in a Hotelling setting, in the spirit of for example Thisse and Vives (1988), Bester and Petrakis (1996), Gehrig and Stenbacka (2005). Gehrig and Stenbacka (2005) analyze how price discrimination can increase competition in a setting with two firms selling a differentiated good. In our model there are two firms, selling an identical good, but the firms are horizontally differentiated with respect to the payment methods they accept (cash or cash and card). The decision whether to accept card payments is here a strategic device the firm uses to differentiate itself from the other firm.

In modeling how merchant competition is affected by the NSR we make a contribution to the literature. Our chosen framework, the Hotelling model, while seldom used in the card payment literature, is common in the price discrimination literature. Our focus on differentiation through card acceptance is novel in this context, yet closely related to how the payment literature has analyzed payment cards. For example Rochet and Tirole (2006) analyze the use of card acceptance as a way to attract customers.

Thus, we draw on both the payment card literature as well as the price discrimination literature.

Our analysis is partially motivated by the lack of attention the issue has received in the theoretical card payment literature previously, partially by the fact that empirical studies have suggested that surcharges on card payments are used for price discrimination (eg. Epstein 2005). The previously highlighted perceived need to reintroduce regulation highlights the importance of the issue. We show how surcharges can be used for price discrimination, and what implications this has for merchant competition.

Our model helps rank surcharging regimes in terms of consumer prices and merchant profitability. It also shows how consumer surplus and the market shares of cash and cards (of interest to card issuers and perhaps to the government) are affected under different surcharging regimes. We also analyze the implicit surcharge faced by consumers (the difference between what a consumer would pay for the good if paying by card or cash, of interest to card issuers among others), which determines whether there is too much or too little card use from a social welfare point of view.

The paper is organized as follows. Section 2 presents the model. Section 3 presents equilibria under three different settings. The first forms the benchmark case, the NSR, while the remaining two present alternatives to the NSR: constrained and unconstrained surcharging. Section 4 presents the fundamental contribution of the paper, comparing and contrasting equilibria under the different regimes. Section 5 concludes.

2 The model

Our model is based on the model of price discrimination used in Gehrig and Stenbacka (2005). In our model, surcharging is a form of price discrimination based on payment method. We assume merchants have some net cost of accepting card payments. We define this net cost, c as the difference between gross costs of card acceptance and gross benefits of card acceptance. We assume that c is positive.[2] A major component of the gross cost is the *merchant rebate*, the fee merchants pay for processing a card transaction. The avoided cost of cash handling is a major component of the gross benefit of accepting a card payment.

The cost is the merchant's private cost. As such, the private cost may be above the true social cost of card processing, due to market power of payment networks.

We do not model the setting of the merchant rebate, and thus we treat c as exogenous. Nevertheless, when we compare equilibria with and without NSR, we acknowledge that c may take different values depending on whether or not a NSR is in place. Economides and Henriques (2011) show that card networks tend to "rebalance" prices under a NSR, such that the merchant fees are higher under a NSR. While Economides and Henriques (2011) derive this result under slightly different assumptions from ours (such as no card user rewards, but rather membership fees; not all consumers hold a card; competing card companies), their result is in line with previous research.

[2] In terms of the payment card literature, our net cost equals $b_S - p_S$, or the merchant surplus (cf. Rochet and Tirole 2006). In particular, our net cost includes any IF. We are silent on the origins of the net cost. Thus our analysis is compatible with a view of payment systems, where merchants' benefits of payment cards exceed costs in the absence of an IF. The IF may change the net benefit from positive to negative, from a strict accounting perspective (however, the above mentioned benefits of card acceptance as a method of attracting customers mitigates the direct costs). Formally, our assumption $c > 0$ is identical to assuming $b_S - p_S < 0$.
The so called "tourist test," proposed by Rochet and Tirole (2011) is supposed to ensure that the IF is such that merchant costs are no greater than transactional benefits, that is in terms of our paper $c \leq 0$, when comparing cards with cash. The European Commission has indicated this is their preferred method for capping IFs (Leinonen 2011). Our analysis is nevertheless valid when comparing different kinds of cards. It also shows what may happen if the IF is not set to pass the tourist test, or when the charges set by the acquirer are not regulated.

Schwartz and Vincent (2006) show that under a NSR, a card company has the "incentive to continue raising the charge to the merchant and lowering it to card users," given any initial total fee level (the sum of fees charged to merchants and consumers) which would have prevailed under surcharging. In terms of our notation, the result of Schwartz and Vincent (2006) is equivalent to an increase in both c and card use rewards, r when imposing a NSR.

The Reserve Bank of Australia (2002) notes that the mere right to surcharge improves the retailers bargaining position vis a vis card companies. Allowing merchants to surcharge will thus act as a disciplining device on card companies, putting downward pressure on merchant fees.

Chakravorti (2010) also supports the idea that the right to surcharge may push down merchant fees, noting that "payment networks may prefer noninstrument-contingent pricing because some consumers may not choose payment cards if they had to explicitly pay for using them at the point of sale."

Thus, when making comparisons, we assume that c is weakly higher under a NSR than under constrained surcharging, and further, that it is weakly higher under constrained surcharging than under unconstrained surcharging. This is expressed in the following inequality: $c_n \geq c_c \geq c_u$, where the subscripts stand for NSR, constrained surcharging, and unconstrained surcharging.

Treating c as exogenous has the advantage of allowing us to reduce the number of restrictive assumptions. If we were to endogenize c and try to capture the decision making of the card company in greater detail, we would have to make assumptions on the market structure of the market for payment methods. We would have to take stands on whether to model issuing of cards as competitive, oligopolistic, or monopolistic. The same would have to be done for acquiring of card payments. Further, we would have to consider whether to model this in conjunction with one or multiple payment platforms. By not taking a stand on all of these issues, our results achieve a greater level of generality.

Assuming that card payments are more expensive than cash for the merchant, can be seen as contentious.[3] One might ask why a merchant in a competitive setting would choose to accept cards if it increases costs. The previous literature offers some suggestions why this might be the case. Rochet and Tirole (2002) explain the merchant's card accepting policy as a strategic device used to attract customers. Rochet and Tirole (2006) point out that merchants may be able to extract some of the consumers' card use benefits through higher prices. Rochet and Tirole (2011) also note this aspect, and conclude that a merchant may well decide to accept card payments despite cost exceeding benefits in a narrow accounting sense. The motive of "card acceptance as a strategic device" forms a building block of our analysis.

Our analysis is general in the sense that it applies both to open, four-party payment card networks (eg. Visa and MasterCard), as well as closed, three-party payment networks (eg. American Express).

[3]For example Brits and Winder (2005) find that debit card payments in the Netherlands in general are cheaper for retailers than cash payments, in particular for transactions above a certain threshold. Monnet and Roberds (2006) on the other hand argue that for the US, cash is the cheapest for retailers. The US Government Accountability Office report (United States Government Accountability Office 2009) also provide evidence that credit cards can be much more expensive for merchants than cash.

We carry out our analysis in a Hotelling framework, where two firms, here termed merchants, are differentiated by their acceptance of payment methods.

2.1 Merchants

Our model has two merchants, selling an identical good. The merchants are otherwise identical, but they are differentiated according to their acceptance of payment media. Merchant A only accepts cash, whereas Merchant B accepts cash and card.

More importantly, the acceptance decision can be generalized into one where Merchant A only accepts some subset of payment media, say the most common payment methods (eg. cash, Visa and MasterCard) and/or those cheapest to the merchant, whereas Merchant B accepts a fuller set of payment media, including those which are more expensive for him (eg. American Express). This interpretation may make more sense empirically. To keep the terminology simple, we refer to the payment methods as 'cash' and 'card', where the general interpretation equates 'cash' with 'low cost payment method' and 'card' with 'high cost payment method'.

The merchants are located on the Hotelling unit line. Locating at zero represents cash acceptance, locating at one represents card acceptance. Thus merchant A is located at zero, accepting cash, while merchant B is located at one, accepting card payments. However, as Merchant B is also required to accept cash (for example due to legal tender status), Merchant B in effect also has a store at zero (representing cash acceptance).

Our modeling choice is justified as a description of the empirically observable situation in some markets,[4] where there are merchants who accept a wider range of payment methods than others. This is meant to be viewed neither as a description of all retail markets, nor as a representative market.

This observation may be explained by sequential entry. Given a NSR is in place and given that card acceptance is the differentiating factor, then, without loss of generality, if A has chosen to only accept cash, then B will find it profitable to accept cards and cash (we assume he cannot refuse to accept cash), as this will differentiate him from A. If A on the contrary has decided to accept cash and cards, then B can differentiate himself from A by choosing to accept only cash. Once A and B have entered, one might ask whether one of them would like to change strategy. For a given period the merchants face the following game:

A\B	cash	cash+card
cash	0,0	$\pi_{\text{cash}}, \pi_{\text{card}}$
cash+card	$\pi_{\text{card}}, \pi_{\text{cash}}$	0,0

As the (cash,cash) and (cash+card,cash+card) solutions would entail no differentiation, profits would be zero. By choosing different card acceptance policies,

[4]For example in Germany, Netto Markendiscount is the only major discount retailer accepting credit card payments with Visa, MasterCard, and American Express on a large scale, while major competitors do not. Lidl accepts Visa credit cards in some stores near the French border, but not other credit cards. Lebensmittel Zeitung (2012).

either (cash, cash+card) or (cash+card, cash) merchants may make a profit, that is we have $\pi_{\text{cash}} \geq 0, \pi_{\text{card}} \geq 0$. These asymmetric strategies then constitute pure strategy Nash equilibria (PSNE) from which neither merchant wants to deviate. The same two PSNE also exist in the absence of a NSR.[5]

This explains why we focus on the asymmetric case of (cash, cash+card). It is the only case where profits may be positive and prices above cost. In this setting we can then observe how prices and profits vary as we change the surcharging regime.

Marginal costs for both merchants are constant, equal, and normalized to zero, but merchant B faces additional cost c per transaction paid by card, as explained above.

Without a NSR, merchant i ($i = \text{A,B}$) may charge cash using customers p_i^{cash}, and card using customers p_i^{card}. Under a NSR, merchant i must charge uniform prices p_i^n to all consumers, regardless of payment method. Thus, under the NSR prices are given by $p_i^{\text{cash}} = p_i^{\text{card}} = p_i^n$.[6]

When analyzing the absence of a NSR, we assume merchants price discriminate only based on payment method, not the particular consumer's realized card use benefits. Thus, merchants charge one price to all card users, and another price to all cash users. This can be motivated by the merchants only knowing the distribution of consumers, not the realization of a particular consumer's card use benefits.

2.2 Consumers

Consumers are assumed to obtain a net benefit from using card instead of cash (gross benefit net of any charges levied by the card issuer). This is termed b_B.[7] The benefits may consist of components such as time saved not having to procure cash, possible interest-free credit, etc. Cf. Baxter (1983) for an early representation of the benefits.

In addition to less tangible benefits, consumers may obtain rewards for card use. Rewards are typically related to card transaction volume, and can take the form of direct monetary rebates, or products, such as frequent flyer points. The rewards can be thought of as a negative price of card use. While the price could also be positive, we restrict it to be negative, that is a payment from card association to consumer. We denote the reward as $r \geq 0$, where the positive value indicates a positive reward (negative price), while also allowing it to be zero, as all cards do not offer rewards.

While the card issuer typically finances the rewards, r, through fees levied on merchants, there is nothing in our model that suggests capping rewards at $r \leq c$. This

[5] It is worth noting that under unconstrained surcharging, a third PSNE exists: If A plays first and chooses (cash+card), then B will be indifferent between (cash) and (cash+card). In that setting, (cash+card,cash+card) is also a PSNE. Nevertheless, as we are interested in making comparisons across regimes, we restrict ourselves to the two PSNE that exist regardless of the regime. We thank an anonymous referee for pointing this out.

[6] Prices charged by Merchant B are denoted p_B^k, where $k \in \{card, cash, n\}$, consistent with standard notation in Hotelling models. This should not be confused with the notation of Rochet and Tirole (2006), where p_B denotes the price the buyer pays for card use.

[7] In terms of the literature, our measure of net benefit is equal to what Rochet and Tirole (2006) call cardholder surplus, ie. benefit less per transaction price of card use: $b_B - p_B$. Thus our notation essentially sets $p_B = 0$, by rather including it in the term b_B.

is due to the nature of c, which as previously stated is merchant's net cost of card acceptance, with any transactional benefits deducted from the gross cost.

Analogously to our treatment of c under different regimes, in comparisons we assume that r takes on the highest value under the NSR, being weakly higher than under constrained surcharging. Further, under constrained surcharging r is assumed to be weakly higher than under unconstrained surcharging. This is based on the findings of Economides and Henriques (2011).

We treat r as exogenous, for the same reasons as we treat c as exogenous. Namely, we can achieve a greater level of generality by avoiding restrictive assumptions on the structure of the market for payment methods. An analogue of the argument that resulted in our assumption of $c_n \geq c_c \geq c_u$ gives our assumption that rewards are the highest under the NSR and lowest under unconstrained surcharging: $r_n \geq r_c \geq r_u$.

Our model has a continuum of consumers of mass one. The consumers are uniformly distributed along the unit line, and are assumed to have unit demand, ie. they buy one good each, from either merchant.

The distribution of consumers along the line represents the heterogeneity of consumers with respect to card use benefits.[8] The location of a specific consumer is given by $x \in [0, 1]$. This represents a normalization of consumer benefits, which are distributed on the interval: $b_B \in [\underline{b_B}, \bar{b}_B]$, where $\underline{b_B} < 0$ and $\bar{b}_B > 0$. Thus a consumer close to one has a high net benefit of card use, whereas consumers close to zero have negative net benefits from card use, ie. they prefer cash. The negative net benefit can be due to high card fees levied on these consumers, or some other reason for preferring cash, like a preference for anonymity, distrust of card payments or the security arrangements of merchants.

The observation that some consumers, faced with identical prices for card payment and cash payment choose to pay by card, while others choose to pay by cash supports modeling the merchants' differentiation as horizontal rather than vertical.[9] Consumers face a linear transportation costs of t per unit, indicating the cost of foregone card use benefits, and/or cost of acquiring cash. The higher t is, the less intense is competition, as a higher t marks a more intense preference for one alternative.

The presence of merchant cost $c > 0$ and card user rewards, $r \geq 0$ makes our Hotelling model asymmetric, that is the good sold at location 1 is more expensive to produce, and may be valued more highly than the good sold at location 0.

The consumer's utility can be expressed as

$$U(x) = \begin{cases} v - p_A - tx, \text{ if the consumer selects A} \\ v - p_B^{\text{cash}} - tx, \text{ if the consumer selects B at point 0 (cash)} \\ v - p_B^{\text{card}} - t(1-x) + r, \text{ if the consumer selects B at point 1 (card).} \end{cases} \quad (1)$$

[8]The assumption of consumer heterogeneity with respect to card use benefits is fairly standard in the literature, cf. Rochet and Tirole (2002), where the benefit is consumer specific.

[9]Cf. Garcia-Swartz et al. (2006b) for a more elaborate discussion on the differences among consumers when it comes to the preferred characteristics of various payment methods.

Here v is the consumer's valuation for the good sold. It is high enough for the whole market to be covered. The transportation cost parameter is represented by $t = \bar{b}_B$, that is it is the highest net benefit of paying by card among consumers. A consumer with the highest net benefit is willing to pay $\bar{b}_B + r$ more for using card rather than cash.

More generally, a consumer located at x has a net benefit of card use given by $b_B + r = 2\left(x - \frac{1}{2}\right)t + r$.

A consumer is indifferent between using cash or card when $U(A) = U(B)$, that is the location of the indifferent consumer is given by

$$\tilde{x} = \frac{1}{2} - \frac{\min\left\{p_A, p_B^{\text{cash}}\right\} - p_B^{\text{card}} + r}{2t}. \tag{2}$$

A consumer with normalized card use benefit $x \in [0, \tilde{x}]$ prefers cash, while a consumer with $x \in (\tilde{x}, 1]$ prefers cards, buying from B. The indifferent consumer, at $\tilde{x}$, has a critical valuation of card use benefits, given by $\tilde{b}_B = 2\left(\tilde{x} - \frac{1}{2}\right)t$.

All consumers are assumed to hold a card, while also being able to use cash. All consumers are assumed to be aware of the merchants' card accepting policies.

3 Equilibrium with and without NSR

In this section we present equilibria with and without the NSR. The first subsection forms the benchmark in that it presents equilibrium under the NSR. The following subsection forms one point of comparison, presenting equilibrium when merchants are free of restrictions on surcharges. This is termed unconstrained surcharging. The third part of this section characterizes equilibrium under constrained surcharging.

3.1 NSR in force

When a NSR is in place, Merchants A and B have to charge uniform prices p_A^n and p_B^n to all consumers, regardless of payment method. The superscript n stands for NSR. The location of the indifferent consumer, $\tilde{x}$, given by Eq. 2 gives A's market share.

Under the assumed distribution, if merchants A and B were to set the same uniform prices, with no rewards for card use, consumers with $x \in \left[0, \frac{1}{2}\right]$ would purchase from merchant A, while those with $x \in \left(\frac{1}{2}, 1\right]$ would purchase from merchant B.

A consumer with positive card use benefits, offered the choice of paying by card at no extra cost (as is the case under NSR) chooses to pay by card. Thus our model presents the same kind of payment separation as shown by Gans and King (2003). However, whereas Gans and King (2003) get separation into two groups of merchants, here separation is into two merchants, who are now differentiated. The differentiation leads to merchants gaining market power, allowing them to set prices above cost.

3.1.1 The pricing decision

Comparing our model to a standard Hotelling model, merchant A faces more competition in our model. This is due to merchant B's ability to accept cash in addition

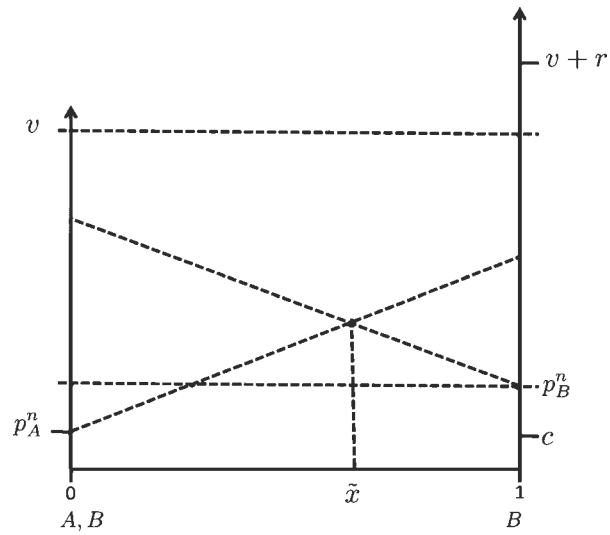

Fig. 1 Competition under the no surcharge rule

to cards. This ability of merchant B turns him into a multilocation retailer, located at both ends of the unit line. Under the NSR, merchant B is however constrained to setting the same uniform price, p_B^n at both locations. This is illustrated in Fig. 1.

Thus, competition for cash users will be more intense than in a classic Hotelling model. When A makes its pricing decision, it has to take into account the possibility that B may want to undercut A. Under the NSR, with B limited to setting the same price for both card and cash customers, A will have to set his price low enough so that B can make more profit by setting a price higher than A. Then B will only sell to card users and A only to cash users. Thus we have payment separation under the NSR. By undercutting A, B could increase his marketshare to 100 %.[10] As A then would make zero revenue and zero profits, this will clearly not be an equilibrium. A's average cost advantage makes this outcome unstable. Intuitively, with merchant B facing higher costs than merchant A, A can set $p_A^n = p_B^n - \epsilon$, where ϵ is small, thus capturing all consumers willing to pay by cash.

In determining equilibrium prices, A will thus have to compare the profits of B conditional on two different decisions by B: undercut or not undercut, given A's price p_A^n. By undercutting, B could make profits of $\left(\pi_B^n | p_B^n < p_A^n\right) = p_B^n - c_n\left(1 - \tilde{x}\right) < p_A^n - c_n\left(1 - \tilde{x}\right)$. Here p_B^n represents total revenue when undercutting, and $c_n\left(1 - \tilde{x}\right)$ represents total cost when undercutting—the cost of serving a card user multiplied by the amount of card users. The right hand side of the inequality follows from the conditionality, that is from $p_B^n < p_A^n$.

[10] We are only concerned with B undercutting A, as it would be enough for B to undercut A by the tiniest possible amount ϵ, in order for B to capture the whole market. For A to capture the whole market, it would need to undercut B by the amount $t + r_n$ in order to capture 100 % of the market. This would not yield a profit greater than what is calculated here.

If B undercuts A, consumers face the same price, whether they pay by card or cash. The market share of cards is then given by $\left(1-\tilde{x}|p_B^n < p_A^n\right) = \frac{1}{2} + \frac{r_n}{2t}$. Substituting this result into the conditional profit function, it can then be expressed as

$$\left(\pi_B^n|p_B^n < p_A^n\right) = p_B^n - c_n\left(\frac{1}{2} + \frac{r_n}{2t}\right) < p_A^n - c_n\left(\frac{1}{2} + \frac{r_n}{2t}\right).$$

On the other hand, not undercutting yields profits of

$$\left(\pi_B^n|p_B^n > p_A^n\right) = \left(p_B^n - c_n\right) \times \left(1-\tilde{x}|p_B^n > p_A^n\right).$$

Merchant A thus sets p_A^n such that $\left(\pi_B^n|p_B^n < p_A^n\right) < \left(\pi_B^n|p_B^n > p_A^n\right)$. Substituting the expressions for the conditional profits into the inequality and rearranging yields:

$$p_A^n \leq \left(p_B^n - c_n\right)\left(1-\tilde{x}|p_B^n > p_A^n\right) + c_n\left(\frac{1}{2} + \frac{r_n}{2t}\right)$$

This restriction is called the no-undercutting-constraint. The profit maximization problem of A is then given by

$$\begin{gathered} \max_{p_A^n} \pi_A^n = p_A^n\left(\tilde{x}|p_B^n > p_A^n\right) \\ st.\ p_A^n \leq \left(p_B^n - c_n\right)\left(1-\tilde{x}|p_B^n > p_A^n\right) + c_n\left(\frac{1}{2} + \frac{r_n}{2t}\right) \\ p_A^n \geq 0 \end{gathered} \tag{3}$$

With Merchant B knowing that A will set a price satisfying the no-undercutting-constraint, B's profit maximization problem is given by

$$\begin{aligned} &\max_{p_B^n} \pi_B^n = \left(p_B^n - c_n\right)\left[1-\tilde{x}\left(p_A^n, p_B^n, t, r_n|p_B^n > p_A^n\right)\right] \\ &st. \qquad\qquad p_B^n \geq c_n > 0 \end{aligned} \tag{4}$$

3.1.2 Equilibrium prices

Merchant B's price is given by the first order condition $p_B^n = \frac{1}{2}\left(c_n + t + r_n + p_A^n\right)$. The no-undercutting constraint on A will in general be binding.[11]

When the no-undercutting-constraint on p_A^n is binding, and the merchants set prices simultaneously, the following equilibrium prices are obtained:

$$p_A^n = \left(3 - 2\sqrt{2 + \frac{c_n - 2r_n}{t} - \frac{c_n r_n}{t^2}}\right)t + c_n - r_n \tag{5}$$

$$p_B^n = \left(2 - \sqrt{2 + \frac{c_n - 2r_n}{t} - \frac{c_n r_n}{t^2}}\right)t + c_n \tag{6}$$

[11] The constraint will not be binding, if $\left(1 - \sqrt{2 + \frac{c_n - 2r_n}{t} - \frac{c_n r_n}{t^2}}\right)3t > r_n - c_n$. The constraint will in general be binding, except for combinations of relatively low $\frac{t}{c_n}$ ratios and higher $\frac{r_n}{c_n}$ ratios. For higher $\frac{r_n}{c_n}$ ratios the constraint will not be binding for larger ranges of the $\frac{t}{c_n}$ ratio. When $r_n = 0$ the constraint is always binding. When the constraint is not binding, prices are higher, and given as in a standard Hotelling model.

For B to cover his costs and thus satisfy his individual rationality constraint, $t + r_n > \frac{c_n}{2} - \frac{c_n r_n}{2t}$ must hold (the coefficient on t must be non-negative in B's pricing formula). For this to hold the consumer with the highest valuation of card use must be willing to pay $\frac{c_n}{2} - \frac{c_n r_n}{2t}$ more for paying by card than for paying by cash. Further simplifying, if the consumer is willing to pay half of the cost his card use imposes on the merchant, in order to pay by card rather than cash, then these prices will constitute an equilibrium.

Another requirement for this to constitute an equilibrium is given by the inequality $\frac{c_n}{2} - r_n - \frac{c_n r_n}{2t} > -t$. This must hold for the discriminant to be non-negative. Thus $t > \frac{c_n}{2} - r_n - \frac{c_n r_n}{2t} > -t$ provides the equilibrium condition for this setting.

Analyzing the prices of Eqs. 5 and 6, we obtain the following insights. Prices increase with increased magnitude of preferences, t. An increase in the cost of card acceptance c_n leads to an increase in prices of both merchants. However, Merchant B will pass on an increase in c_n to prices by a factor of less than one, that is B will absorb part of the increase. Another interesting fact is that an increase in r_n leads to an increase in the prices of both merchants. This is because an increase in r_n makes B more attractive, thus increasing his price. In the shadow of this increase, A can also increase his price.

3.1.3 Implicit surcharge

The implicit surcharge, $\hat{b}_B$, is given by the price difference between A and B, taking into account rewards earned by a consumer paying by card, that is $\hat{b}_B = p_B^n - p_A^n - r_n$. Under the NSR it is given by:

$$\hat{b}_B = \left(\sqrt{2 + \frac{c_n - 2r_n}{t} - \frac{c_n r_n}{t^2}} - 1 \right) t \tag{7}$$

Socially efficient card use would dictate that $\hat{b}_B = c_n$, that is the marginal card user should be willing to pay c_n more for paying by card than cash.[12] Under the NSR the implicit surcharge may be greater or smaller than c_n, depending on parameter values. There may thus be too much or too little card use from a social welfare point of view.

3.1.4 Market shares

The market share of A, and thus of cash is given by

$$\tilde{x} = \frac{\sqrt{2 + \frac{c_n - 2r_n}{t} - \frac{c_n r_n}{t^2}}}{2} \tag{8}$$

In the absence of card use rewards, this will always be more than 1/2. With positive rewards the marketshare of cash may be less than 1/2.

[12] This is equivalent to saying that the sum of consumer net benefits and merchant gross benefits should equal merchant gross cost for the marginal consumer. By socially optimal we in this case mean that cards are used only when they increase the combined surplus of the consumer and the merchant. In terms of Hermalin and Katz (2004), our definition is equal to their first best criteria for message exchange, where messages are only exchanged when the joint value of the exchange exceeds the joint cost.

3.1.5 Profits

Equilibrium profits of the two merchants are given by:

$$\pi_A^n = \left(\frac{3\sqrt{2+\frac{c_n-2r_n}{t}-\frac{c_nr_n}{t^2}}}{2}-2\right)t+\left(\frac{\sqrt{2+\frac{c_n-2r_n}{t}-\frac{c_nr_n}{t^2}}}{2}-1\right)c_n + \left(2-\frac{\sqrt{2+\frac{c_n-2r_n}{t}-\frac{c_nr_n}{t^2}}}{2}+\frac{c_n}{t}\right)r_n \tag{9}$$

$$\pi_B^n = \left(3-2\sqrt{2+\frac{c_n-2r_n}{t}-\frac{c_nr_n}{t^2}}\right)t+\frac{1}{2}c_n-\left(1+\frac{c_n}{t}\right)r_n \tag{10}$$

Summarizing Merchants A and B's profits gives aggregate profits:

$$\pi^n = \left(1-\frac{\sqrt{2+\frac{c_n-2r_n}{t}-\frac{c_nr_n}{t^2}}}{2}\right)t+\left(\frac{\sqrt{2+\frac{c_n-2r_n}{t}-\frac{c_nr_n}{t^2}}-1}{2}\right)c_n + \left(1-\frac{\sqrt{2+\frac{c_n-2r_n}{t}-\frac{c_nr_n}{t^2}}}{2}\right)r_n \tag{11}$$

Looking at the comparative statics we see that profits of both merchants increase in r_n. This follows as both merchants increase their prices in response to increases in r_n. Merchant A's profits increase in c_n, while those of Merchant B are decreasing.

3.1.6 Consumer surplus and total user surplus

Consumer surplus is given by

$$CS^n = v-\left(2-\sqrt{2+\frac{c_n-2r_n}{t}-\frac{c_nr_n}{t^2}}\right)t-\frac{3}{4}c_n+\left(\frac{1}{2}+\frac{c_n}{4t}\right)r_n \tag{12}$$

Adding aggregate profits gives the total user surplus (TUS):

$$TUS^n = v-\left(1-\frac{\sqrt{2+\frac{c_n-2r_n}{t}-\frac{c_nr_n}{t^2}}}{2}\right)t-\left(\frac{5}{4}-\frac{\sqrt{2+\frac{c_n-2r_n}{t}-\frac{c_nr_n}{t^2}}}{2}\right)c_n + \left(\frac{3}{2}-\frac{\sqrt{2+\frac{c_n-2r_n}{t}-\frac{c_nr_n}{t^2}}}{2}+\frac{c_n}{4t}\right)r_n \tag{13}$$

Aggregate consumer surplus is decreasing in c_n, but more surprisingly, it is also decreasing in r_n. This is a result of the prices of both merchants not only increasing in c_n, but also in r_n. This gives rise to the following result:

Result 1 Under the NSR, even cash-using consumers patronizing a merchant not accepting cards suffer from an increase in the cost of card acceptance.

This rather surprising result is due to the non-card merchant increasing his prices in response to his competitor's increase in prices, which are a result of increases in costs. Furthermore, card use rewards have similar effects, as we show in the next result.

Result 2 Under a NSR, consumers as a group suffer from card use rewards, r_n, even when the financing of these rewards is not explicitly taken into account.

Given an increase in r_n, both merchants increase prices. Card users get increased rewards in return, while cash users only experience price increases. The price increases cause aggregate consumer surplus to decrease when rewards are increased. This happens even if rewards are not linked to the costs they impose on merchants. Given that an increase in rewards typically would be financed through an increase in costs to merchants, the above effects would be amplified. As aggregate consumer surplus is decreasing in both c_n and r_n, a simultaneous increase in both would harm aggregate consumer surplus through both mechanisms. The cash users would be hurt the most.

3.2 Abolishing the NSR—unconstrained surcharging

Abolishing the NSR means prices are no longer constrained to be uniform. Thus a card accepting merchant is no longer restricted to maintain the same uniform price for both methods of payments, or both of his shops. In this subsection we characterize the equilibrium without the NSR, focusing on the case of unconstrained surcharging.

Under unconstrained surcharging, merchant B is free to set any prices it wants in its two shops, with no constraints linking the prices of B's two shops. With no restraint on merchant B's cash only shop at zero, A and B will engage in Bertrand competition (as they are identical) at this end of the line, driving down p_i^{cash} to zero for both merchants. Thus the following result is immediately obtained:

Result 3 Competition for cash consumers is most intense under unconstrained surcharging.

While competition drives down prices to zero (normalized cost) for cash users, card users will pay a price above cost, as will be seen.

Merchant B will still attract all consumers preferring to pay by card, but the number of these customers will be smaller, compared to the NSR. The market share of cash is now a function of three different prices, $\tilde{x}(p_A^{\text{cash}}, p_B^{\text{cash}}, p_B^{\text{card}}, t, r)$, decreasing in the cash prices and increasing in the card price. As the cash prices decrease due to increased competition, this increases the market share of cash. Since $\hat{b}_B$, the implicit surcharge is positively correlated with the market share of cash, this also means that the implicit surcharge increases.

With competition for cash customers driving down p_i^{cash} to zero, merchant B faces the following profit maximizing problem under unconstrained surcharging:

$$\max_{p_B^{\text{card}}} \pi_B^u = \left(p_B^{\text{card}} - c_u\right)(1 - \tilde{x}) \tag{14}$$

The problem is subject to an individual rationality constraint like the one under the NSR, that is $p_B^{\text{card}} \geq c_u > 0$.

3.2.1 Equilibrium prices

With cash prices at zero, the equilibrium price charged to card paying customers is simply given by B's first order condition, with p_A set to zero:

$$p_B^{\text{card}} = \frac{1}{2}(t + c_u + r_u) \tag{15}$$

Unit profit is thus given by $(p_B^{\text{card}} - c_u) = \frac{1}{2}(t - c_u + r_u)$. For this to be weakly positive, it is enough that the condition $t \geq c_u - r_u$ holds. Recalling that $t = \bar{b}_B$, this means that for B to be willing to accept card payments, card use needs to be socially desirable for at least the consumers with the highest card valuation.

Interestingly enough, if the cost of card acceptance, c_u increases, Merchant B will absorb half of the increase, only passing on half of the increase onto prices. Similarly, only one half of an increase in rewards, r_u, will flow to card users, the rest being internalized by the merchant through higher prices.

3.2.2 Implicit surcharge

The equilibrium condition $t \geq c_u - r_u$ and the price $p_B^{\text{card}} = \frac{1}{2}(t + c_u + r_u)$ implies that $p_B^{\text{card}} \geq c_u$. With $p_i^{\text{cash}} = 0$, this means that the equilibrium implicit surcharge,

$$\hat{b}_B = \frac{1}{2}(t + c_u - r_u) \tag{16}$$

is weakly greater than c_u. This means that there is typically too little card use in this setting, as the implicit surcharge exceeds the cost of card payments. From this follows

Result 4 Under unconstrained surcharging, cards are only used when card use creates social surplus.

3.2.3 Market shares

The market share for cash is given by

$$\tilde{x} = \frac{3}{4} + \frac{c_u - r_u}{4t} \tag{17}$$

From this expression it is easy to see that cash use increases in c_u and decreases in r_u.

3.2.4 Profits

The equilibrium profit of Merchant B is given by

$$\pi_B^u = \frac{1}{8}\left[t - 2c_u + \frac{c_u^2}{t} + \left(2 - \frac{2c_u}{t}\right) r_u + \frac{r_u^2}{t}\right] \tag{18}$$

This is strictly positive under the equilibrium condition $t > c_u - r_u$, and under that condition increasing in r_u and decreasing in c_u.

3.2.5 Consumer surplus and total user surplus

The consumer surplus under unconstrained surcharging is given by

$$CS^u = v - \frac{7}{16}t + \frac{1}{16t}c_u^2 - \frac{1}{8}c_u + \frac{1}{16t}r_u^2 + \left(\frac{1}{8} - \frac{c_u}{8t}\right)r_u \tag{19}$$

While this expression may seem unwieldy, the comparative statics are straightforward and intuitive. An increase in c_u decreases consumer surplus, while an increase in r_u has the opposite effect. These effects come along purely by affecting card users, as the price they face is the only price reacting to changes in these parameters.

Adding industry profits to consumer surplus yields total user surplus, given by

$$TUS^u = v - \frac{5}{16}t + \frac{3}{16t}c_u^2 - \frac{3}{8}c_u + \frac{3}{16t}r_u^2 + \left(\frac{3}{8} - \frac{3c_u}{8t}\right)r_u \tag{20}$$

Again, while the expression contains many terms interacting with each other, the comparative statics are straightforward. An increase in c_u lowers total user surplus, while an increase in r_u has the opposite effect.

3.3 Constrained surcharging

In this section we present the equilibrium when surcharging is constrained not to exceed the true cost of card acceptance. This can be viewed as corresponding to for example new Finnish legislation, as well as the proposed settlement between the US Department of Justice and Visa and MasterCard (New York Times 2010). Similar regulation is also considered in Australia (Reserve Bank of Australia 2011).

Under constrained surcharging merchant B faces the following restriction:

$$p_B^{\text{card}} - p_B^{\text{cash}} \leq c_c \tag{21}$$

As under the NSR, Merchant A needs to set a price such that B will not undercut A in the market for cash users. Thus, A needs to set it's price low enough so that B maximizes profits by setting a high enough price for card users. This price, p_B^{card} should be such that the price charged to cash users will be higher than the price charged by A. Formally $p_B^{\text{cash}} = p_B^{\text{card}} - c_c > p_A$. Merchant B's profits conditional on not undercutting A are given by $\left(\pi_B^c | p_B^{\text{cash}} > p_A\right) = \left(p_B^{\text{card}} - c_c\right)\left(1 - \tilde{x} | p_B^{\text{cash}} > p_A\right)$. The right hand side's first brackets represent unit profits, while the second set of brackets represent the number of consumers B attracts.

If B were to undercut A, then the inequality $p_B^{\text{cash}} = p_B^{\text{card}} - c_c < p_A$ would hold, and B would capture the whole market, making a profit of $\left(\pi_B^c | p_B^{\text{cash}} < p_A\right) = p_B^{\text{cash}}\tilde{x} + \left(p_B^{\text{card}} - c_c\right)(1 - \tilde{x}) = p_B^{\text{cash}} < p_A$. Then A would sell nothing and thus make a zero profit. Thus A needs to ensure that the inequality $\left(\pi_B^c | p_B^{\text{cash}} > p_A\right) > p_A > \left(\pi_B^c | p_B^{\text{cash}} < p_A\right)$ holds, that is A needs to make sure B makes more profit by not undercutting A.

The last inequality forms the basis of A's no-undercutting-constraint. A's profit maximization problem is thus

$$\begin{gathered} \max_{p_A} \pi_A^c = p_A\left(\tilde{x} | p_B^{\text{cash}} > p_A\right) \\ st.\ p_A \leq \left(p_B^{\text{card}} - c_c\right)\left(1 - \tilde{x} | p_B^{\text{cash}} > p_A\right) \\ p_A \geq 0 \end{gathered} \tag{22}$$

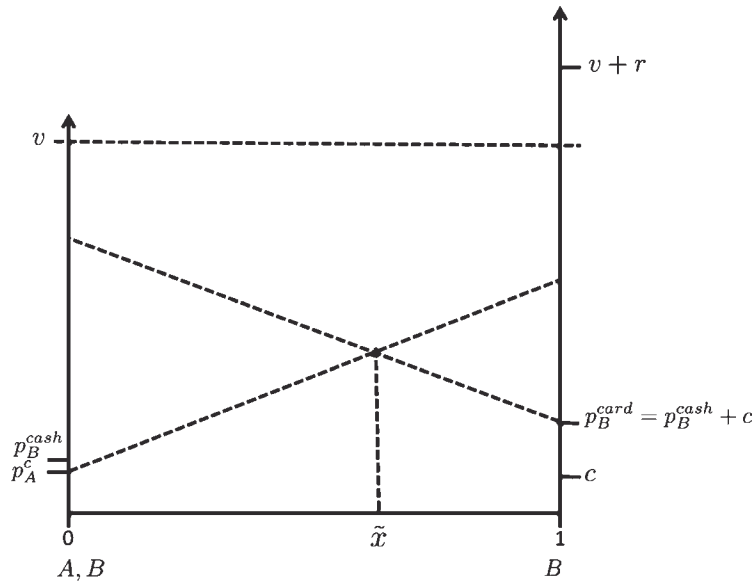

Fig. 2 Competition under constrained surcharging

The situation is illustrated in Fig. 2. It is worth noting that compared to the NSR, A's no-undercutting-constraint is more restrictive under constrained surcharging.

Merchant B's profit maximizing problem stays the same, that is

$$\begin{aligned} &\max_{p_B^{\text{card}}} \pi_B^c = \left(p_B^{\text{card}} - c_c\right)\left(1 - \tilde{x} | p_B^{\text{cash}} > p_A\right) \\ st. \quad &p_B^{\text{card}} \geq c_c > 0 \end{aligned} \tag{23}$$

3.3.1 Equilibrium prices

Substituting B's first order condition $p_B^{\text{card}} = \frac{1}{2}\left(t + c_c + r_c + p_A\right)$ into A's no-undercutting-constraint and solving yields the following prices when the constraint is binding:[13]

$$p_A = \left(3 - 2\sqrt{2 + \frac{2\left(c_c - r_c\right)}{t}}\right) t + c_c - r_c \tag{24}$$

$$p_B^{\text{card}} = \left(2 - \sqrt{2 + \frac{2\left(c_c - r_c\right)}{t}}\right) t + c_c \tag{25}$$

[13]The constraint is in general binding. Formally, it is binding when the inequality $\left(1 - \sqrt{2 + \frac{2(c_c - r_c)}{t}}\right) 3t > r_c - c_c$ holds. Only for combinations of relatively low $\frac{t}{c_c}$ ratios and higher $\frac{r_c}{c_c}$ ratios the constraint is not binding. If there are no card use rewards ($r_c = 0$) the constraint will always bind.

$$p_B^{\text{cash}} = \left(2 - \sqrt{2 + \frac{2\,(c_c - r_c)}{t}}\right) t \geq p_A \tag{26}$$

Merchant B's equilibrium price gives $t > c_c - r_c$ as an equilibrium condition, that is the net card use benefits of the consumer with the highest benefits must exceed merchant card acceptance cost. Otherwise B will have no interest in accepting cards.

Interestingly enough, comparative statics reveal that merchant A's price (and profit) decreases when merchant B's cost of card acceptance, c_c, increases. Formally $\frac{\partial p_A}{\partial c_c} = 1 - \frac{2}{\sqrt{2+\frac{2(c_c - r_c)}{t}}} \leq 0$. Intuitively this follows from B's need to increase the price charged to card users, p_B^{card} when c_c increases. This increase leads to more consumers preferring cash, and a decrease in B's profits from only serving card users. When B previously, given the equilibrium prices, was indifferent between undercutting A on the one hand and only serving card users on the other, the new situation makes focusing on card users a less attractive proposition. Merchant A then needs to lower the price to cash users, in order to decrease the profits available to B from targeting the cash users.

Further inspection reveals that p_B^{card} does not increase monotonically in c_c, but the sign of the derivative, $\frac{\partial p_B^{\text{card}}}{\partial c_c} = 1 - \frac{1}{\sqrt{2+\frac{2(c_c - r_c)}{t}}}$, is dependent on parameter values.

This slightly surprising result, which also has implications for profits and consumer surplus, follows from the dual role played by c_c under constrained surcharging. Not only is c_c a measure of cost of card acceptance, but it is also the maximum allowable surcharge. As such it affects competition between A and B, and an increase in c_c increases the difference between the price B can charge card and cash users.

Both A's and B's prices increase in r_c. This happens as B's prices (and profits) are increasing in r_c, leaving more room for A to increase its prices.

3.3.2 Implicit surcharge

The implicit surcharge is given by:

$$\hat{b}_B = \left(\sqrt{2 + \frac{2\,(c_c - r_c)}{t}} - 1\right) t \tag{27}$$

For a wide range of parameter values this is greater than c_c, indicating that there may be too little card use from a social efficiency point of view. However, for some parameter values this may also be less than c_c, indicating that there can be too much card use. However, this will never happen when there are no rewards. This shows that only rewards can cause excessive card use under constrained surcharging.

3.3.3 Market shares

The equilibrium market share of merchant A, and thus of cash is given by

$$\tilde{x} = \frac{\sqrt{2 + \frac{2(c_c - r_c)}{t}}}{2} \tag{28}$$

3.3.4 Profits

The above given prices and market shares yield the following profits:

$$\pi_A^c = \left(\sqrt{2 + \frac{2\,(c_c - r_c)}{t}}\right) t + \left(\frac{\sqrt{2 + \frac{2(c_c - r_c)}{t}}}{2} - 2\right) [t - (c_c - r_c)] \tag{29}$$

$$\pi_B^c = \left(3 - 2\sqrt{2 + \frac{2\,(c_c - r_c)}{t}}\right) t + c_c - r_c \tag{30}$$

The sum of the above expressions yields industry profits of

$$\pi^c = \left(1 - \frac{\sqrt{2 + \frac{2(c_c - r_c)}{t}}}{2}\right) [t - (c_c - r_c)] \tag{31}$$

As alluded to in the discussion on pricing, profits of both merchants are increasing in r_c and decreasing in c_c under constrained surcharging. This is a result of how changes in these parameters affect the intensity of competition for cash users.

3.3.5 Consumer surplus and total user surplus

Under constrained surcharging the consumer surplus is given by

$$CS^c = v - \left(2 - \sqrt{2 + \frac{2\,(c_c - r_c)}{t}}\right) t - \frac{1}{2}\,(c_c - r_c) \tag{32}$$

Adding industry profits gives total user surplus, given by

$$TUS^c = v - \left(1 - \frac{\sqrt{2 + \frac{2(c_c - r_c)}{t}}}{2}\right) t - \left(\frac{3}{2} - \frac{\sqrt{2 + \frac{2(c_c - r_c)}{t}}}{2}\right) (c_c - r_c) \tag{33}$$

Comparative statics yields some interesting results.

Result 5 Under constrained surcharging consumers suffer from an increase in card user rewards, r_c, as not only card users, but also cash users pay a higher price, the latter without getting any benefits in return.

Looking at the effect of changes in c_c, the following result follows.

Result 6 Under constrained surcharging consumers benefit from an increase in cost of card acceptance, c_c.

This puzzling result follows from the dual nature of c_c described previously. Not only does an increase in c_c increase the cost of serving card users, but it also increases the allowable price difference between card users and cash users, thus allowing for more intense competition for cash users. Under constrained surcharging c_c is thus also a measure of the intensity of competition. An increase in c_c decreases prices for cash users for all parameter values, thus making cash users better of. For some

parameter values this will even happen to prices for card users. Even when card user prices increase as a consequence of an increase in c_c, the price decrease offered to cash users is enough to offset the loss to card users when looking at aggregate consumer surplus.

While the results of increases in c_c and r_c are a bit surprising for consumer surplus, overall welfare, as measured by total user surplus (TUS) is more in line with what is to be expected. An increase in c_c decreases TUS, while an increase in r_c increases TUS. Thus any change in these parameters will predominantly affect merchants' profits rather than consumer surplus.

4 Comparing surcharging regimes

In this section we present some of the key findings from comparing the different surcharging regimes. Each regime exhibits payment separation, but there are some interesting differences in welfare, as well as in comparative statics.

4.1 Effect of surcharging regime on competition and prices

Comparing the different surcharging regimes, we first analyze how the regime affects competition between merchants, and pricing. This gives the following result:

Result 7 Any constraint on surcharges, in particular a NSR, serves as a competition-softening device.

Compared to unconstrained surcharging, when surcharging is constrained B has less incentive to set a low price for cash consumers, as this more directly depresses the price he can charge to card users. This is true for constrained surcharging as well as for NSR. In terms of the above result, we can interpret the NSR as a special case of constrained surcharging, where the constraint forces the card price to equal the cash price, that is the constraint is more severe than under the "regular" constrained surcharging.

Under constrained surcharging, prices will be slightly lower than under the NSR. This is true even if one assumes that the cost of card acceptance, c and rewards for card users, r are the same under the two regimes. Given that c and r may be higher under the NSR, and given that prices increase in c and r under the NSR, it follows that prices are higher under the NSR.

On the other hand, comparing constrained and unconstrained surcharging we see that with competition from B relaxed, A will also set higher prices under constrained surcharging, compared to unconstrained surcharging. By setting prices low enough A ensures that it will not be undercut by B in the market for cash consumers, since B is constrained not to set its cash price more than c lower than its card price. Due to B's status as sole card accepting merchant it then sets the price sufficiently high for card consumers, so as to compensate for any sales lost to cash preferring consumers.

While both A and B make positive profits under constrained surcharging, these profits are lower than under the NSR for a wide range of parameter values.[14]

[14] If the parameters stay the same under different regimes, then this result always holds.

The reason for this lies in the no-undercutting-constraint on A, which is more severe under constrained surcharging than under the NSR. Merchant A has to set a lower price under constrained surcharging compared to the NSR to pre-empt undercutting. This is due to B's lower cost of undercutting under surcharging. When B under the NSR had to extend the undercutting price to all customers, its cost of undercutting was greater. Under surcharging, B can charge different prices to different groups. This makes targeting cash users with lower prices cheaper, since B has to forgo less profit from card users. In the extreme this was seen under unconstrained surcharging, where B sets a price of zero to cash users. Under constrained surcharging B must decrease card user prices in order to target cash users, but cash and card prices do not have to be identical. Thus constrained surcharging can be viewed as a compromise between the NSR and unconstrained surcharging.

Both merchants make the smallest profits under unconstrained surcharging, if cost of card acceptance stays the same. Allowing for higher costs when surcharges are constrained, merchant A will still always make the smallest profits when there are no constraints on surcharging. The high intensity of competition in this case also tends to drive down B's profits compared to other settings.

Result 8 Merchants may gain from constraints on surcharging. If the NSR is abolished, merchants may prefer constrained over unconstrained surcharging.

This preference order tends to hold both for the merchants collectively and individually.

This can be seen as a extension of Result 7, that a constraint on surcharging is a competition-softening device. Viewing the NSR as the ultimate constraint, the competition-softening effect is the strongest under the NSR.

Looking at consumer and total user welfare, some interesting facts emerge. For consumers unconstrained surcharging tends to be the preferred regime as it leads to the lowest prices and tends to lead to highest consumer surplus. For the same reasons, constrained surcharging tends to be preferred to the NSR. The consumers' preference ordering is thus the opposite to that of the merchants.

Taking into account both consumers' and merchants' interests, the picture is more nuanced when looking at the total user surplus (TUS). When analyzing equilibria under different surcharging regimes, the ordering of the regimes in terms of TUS is dependent on the ratios of the parameters t, c and r. This even holds true if parameters are assumed to be the same under different regimes. Allowing the parameters to vary with regime further muddles the picture. This indicates that finding the socially optimal solution, taking into account all concerned parties is not easy.

4.2 Distribution of profits

Under the NSR, Merchant A makes a bigger profit than Merchant B. Abolishing all constraints on surcharging hurts both merchants, completely wiping out A's profit and substantially reducing B's profit. The cash only merchant is hurt the most by a removal of the NSR, as this mainly increases competition for his customers. Thus a NSR may be good for merchants, as it provides the card accepting merchant with

a device for committing not to target cash customers too aggressively. If legislation is neutral on the NSR, merchants could even find it profitable to introduce NSR terms into agreements with card payment processors. This might be done in a framework where general terms are negotiated between a confederation of banks and a confederation of merchants, or in a situation where payment processing is handled by a joint-venture between banks and merchants (as used to be the casein Finland with the main processor, Luottokunta).

4.3 Socially excessive card use under the NSR

Under a NSR there may be too much card use from a social welfare point of view. Cards will be used in situations where the net marginal costs they impose on merchants are not offset by net marginal benefits to consumers. Furthermore, under the NSR there is scope for cards that impose net costs on merchants that are not offset by the net benefits for any single consumer. Still, merchants are better off with these cards, as their existence, and some consumers' preference for them, enables the merchants to differentiate themselves from each other, thus making positive profits.

Result 9 Abolishing the NSR means that there is no longer scope for cards whose net costs exceeds the net benefit to the consumer valuing card use the highest.

Further, if merchants surcharge and no rewards are offered for card use, cards will not be used when merchant costs exceed user benefits. Introducing rewards can overthrow this result, that is rewards may induce excessive card use under constrained surcharging. However, under unconstrained surcharging card use will never be socially excessive.

If surcharging is introduced, the card accepting merchant's surcharge will be above the true net cost of card use. Under unconstrained surcharging, the implied surcharge will be greater than the merchant's cost of card acceptance. Thus there will be socially too little card use. The reduction in card use following from allowing surcharges is a standard result of the payment card literature (cf. Rochet and Tirole 2002).

4.4 Cost absorption

An interesting result is that under constrained surcharging an increase in the cost of card acceptance will decrease the price for cash users. This is because Merchant B will have a stronger incentive to attract cash users, as the profits obtainable from card users decrease. Under the NSR, an increase in the cost of card acceptance increased prices for both card and cash users. This is remarkable, since here even cash users patronizing a store that doesn't accept cards end up paying higher prices when card acceptance costs increase. Furthermore, the following result is obtained.

Result 10 Under the NSR, an increase in c is passed on to prices to a greater extent than under surcharging.

Under constrained surcharging, a one unit increase in c will increase p_B with less than $\frac{1}{2}$, that is B absorbs most of the cost increase. Under unconstrained surcharging the absorption rate is lower, at $\frac{1}{2}$. Under the NSR the absorption rate is at it's

lowest. This helps explain why card companies favor NSRs. The NSR doesn't only increase card use as described above, it will also make merchants less likely to protest against price increases from the card companies, as most of the increase is passed on to consumers (both card and cash users). Thus, a bit counterintuitively, merchants actually pass less of a cost increase on to consumers when allowed to surcharge than under the NSR.

Looking at the effect of card acceptance cost on the pricing of the cash only retailer, we see that under constrained surcharging the cash price p_A is decreasing in c, while under the NSR the opposite is the case. Thus the card company poses less of a negative externality on cash users under constrained surcharging than under the NSR.

4.5 Card rewards

Rewards for card use may lead to socially inefficient card use. Further, rewards may be bad for consumers through their effects on cash prices. Similarly to the cost absorption described above, rewards are also subject to "absorption", or internalization by merchants, in the form of higher prices. This has been shown earlier, cf. Rochet and Tirole (2006) where the merchant internalizes some of the card users' card use benefits.

Under the NSR, as well as under constrained surcharging, an increase in rewards will increase the prices not only of card users, but also of cash users. Thus cash users who buy in a store that doesn't accept cards are not only affected by the costs of cards imposed on card accepting stores (see above), but also by the rewards offered to card users. This remarkable result even holds in a setting with no clear link between card use rewards and cost of card acceptance. As rewards are typically financed through the merchant fee, the negative effect of card use rewards is aggravated.

The same effect from rewards on consumer surplus is present under constrained surcharging. Only under unconstrained surcharging will an increase in rewards actually increase consumer surplus. This leads us to the following result:

Result 11 Consumers may suffer from card use rewards, even when not taking into account that rewards typically in the end are financed by consumers.

5 Concluding comments

Abolishing the NSR increases merchant competition and drives down prices, benefiting consumers. Any constraint on surcharging amounts to a competition-softening device. With regards to this central conclusion of ours, the NSR can be viewed as the ultimate constraint. The payment card literature has so far had little to say on this issue.

Competition increases, as relaxing the constraints on surcharges means that card accepting merchants find it cheaper to target cash users. Cash accepting merchants will anticipate this, and this reduces the prices cash users face. Reduced cash prices in turn leads to lower prices for card users, as the card accepting merchant needs to

avoid losing too many of them to the cash accepting merchant. This effect is clearest when surcharging is unconstrained.

In practice, where surcharging has been allowed, merchants have been slow to introduce it. For example the survey by Verdier (2011) reports evidence of very limited uptake of surcharging where and when it has been allowed. This is supported by Balaban (2009) who notes that in the Netherlands, UK and Sweden, where surcharging has been allowed for some time, few merchants engage in it. In Australia, where comprehensive reform of the payment card market was undertaken in the early 2000s, approximately 40 % of large merchants and 20 % of small merchants impose surcharges (Bullock 2010). Chakravorti (2010) describes the absence of surcharging, where allowed, as a "most interesting puzzle." Our analysis indicates that surcharging makes competition more intense, and may thus help understand the slow uptake. On the other hand, the slow uptake is in line with a general inertia when it comes to payments, with changes in behavior taking place very slowly, as noted by Litan and Baily (2009).

The lower prices cash users enjoy under surcharging are in line with the general conclusions of the card payment literature (cf. Chakravorti 2003; Schwartz and Vincent 2006). However, the explanations differ to some extent. While the card payment literature in general explains the higher prices faced by cash users under the NSR as a consequence of cash users cross-subsidizing part of the costs card users impose on merchants, our model suggests an additional reason: Constraints on surcharging limits competition for cash users.

Our result that cash use tend to increase if unconstrained surcharging replaces the NSR is compatible with the empirical findings of Bolt et al. (2010).

While the card payment literature's general conclusions on the effects of surcharging on prices and market shares are compatible with our conclusions, when it comes to profits there are some differences. Schwartz and Vincent (2006) find that merchant profits are greater without the NSR than with it. Their result is thus in contrast to the findings of this paper. Prager et al. (2009) point out that abolishing the NSR may be a cause for concern if merchants have market power, as this may lead to excessive surcharges not reflecting true social costs. This is in line with concerns based on empirical observations in Australia (cf. MarketWatch 2011). While our analysis points in the same direction, with implicit surcharges frequently exceeding the true social cost of card use, we show that this need not be a concern. Prices are the lowest when the NSR is abolished, even in a duopoly situation. Thus the policy implication of this paper would be that from a consumer welfare perspective, the excessive surcharges are dominated by lower over all prices, and thus abolishing any constraints on surcharging would benefit consumers. Thus regulations like the EC payment directive (European Commission 2007) outlawing NSRs by default are indeed good for consumers.

5.1 Comparison with the price discrimination literature

We have shown that the card accepting merchant's interest is not to be allowed to price discriminate through surcharging. This is similar to what the price discrimination literature would predict. Stole (2007) shows that price discrimination can lead to a prisoner's dilemma, where price discrimination, while individually rational

nevertheless leads to lower profits compared to a situation where all firms stick to uniform pricing.

In our case, the cash-only merchant can not price discriminate, but he will set prices differently depending on whether the card accepting merchant is allowed to discriminate. If merchant B is constrained by a NSR, then both he and A will set higher prices, earning higher profits than if B is not constrained. The NSR provides a credible commitment device for achieving the higher profits, a device that is often missing in other circumstances. This finding is in line with Economides (2009), who notes the similarity between the NSR and most-favored-customer rules.

Our result, that the NSR increases prices for cash users, is also consistent with the findings of Armstrong and Vickers (1993). They note that in a situation with two markets, one competitive and the other captive, a ban on price discrimination across markets (the ban being analogous to a NSR) increases prices in the competitive market (analogous to the cash user market). However, unlike the Armstrong and Vickers (1993) analysis, in our model the price in the captive (card user) market also decreases when price discrimination (surcharging) is allowed. This discrepancy can be explained by Armstrong and Vickers (1993) modeling a situation where the competitive and captive markets are disjoint, whereas in our model the card user market is not fully captive to Merchant B, as the card users have the option of using cash at Merchant A.

5.2 Interpretation of the model and its results

Our analysis pertains superficially to a situation of two merchants, differentiating themselves solely based on the payment methods they accept, where both are forced to accept cash, and one of them additionally accepts card payments. This can also be interpreted as a situation where one merchant (A) only accepts a small subset of payment methods, and the other (B) is accepting some additional payment method, with higher costs to the merchant.

The model can also be loosely interpreted as pointing to some general dynamics in a situation where some merchants accept cards while others do not. The presence or absence of the NSR will then affect the level of competition between the two groups.

Our results have been derived under certain modeling assumptions. These assumptions are not valid across all retail markets, but we nevertheless think that we point to an interesting, thus far ignored effect.

Our results are contingent on consumers having varying preferences for card use, and merchants exploiting this to differentiate themselves. Differentiation occurs when some merchants are willing to use a costly payment technology to differentiate themselves from their competitors. Our assumption is compatible with the way card acceptance is marketed to merchants. For example American Express markets card acceptance as “an investment in attracting customers” (American Express 2011).

While we have not focused on the reaction of card companies to changes in surcharging regimes, we have not ignored it. By assuming that card companies set weakly higher prices to merchants when a NSR is in place, and correspondingly incentivize card holders more, by implementing weakly higher card use rewards

under the NSR, compared to other regimes, we incorporate the reactions of card companies.

5.3 Quantifying the impact

Having identified that the NSR has an effect on competition, how can we quantify this? Looking at this through an example is instructive. Typically, the card use fees faced by merchants is a percentage of transaction value. Garcia-Swartz et al. (2006a) is one of few empirical studies on actual costs of different payment methods to merchants. They find that an American grocery store's marginal cost of receiving cash payments is 2.61 % of the transaction value,[15] while it for credit card payments is 5.92 %, making for an approximate difference of 3.3 percentage points, this difference corresponding to our c. Setting $c = 3.3$ %, then going from the NSR to unconstrained surcharging typically reduces A's price by between $0.5c$ and $1.5c$, depending on the ratios of $\frac{t}{c}$ and $\frac{r}{c}$. Comparing the NSR to constrained surcharging gives a slightly smaller difference.

How do we interpret a range of $0.5c$ to $1.5c$? With c being a percentage of sales, then with the suggested $c = 3.3$ %, merchant A faces a potential drop in prices of around 1.65 % to 4.95 %. In an industry with slim profit margins, this seemingly small figure is quite big. For example Wal-Mart reports US operating income as a percentage of sales of around 7.5 % for fiscal years 2009–2011 (Wal-Mart Stores, Inc 2011).

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3 ESSAY 2: STRATEGIC SUPPLY CHAIN FINANCING[12]

Abstract

We present a model of strategic supply chain financing, with a manufacturer financing a retailer. The manufacturer has strategic financing incentives different from an outside financier. We show that this implies a more severe moral hazard problem. We show that intensified downstream competition may make it harder to induce truthful reporting. Contracting is thus affected by downstream competition, as well as by the manufacturer's outside options. Our results are also applicable to the analysis of private labels, by inverting the model such that the retailer lends to a manufacturer. We also show that supply chain financing may improve welfare, compared to strict separation of commerce and banking.

JEL Classification: D21, D43, D82, G32, L14.

Keywords: Supply chain finance, vertical relations, intermediate goods, contracting, cooperative investment, limited liability.

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3.1 Introduction

So called "alternative financing," that is financing from sources other than financial markets and banks play an important role in corporate finance today (Allen et al., 2012). In the US, non-bank financial companies had 467.4 billion dollars in outstanding receivables from business borrowers in 2011, compared to 1.27 trillion dollars for banks' commercial lending (Federal Reserve System, 2012a,b). A special case of alternative financing, supply chain financing, or the financing of trading partners in the same supply chain is recognized as being increasingly important (Hofmann et al., 2011). As the Financial Times (2012a) put it in their report of Amazon's and Google's move into extending credit: "the biggest internet companies... ...turn to their balance sheets as a source of competitive advantage." In the same article, a Google representative is quoted as saying that Google is "not trying to run the financing business as a profit centre," with the clear implication that credit extension is driven by its effect on sales. Starbucks providing financing to coffee growers to enable them to invest in better yielding plants is yet another example of supply chain financing (see Financial Times, 2012b).

In this paper we analyze supply chain financing, or financial contracting in vertical relationships. While our mechanism is general, for the sake of exposition we focus on the specific example of an upstream firm (manufacturer) extending credit to a cash constrained downstream firm (retailer). We refer to the firm extending credit as the manufacturer, with the retailer representing the firm receiving credit. Nevertheless, the economic mechanisms are qualitatively similar when looking at the opposite case, that is the downstream firm extending credit to an upstream firm.

The contribution of the paper is to show how the vertical relationship affects the strategic incentives to finance a cash constrained (downstream) firm, as well as how the downstream product market conditions affect these incentives. The incentives give rise to post-contractual opportunistic behavior by the downstream firm, which needs to be controlled by the upstream financier, through the design of the financial contract. Furthermore, by contrasting the outcomes when the lender is an external financier and when it is engaged in a vertical relationship with the debtor, we can draw policy implications for the debate on separation of banking and commerce.

We characterize financing in very general terms as financing of the downstream firm's upfront fixed costs. Examples of this might be the manufacturer funding the retailer's advertising, or assisting with start-up costs, phenomena which are often observed empirically. We can also think of financing as a more straightforward lending of money. Lafontaine (1992) notes that this is observed in some franchisor-franhisee relationships. Besanko and Perry (1993) note that construction of gasoline stations, owned by independent operators have been financed by suppliers. Amazon's lending to sellers on its platform is yet another example. The volume of non-bank commercial lending in the US described in the opening paragraph highlights the importance of the issue. While the issue is important, the reason for the existence of manufacturers' financing arms is, in

the words of Nocke and Thanassoulis (2013) "not well understood." Our paper tries to improve on this.

We conduct our analysis in a two period model, with uncertainty over fixed costs of the retailer. The manufacturer acts as a lender, extending credit to the retailer. The vertical relationship between the two gives the manufacturer additional strategic incentives for lending. In addition to the pure financial return in terms of repayment of the loan, the manufacturer will also consider the increase in profit arising from the retailer expanding the manufacturer's output. This strategic incentive is absent from the seminal Bolton and Scharfstein (1990) model of an external financier lending to an entrepreneur. The additional strategic incentive may cause a hold-up problem after the first period, as the downstream firm may have incentives to behave opportunistically and renege on its commitments, knowing that the upstream firm will continue to extend credit.[1]

The problem can be thought of in terms of Klein et al. (1978) as the manufacturer making a relationship specific investment in the retailer, and the retailer then tries to appropriate some of the quasi rents from this relationship. We show that whether appropriation can be prevented depends on downstream market characteristics. In particular we show that how prone the manufacturer will be to retailer opportunism will depend on the intensity of retail competition, and its effect on prices and market size.

Nevertheless, the fact that the manufacturer is hurt by retailer opportunism suggests an incentive for the manufacturer to insulate itself from this. We propose a solution, where the manufacturer invests in an outside option, executable should the retailer not perform. The outside option is given two different interpretations: Capacity to sign up an alternative retailer, or building a direct distribution channel.

We show that the outside option may be valuable for two reasons. The option value lies in that when the option is effective, it will discipline the cash constrained retailer into truthful reporting, by making the termination threat credible. The exercise value lies in the fact that the option, if effective, may be exercised in equilibrium. In both cases the option will increase expected profits of the manufacturer.

An important policy implication of this paper is that having the upstream firm extend credit can enhance welfare by ensuring that there will be downstream competition when an external financier would not result in this outcome. Thus we also contribute to the debate on separation of banking and commerce.

3.1.1 Previous literature

Our paper draws mainly on two literatures.

[1] As noted above, the same problem may be present if a downstream firm lends to an upstream firm. Further, the same problem may also be present in case of state aid loans to private companies. These are often politically motivated with the claim that granting the loan will guarantee a continued stream of tax revenues, which otherwise might be jeopardized.

On the one hand, we draw on the literature on the interaction of corporate finance and industrial organization. This literature analyzes how financial structure and financial contracts influence product market behavior on the one hand, and on the other hand how product market structure influences financial structure and contracts. Brander and Lewis (1986) is a seminal paper, with Maksimovic (1988), and Maksimovic and Titman (1991) representing other early contributions. Fershtman and Judd (1987) is also a pioneering paper, even though it superficially deals with firms' internal incentives rather than external financial contracts. For a brief summary of the literature up until the early 2000s, see Riordan (2003).

Our analysis builds on the influential analysis of Bolton and Scharfstein (1990), who characterized the optimal debt contract and showed why debt typically is staged and short term rather than long term. Profit is only partially observable and there is a risk that the entrepreneur receiving financing diverts part of the profit. This feature has given the literature the nickname of "stealing-literature."

Bolton and Scharfstein (1990) mainly focus on the optimal debt contract, and only in the most general way consider product market interaction, when they in an extension analyze the incentives for a rival with deep pockets to predate on the debt financed firm. Our paper has more focus on how product market interactions affects the debt contract. In this respect we follow recent papers like Povel and Raith (2004); Clayton (2009); Khanna and Schroder (2010).

Both Povel and Raith (2004) and Clayton (2009) follow in the footsteps of Brander and Lewis (1986), analyzing how debt affects firms' ability to invest in capacity, and thus their ability to compete in the product market. Khanna and Schroder (2010) look more closely at the pricing decisions of the levered firm and the incentives for the firm with deep pockets to predate. Where Bolton and Scharfstein (1990) assume that successful predation would always be beneficial for the predator, Khanna and Schroder (2010) also allow for the possibility that it may be harmful, if it leads to the levered firm being replaced by a more efficient competitor, or if the two share a common supplier, whose viability would be endangered by the exit of one its customers. While our paper doesn't focus on the predatory aspect, we share with Khanna and Schroder (2010) the approach of more explicitly modeling the product market interaction and its effects on the debt contract. Valta (2012) studies empirically the sensitivity of borrowing terms to product market competition. He finds that firms facing competition from financially strong competitors face a higher cost of bank borrowing than similar firms in less competitive settings.

Nocke and Thanassoulis (2013) show how credit constraints of a downstream firm, coupled with demand uncertainty affects wholesale and retail prices. Thus they focus more on the effect of financial issues on product markets, as opposed to our focus on product market effects on financial contracting. Nevertheless, the interaction between product markets and financing activities give an upstream firm incentives to lend when a bank with the same access to capital would not find it profitable. We share this conclusion.

Another common feature of our paper and that of Nocke and Thanassoulis

is the upstream firm's sharing in the downstream firm's risk. However, in Nocke and Thanassoulis (2013) risk is shared through changes in variable payments (i.e. wholesale price), whereas in our case risk is transferred through the loan arrangement (i.e. the manufacturer assumes credit risk).[2] Also, Nocke and Thanassoulis assume that the cash-constrained risk-averse downstream monopolist borrower has all the bargaining power, whereas our borrower is a risk-neutral oligopolist, with the bargaining power resting with the manufacturer, who provides credit.

Another important literature we draw upon is the literature on vertical relationships and vertical restraints, and the strategic delegation literature. Here Fershtman and Judd (1987) is a seminal paper, focusing on strategic aspects of downstream competition. The literature on vertical relationships can be traced back much earlier, with Telser (1960) being an early entry discussing why an upstream firm might want to limit downstream competition. Rey and Tirole (1986); Shaffer (1991); O'Brien and Shaffer (1992); Winter (1993); Rey and Stiglitz (1995); Jullien and Rey (2007); Foros and Jarle Kind (2008); Inderst and Shaffer (2009); Hansen and Motta (2012) constitute a handful of other papers on vertical relationships, all focusing on some aspect of the double marginalization problem. The problem refers to the presence of more than one level of firms in the supply chain, all setting markups on their input prices and thus, in the absence of more advanced mechanisms, leading to retail prices above what a vertically integrated entity would set. In addition to efficiency gains from vertical restraints, the literature also identifies practices that may be collusive or exclusive in nature. For a recent review, see Secrieru (2006). Two other recent survey articles, Bresnahan and Levin (2012) and Lafontaine and Slade (2007) summarize the literature on vertical integration looking at both industrial organization aspects, as well as aspects related to the theory of the firm.

Our paper relates to the vertical relationships literature by analyzing the codependence of manufacturers and retailers. Our analysis of retail competition and its effect on manufacturer profits is a well known feature of this literature. We contribute by showing how product market competition in the downstream industry impacts on the financial contract designed by an upstream firm.

Bergès and Chambolle (2009) capture some of the features we analyze, namely how a firm on the competitive level can extract profits from the monopoly level through an exit threat. In our case monopoly occurs at the manufacturing level, whereas in Bergès and Chambolle (2009) the retailer is the monopolist. In Bergès and Chambolle (2009) profit extraction happens through the wholesale price, whereas in our paper it occurs through the debt contract.

Our paper also relates to the trade credit literature. Many of the findings in the trade credit literature are also valid in our paper, where credit is extended for financing fixed costs, rather than purchasing of inputs.

[2] In addition to highlighting risk sharing aspects, Nocke and Thanassoulis also show how the upstream firm's lending to the downstream firm may make truthful reporting more tempting for the downstream firm, compared to a situation where an external financier acts as a lender. This helps explain why we observe firms financing their customers.

Nadiri (1969) is an early entry, analyzing trade credit as just another expense necessary to increase demand. The foregone profits from denying credit can be substantially higher for a supplier than for a bank, as the supplier will also take into account that sales might be lost sales if credit is denied. This is a crucial aspect of our model. Petersen and Rajan (1997) find some empirical evidence of suppliers having an informational advantage when evaluating credit risk of their buyers. Not paying a supplier may have more adverse effects on a retailer than not repaying a bank. A supplier withholding deliveries may be able to extract a quicker response from the retailer than what an external financier is able to gain. This theme is also explored in Cuñat (2007). Petersen and Rajan (1997) also note that the prospect of future business gives suppliers greater incentives to extend trade credit than a bank might have.

This also helps explain why suppliers rather than external financiers may finance downstream firms, something that already Schwartz (1974) explained theoretically in similar terms. Giannetti et al. (2011) find empirical evidence that suppliers do sustain financially troubled customers with trade credit.

A recent theoretical paper on trade credit with some similarities to ours is Troya-Martinez (2012), which similarly to us uses the manufacturer's threat of terminating the retailer as a device to induce truthful reporting. However, Troya-Martinez (2012) does this in a setting different from ours, modeling a bilateral monopoly, focusing on limiting sales volume to leave surplus to the retailer.

Thus, many of the features of the trade credit literature would also be applicable to our analysis, where the manufacturer lends to the retailer to cover fixed costs. However, whereas for example Petersen and Rajan (1997) note that suppliers extending credit rely on their ability to repossess and resell goods in case of default, this is not the case in our paper. In our paper collateral does not play any role. Further, our paper takes into account the effect of product market interactions between retailers, and how this affects the potential moral hazard problem, and how this in turn impacts the financial contract. This is a novel feature of our analysis.

Further, in the field of supply chain management a literature on supply chain financing has recently developed. This literature is concerned with financing in vertical relationships. Randall and Farris II (2009) demonstrate how the total cost of capital for a supply chain can be lowered if the company with the lowest cost of capital lends to other companies in the supply chain. Hofmann et al. (2011, chapter 5) further investigates this theme, noting that the financial crisis has highlighted the need to not only build lasting relationships with suppliers, but also support the investments made by suppliers. The authors highlight the example of credit extension from Knorr-Bremse, a braking system manufacturer extending credit to their suppliers to enable them to invest in cost saving technology. Another example is de Hildebrand e Grisi and Puga Ribeiro (2004), who document how Brazilian auto manufacturers finance their suppliers.

Similarly to Hofmann et al. (2011), Allen et al. (2012) point out the importance of alternative sources of finance, especially in light of the recent financial crisis. Since bank lending is often procyclical, alternative sources of financing,

such as financing from suppliers can play an important role.

Finally, our paper has implications for the debate on separation of commerce and banking, a long ongoing, politically charged US debate. Baradaran (2011), Government Accountability Office (2012) and Lehar et al. (2012) constitute recent entries. Baradaran (2011) provides an academic entry, with a good overview of the history of this argument. Government Accountability Office (2012) provides a policy oriented study, while Lehar et al. (2012), in the context of trade credit and its effects on product market competitiveness, finds support for the separation of banking and commerce.

3.1.2 Structure of the paper

We proceed as follows. In section 3.2 we characterize the model in general. In section 3.3 we provide a configuration highlighting the additional profit incentives of the manufacturer to finance an independent retailer. In section 3.4 we describe the equilibrium financial contract in light of the configuration in section 3.3. In section 3.5 we introduce an outside option for the manufacturer and we characterize the equilibrium financial contract with the outside option. These two sections present the contribution of our paper. In section 3.6 we conduct a robustness check of our results, by relaxing some of the assumptions on the product market, made in section 3.3. We also discuss the applicability of the results to a situation where the retailer finances the manufacturer. Section 3.7 concludes.

3.2 The model

Our setup follows closely that of Bolton and Scharfstein (1990). Consider a two period game, where a manufacturer (investor in terms of Bolton and Scharfstein), denoted M, contemplates signing up a retailer (firm in terms of Bolton and Scharfstein). The potential retailer, denoted B, is cash constrained and needs funding for fixed costs incurred at the beginning of each period. In addition to retailer B, the manufacturer already has a financially unconstrained retailer A. This is illustrated in figure 1. As stated in the introduction, the assumption that the manufacturer provides financing to the retailer is just an example. The reverse, a retailer providing financing to a manufacturer is also possible, as are the more general interpretations of an upstream firm financing a downstream firm, or vice versa.

The timing of the game is illustrated in figure 2. At the beginning of each period the retailer is active, it incurs a fixed cost F. Lacking capital, retailer B turns to the manufacturer for financing. The manufacturer stands to benefit, as adding the retailer increases output. This consideration is not present for an external financier. At the end of the period a cost shock z hits the retailer. If this shock is large, the retailer's gross profit minus the cost shock will be less than F, while a small shock will make gross profits minus cost shock larger than F. The shock is private information to the retailer, and can therefore not be contracted on.

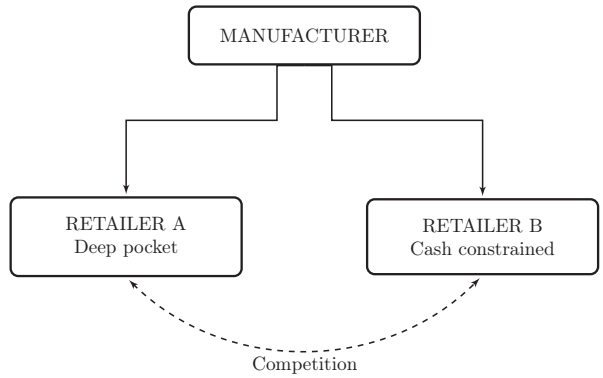

Figure 1: Product market interaction

We can interpret the fixed cost F as general start-up costs borne by the retailer. This could for example be cost of advertising, educating the sales force, investment in merchandise, building costs, etc. Manufacturers frequently support their retailers' advertising, and are also known to support the establishment of new retailers by subsidizing start-up costs.

As in Bolton and Scharfstein (1990), the manufacturer wants to design a contract that induces B to report truthfully the realization after period 1, and may make debt repayment and continuation of the business relationship conditional on this report.

Abstracting from financing costs, retailer B's periodic profit is given by

$$\pi_B = p_B D_B - \tau\left(D_B\right) - F - z, \tag{1}$$

where p_B is the retail price, D_B the demand facing the retailer, $\tau\left(D_B\right)$ is the transfer paid to the manufacturer (typically the wholesale price). Marginal cost of retailing (excluding wholesale price) is assumed to be constant and normalized to zero.

The profit can be split in two parts, gross profit given by $\pi_B^{var} = p_B D_B - \tau\left(D_B\right)$, and fixed costs given by $-F - z$.

The non-verifiable fixed cost z has a known distribution, here assumed to be dichotomous, with $z = z_k, k \in \{1, 2\}$, where $z_1 > z_2$. Probabilities are given by $\Pr\left(z = z_1\right) = \theta$ and $\Pr\left(z = z_2\right) = (1 - \theta)$. Further $\pi_B^{var} - F < z_1 \leq \pi_B^{var}$. This implies that retail net profits are negative when $z = z_1$, when taking into account the fixed cost F.[3] On the other hand $\pi_B^{var} - F - z_2 > 0$. Taking expectations

[3]The upper limit on z_1 stems from limited liability of B. Retailer B is cash constrained, in that it at the beginning does not have any capital. Thus it must get external financing for the initial fixed cost F. As z_k is realized at the end of the period, and it is assumed that the cash constrained retailer will cover it, we make the assumption that z_k is at most equal to gross profits, that is $z_1 \leq \pi_B^{var}$. This makes sense in particular in the first period, as it is assumed that B doesn't have any cash from before. Thus limited liability implies that the largest fixed cost shock he will sustain is equal to the variable profit he has made during the period. Any

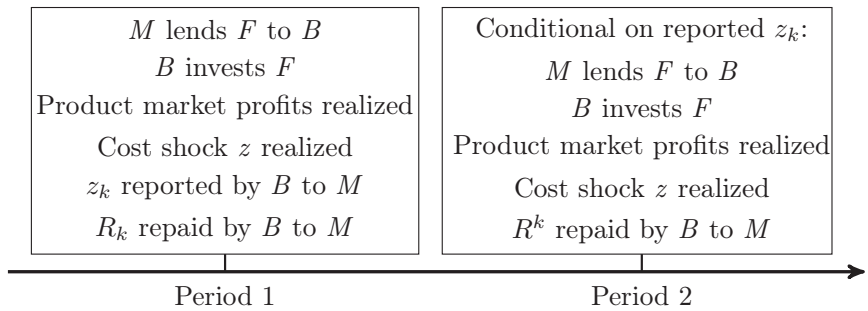

Figure 2: Timeline

over z gives the expected per period retail profit, gross of the initial investment F (still abstracting from financing costs):

$$\bar{\pi}_B \equiv E(\pi_B) + F = \pi_B^{var} - \theta z_1 - (1-\theta) z_2. \tag{2}$$

We assume this is greater or equal to F, that is an unconstrained entrepreneur finds the business profitable in expectation.

For retailer A, profits are similarly given by

$$\pi_A = p_A D_A(\kappa) - \tau(D_A(\kappa)) - F - z, \tag{3}$$

where κ is a binary variable, which is zero if retailer B is not active and 1 otherwise. To highlight that the demand facing A is influenced by whether B is active or not, we use the notation $D_A(\kappa)$.

The manufacturer's profit in period 1 is given by

$$\pi_m = \tau(D_A(1)) + \tau(D_B) - m(D_A(1) + D_B) + R_k - F. \tag{4}$$

The two first terms are the revenue it receives from the retailers, F stands for the financing M extends to B and R_k the repayment it receives on the financing. Total revenue, and sales volume, $i \in \{A, B\}$ is affected by whether B is active or not, that is , is typically higher when B is active. This demand expanding effect is crucial in that it affects the manufacturer's profitability of adding retailer B. The marginal cost of production is given by m and is assumed to be constant. In period 2 the manufacturer's profit is given by

$$\pi_m = \tau(D_A(\kappa)) - mD_A(\kappa) + \kappa\left[\tau(D_B) - mD_B + R^k - F\right], \tag{5}$$

where R^k represents the repayment on the financing in period 2.

Abstracting from the financing aspect, M stands to gain

$$\begin{aligned} \Delta\pi_m \quad &= \tau(D_A(1)) \quad -\tau(D_A(0)) + \tau(D_B) \\ &\qquad\qquad -m\left[D_A(1) - D_A(0) + D_B\right] \end{aligned} \tag{6}$$

shock larger than that would simply mean that the retailer went bankrupt, and protected by limited liability he would at most incur a cost equal to the size of variable profit, defaulting on any shock larger than that.

from signing up retailer B. The first two terms reflect the difference in revenue from retailer A when B is active and when not. The third term reflects revenue from retailer B, while the last term reflects the change in manufacturer costs, which results from the change in quantity.

For clarity of exposition we assume no discounting.

We assume that M has all the bargaining power, that is M will make a take it or leave it offer to B. This can be motivated by there being several potential retailers at period zero. Once the retailer and manufacturer have signed their agreement, there are some switching costs for the manufacturer, preventing him from signing up other potential retailers. It might be that if the manufacturer terminates the retailer after one period, then setting up a relationship with another retailer consumes the following period. Later on in the paper we study the effects of relaxing this assumption.

We have indicated above that the addition of a retailer may increase demand for the manufacturer's output, and the manufacturer may thus have a strategic incentive to finance the retailer, if the retailer cannot raise financing from the capital market. In the literature review we saw that the manufacturer may have both more incentives to act as a lender, but also a competitive advantage over outside financiers, in that it may have better ability to induce repayment.

We can interpret the retailer's investment, F, in the words of Tirole (1999) as a "game with cooperative investments," that is the investment has a greater effect on the trading partner's (the manufacturer) surplus than on the actual investor's (the retailer) surplus. By financing the retailer, the manufacturer can internalize this externality. Neither the retailer, nor an external financier would incorporate this externality in their decisions. The manufacturer's extension of finance can also be seen as sharing the risks of the retailer. As previously pointed out, the trade-credit literature has also advanced risk-sharing as a motive for trade credit.

Furthermore, the manufacturer may constitute a more diversified entity than the retailer. Thus the manufacturer may be better able to raise funding than the retailer. For reasons outlined above, the manufacturer may then pass on this financing to the retailer.

The above mentioned can help explain the prevalence of suppliers maintaining large financial arms, as pointed out in the introduction.

3.2.1 Timing of the game

Summarizing, the timing of the game is as follows.

1. In period zero manufacturer M makes a take it or leave it offer to retailer B. B needs funding from M to invest F to start operations. M sets wholesale prices. Financing terms are set, represented by R_k and R^k, the repayments in period 1 and 2, conditional on reports of z_k in period 1. The contract also stipulates whether to finance B in period 2, conditional on reports of z_k in period 1. The contract is legally enforceable.

2. Period 1. Conditional on accepting M's offer, B invests F. Upstream and downstream markets clear. At the end of the period the realization of the cost shock z_k is revealed to B, but not to M. B reports realization of z_k to M and repays R_k, which is conditional on the reported z_k, in accordance with the contract. Based on the report and the contract, M will either continue the business relationship with B or not (If the contract stipulates that M should continue under the given circumstances, he will, due to the enforcability of the contract).

3. Period 2. M finances B if it is stipulated by the period 0 contract and period 1 reporting. B may try to renegotiate. Wholesale terms, are set, as in period 0. Conditional on receiving financing for the investment F from the manufacturer, B is active in the market. Product markets clear. With B active, the game is as in period 1. At the end of the period fixed cost shock z^k is realized and B pays M the sum of R^k, conditional on period 1 report.

This two-period model can be interpreted as a general framework, where the second period represents the future in a general sense. Alternatively, using the Buehler and Gärtner (2012) line of thinking, we can view period two as a new round in the product cycle. The retailer may need to invest in costly staff training, advertising, etc, to participate in the new round.

3.3 A model of product market interaction

In this section we present a baseline model of the product market interaction between manufacturer and retailer. As stated above, the manufacturer initially has a retailer, retailer A signed up. The manufacturer considers adding a second retailer, retailer B. Adding a second retailer can expand output, by increasing the size of the potential market, as well as by reducing double marginalization.

Our configuration provides an illustration of the additional profits the manufacturer can make by financing the retailer. In section 3.4 we analyze the implications for the financial contracting of the additional profits introduced in this section. In section 3.6 we look at alternative settings to see to what extent the results we derive are robust to changes in product market features.

The retailers are differentiated and consumers heterogeneous, that is some consumers have a stronger preference for A, while others have a stronger preference for B. The heterogeneity can be thought of as either representing differentiation in terms of geographical location, or more generally, as differentiation in some other dimension.

The retailers face individual demand functions given by the formulation of Singh and Vives (1984). For tractability the demand functions are symmetric and given by

$$D_i = \tfrac{\alpha}{\beta+\gamma} - \tfrac{\beta}{\beta^2-\gamma^2}p_i + \tfrac{\gamma}{\beta^2-\gamma^2}p_j; \quad i \neq j; \alpha, \beta > 0; \tfrac{\gamma}{\beta} \in [0,1)\,. \tag{7}$$

The parameter γ measures substitutability, and thus it also measures competition. If i and j are independent, then $\gamma = 0$. This is the case for example

when there is monopoly (that is B is not active, i.e. when $\kappa = 0$ in terms of (3)-(6)). The greater $\frac{\gamma}{\beta}$ is, the more intense competition is. When the retailers are completely homogenous, then $\frac{\gamma}{\beta} \to 1$. The heterogeneity of consumers can be seen from the demand function in the fact that for a given price, more retailers imply weakly greater quantities demanded for the manufacturer, that is $D_i + D_j \geq D_i$ for a given price.

We assume no capacity constraints, neither in manufacturing, nor retailing. The differentiated retailers thus play a price setting game. Retailers set uniform prices, that is retailer i sells each unit for price $p_i, i \in \{A, B\}$.

In the upstream market, the manufacturer faces total demand of $\Sigma D_i = D_A + D_B$. The manufacturer is restricted to charging a uniform, linear wholesale price w.[4] This allows us to keep the setup reasonably simple, while still illustrating the increase in wholesale profits, $\Delta\pi_m$ that the manufacturer stands to gain from extending financing. In the extensions in section 3.6 we investigate the effects of relaxing the assumption of linear wholesale prices.

Focusing on the product market interaction, the above structure gives the following profit maximization problems for retailer i and manufacturer M:

$$\max_{p_i} \pi_i = (p_i - w) D_i - F - z \tag{8}$$

$$\max_{w} \pi_m = (w - m) (D_A + D_B) \tag{9}$$

These are special cases of the objective functions (1) and (4), disregarding the manufacturer's credit extension, and setting the wholesale payment $\tau(D_i) = wD_i$.

3.3.1 Comparing retail monopoly and duopoly

As stated earlier, the manufacturer's profit increases when adding the second retailer. The incremental profit from adding retailer B, given by (6) in the general case, is here given by the difference between the manufacturer's profits under duopoly and monopoly:[5]

$$\Delta\pi_m = \pi_m^{duo} - \pi_m^{mono} = \frac{\left(2\beta^2 - \beta\gamma + \gamma^2\right)(\alpha - m)^2}{8\beta(2\beta - \gamma)(\beta + \gamma)}. \tag{10}$$

This is positive for all parameter values, as long as demand is positive.

Furthermore, the following lemma, comparing the incremental profits of the manufacturer from adding a second retailer (10) with retailer variable profit (53), will prove to be important.

[4] Ferrari and Verboven (2012) note that uniform wholesale prices are widely observed in practice. Their literature review points to a number of articles supporting this. McAfee and Schwartz (1994) talk about the "striking uniformity" of franchise contracts. The assumption of linear prices is not critical for our analysis. In section 3.6.2 we discuss the effects of allowing for two part tariffs instead of linear prices.

[5] These profits are calculated in the appendix and are given by (52) and (44).

Lemma 1. *It can be shown that* $\Delta\pi_m > \pi_i^{var}$. *Furthermore, since* $\pi_i^{var} > F$ *by assumption, it follows that* $\Delta\pi_m > F$.

The first part states that the monopolist manufacturer captures more of the surplus from adding a duopolist retailer than the retailer itself captures, as the manufacturer's incremental profit is greater than the retailer's gross profit. Since the retailer's gross profits are larger than the fixed cost F, it follows that the manufacturer's incremental profit also is larger than the fixed cost F.

The manufacturer's profits are higher, as the wholesale price stays the same, but output is expanded. Output is expanded for two reasons.

First of all, for a given retail price, output is weakly greater under duopoly than under monopoly. This is due to consumers' heterogeneous preferences for the retailers. Only if there is no heterogeneity, that is if $\gamma = \beta$ we do not have this effect. If there is no heterogeneity, the second retailer only cannibalizes sales of the first retailer. As long as there is some heterogeneity, increasing the number of retailers will expand output for a given retail price. Put succinctly, variety promotes demand.

Second of all, retail prices do not stay constant as we go from monopoly to duopoly. Increasing the number of retailers lead them to set lower prices in order to attract customers. This happens as long as the substitution parameter γ is positive, thus alleviating the double marginalization problem. If γ is zero then the retailers will act as separate monopolies.[6]

Having established the manufacturer's preference for having a second retailer, we turn to the aspects of how to finance this retailer.

3.4 The financial contract

In this section we present the profit maximizing financial contract that manufacturer M will offer to retailer B. We also present the equilibrium outcome of the contract, including manufacturer and retailer profits. Furthermore, we discuss some issues with the contract.

3.4.1 The equilibrium contract

In order to be active, retailer B must pay the fixed cost F at the start of the period. Lacking this capital initially, B turns to M for funding. We know that M would prefer to have B as a retailer whenever this increases M's profits, that is whenever $\Delta\pi_m$ (given by (6) for the general case, or by (10) for the baseline model) is positive. Thus, M has greater incentives to finance B than an external investor would have.

Looking at the manufacturer's problem, it is the same as in Bolton and Scharfstein (1990), augmented with the additional per period wholesale profit $\Delta\pi_m$ from having retailer B signed up. The problem can be expressed as maximizing expected profit over the two periods, by setting the repayments in the first period, R_k and the second period, R^k, as well as the binary decision of

[6] This might for example be the case if they operate under exclusive territory provisions.

whether to finance the retailer in the second period or not, β_k, all conditional on reported first period profits.[7] For simplicity the discount rate is set at zero.

The manufacturer's incremental profit from signing up retailer B is expressed as follows:

$$\max_{\beta_k, R_k, R^k} E(\Pi) = \Delta\pi_m - F + \theta\left[R_1 + \beta_1\left(R^1 - F + \Delta\pi_m\right)\right] + (1-\theta)\left[R_2 + \beta_2\left(R^2 - F + \Delta\pi_m\right)\right] \quad (11)$$

The first two terms represent the increase in wholesale profits that occur in the first period, as well as the investment in the retailer. This is realized with probability one. With the appropriate incentive compatibility (IC) constraint truthful reporting by the retailer can be assumed.[8] There is a probability of θ that z_1 is realized and reported, giving the outcome inside the first set of squared brackets, while the probability of z_2 occurring and being reported is given by the complementary probability $(1-\theta)$, with that outcome given by the terms in the second set of square brackets. β_1 and β_2 are the binary decisions on whether to finance retailer B in the second period, given that B has reported z_1 or z_2 at the end of period 1. The role of β_1 and β_2 is to act as a disciplining device on B. Given that $\beta_2 = 1$ in the equilibrium contract, then setting $\beta_1 = 0$ makes reporting z_1 costly for B, as this means B will lose the next period expected profits.

The manufacturer maximizes the incremental profit function subject to the IC, individual rationality (IR) and limited liability (LL) constraints of B.

The IC constraint ensures that B will report truthfully, that is B will not report lower gross profits in order to achieve higher profits net of financing costs. The IC constraint is given by

$$\pi_B^{var} - z_2 - R_2 + \beta_2\left(\bar{\pi}_B - R^2\right) \geq \pi_B^{var} - z_2 - R_1 + \beta_1\left(\bar{\pi}_B - R^1\right). \quad (12)$$

The left hand side of the constraint gives the expected profit of reporting truthfully when z_2 is the outcome in the first period, while the right hand side gives the expected profit of reporting z_1 despite z_2 being the true outcome.[9]

The (LL) constraints ensures the retailer doesn't make a loss. The constraints are given by

$$\pi_B^{var} - z_k \geq R_k \quad (13)$$

$$2\pi_B^{var} - z_k - z_1 - R_k \geq R^k. \quad (14)$$

The first line tell us that first period gross profit must be greater or equal to first period payment. From the second line we see that first period net profit plus minimum second period profit must exceed second period payment. The

[7] We only consider pure strategy games, where $\beta_k \in \{0, 1\}$, not allowing for randomization.

[8] See later on for a caveat.

[9] Note that the complementary IC constraint, making reporting z_1 more profitable than reporting z_2 when realization was z_1 will also be satisfied when (12) is binding (furthermore, the LL constraints can preclude this potential problem). The proof is in appendix 3.A.3.

second period profit taken into account here is the lowest possible profit, as there are no incentives for B to report anything but the lowest realization, as there are no gains from future periods which would discipline him. If the LL constraints are satisfied, the IR constraint will also be satisfied.

Rearranging the binding IC constraint gives the optimal first period payment given a report of $z = z_2$ in that period:

$$R_2 = \beta_2 \left(\bar{\pi}_B - R^2\right) - \beta_1 \left(\bar{\pi}_B - R^1\right) + R_1. \tag{15}$$

Substituting this into the maximization problem yields

$$\begin{aligned}\max_{\beta_k, R_k, R^k} E(\Pi) = \Delta\pi_m - F + R_1 + \theta\left[\beta_1\left(R^1 - F + \Delta\pi_m\right)\right] \\ + (1-\theta)\left[\beta_2\left(\bar{\pi}_B - F + \Delta\pi_m\right) - \beta_1\left(\bar{\pi}_B - R^1\right)\right].\end{aligned}$$

Rearranging yields

$$\begin{aligned}\max_{\beta_k, R_k, R^k} E(\Pi) = \Delta\pi_m - F + R_1 + \beta_1\left[R^1 + \theta\left(\Delta\pi_m - F\right) - (1-\theta)\bar{\pi}_B\right] \\ + \beta_2\left[(1-\theta)\left(\bar{\pi}_B - F + \Delta\pi_m\right)\right].\end{aligned}$$

First period payment conditional on report of z_1 is determined by $\frac{\partial E(\Pi)}{\partial R_1} = 1 > 0$. Since $\frac{\partial E(\Pi)}{\partial R_1} > 0$ it is optimal to set R_1 as high as possible, that is $R_1 = \pi_B^{var} - z_1$ in accordance with the LL constraint.

Looking at the second period payment given that first period reported z was z_1 yields $\frac{\partial E(\Pi)}{\partial R^1} = \beta_1 \geq 0$, supporting the setting of R^1 as high as possible, that is $R^1 = \pi_B^{var} - z_1$ in accordance with the LL constraint.

The decision to finance the retailer in period two, given that reported profits in period one were high are given by $\frac{\partial E(\Pi)}{\partial \beta_2} = (1-\theta)\left(\bar{\pi}_B - F + \Delta\pi_m\right) \geq 0$. The derivative is non-negative, since the sum of the two first terms in the second bracket is non-negative by assumption. This implies that as long as $\theta < 1$, the profit function is increasing in β_2. Thus β_2 should be set to its maximum, that is $\beta_2 = 1$.

Whether to finance the retailer in period 2 given a report of z_1 is determined by β_1. This in turn is determined by the sign of $\frac{\partial E(\Pi)}{\partial \beta_1} = R^1 + \theta\left(\Delta\pi_m - F\right) - (1-\theta)\bar{\pi}_B$. If this is positive, then profits are increasing in β_1 and β_1 will be set to its maximum, equal to 1. If the expressions is negative, then β_1 will be set to its minimum, that is equal to zero.

Having established $R_1 = R^1 = \pi_B^{var} - z_1$, and $\beta_2 = 1$, substituting these into the IC constraint gives $R_2 = (1-\beta_1)\bar{\pi}_B - R^2 + (1+\beta_1)(\pi_B^{var} - z_1)$.

This yields two alternatives. With $\beta_1 = 0$ we have $R^2 + R_2 = \pi_B^{var} - z_1 + \bar{\pi}_B$, with $\beta_1 = 1$ we have $R^2 + R_2 = 2 \times (\pi_B^{var} - z_1)$. Comparing the two, we see that $\left(R^2 + R_2 | \beta_1 = 0\right) > \left(R^2 + R_2 | \beta_1 = 1\right)$, that is the sum of repayments given a report of z_2 is higher when $\beta_1 = 0$ compared to the case with $\beta_1 = 1$.

	$\beta_1 = 0$	$\beta_1 = 1$	Explanation of variable
β_1	0	1	Binary - Finance retailer given report of $z_k = z_1$
β_2	1	1	Binary - Finance retailer given report of $z_k = z_2$
R_1	$\pi_B^{var} - z_1$	$\pi_B^{var} - z_1$	Repayment in period 1 given report of $z_k = z_1$
R^1	$\pi_B^{var} - z_1$	$\pi_B^{var} - z_1$	Repayment in period 2 given report of $z_k = z_1$
R_2	$\bar{\pi}_B$	$\pi_B^{var} - z_1$	Repayment in period 1 given report of $z_k = z_2$
R^2	$\pi_B^{var} - z_1$	$\pi_B^{var} - z_1$	Repayment in period 2 given report of $z_k = z_2$

Table 1: Parameters of the financial contract, conditional on β_1.

We summarize the optimal contract, conditional on β_1, in table 1.

Returning to the determination of β_1, the expression $\frac{\partial E(\Pi)}{\partial \beta_1}$ can be simplified by collecting the terms determined so far. Defining $\delta = z_1 - z_2 > 0$, we can express $\frac{\partial E(\Pi)}{\partial \beta_1}$ as

$$\frac{\partial E\left(\Pi\right)}{\partial \beta_1} = \theta\left(\Delta\pi_m - F + \pi_B^{var}\right) - \theta z_2 - \left(1 + \theta^2 - \theta\right)\delta. \tag{16}$$

The sum of the terms in the first set of brackets is positive, and from this the remaining terms, also positive, are subtracted. The sign of the derivative is thus ambiguous. Thus, it is ambiguous whether the optimal contract calls for $\beta_1 = 0$ or $\beta_1 = 1$. When the investor is an external financier, as in Bolton and Scharfstein (1990), the optimal policy always calls for $\beta_1 = 0$.

Nevertheless, studying the comparative statics sheds some light on the sign under different settings.

Starting with θ, the probability that $z = z_1$, we make the following observations. When $\theta = 0$ this expression boils down to $\frac{\partial E(\Pi)}{\partial \beta_1} = -\delta < 0$, thus $\beta_1 = 0$ is optimal in that case. When $\theta = 1$ the expression is $\frac{\partial E(\Pi)}{\partial \beta_1} = \Delta\pi_m - F + \pi_B^{var} - z_1$. When lemma 1 holds true, this is positive, since the difference between the first and the second term are positive in that case, and the difference between the third and the fourth term is non-negative. Thus in this case $\beta_1 = 1$ is optimal. More generally, $\frac{\partial E(\Pi)}{\partial \beta_1}$ is increasing in θ, as the derivative with respect to θ, $\frac{\partial^2 E(\Pi)}{\partial \beta_1 \partial \theta} = \Delta\pi_m - F + \pi_B^{var} - z_2 + (1 - 2\theta)\,\delta$ is strictly positive when lemma 1 holds. The more likely it is that the true realization of z is z_1, that is that costs are high, the more often it is profit maximizing for the manufacturer to set $\beta_1 = 1$ and continue the business relationship. This can be understood against the effects an increase in θ has on expected profits, and the role of β_1 as a costly disciplining device.

Given that maintaining the business relations with retailer B is profitable for the manufacturer, the only reason to set $\beta_1 = 0$ is for the disciplining effect it has, inducing B to report truthfully. Given truthful reporting, with an increase in θ, it will be increasingly likely that the manufacturer has to cut B off after period 1 if the policy is $\beta_1 = 0$, while at the same time the probability that z_2 is

reported, and the higher repayment is obtained is diminished. Thus an increase in θ increases the expected cost of maintaining the disciplining device, while the expected benefits decrease.

With a strategy of $\beta_1 = 0$ acting as a device for inducing truthful reporting, we can say that any change that increases $\frac{\partial E(\Pi)}{\partial \beta_1}$ makes it harder to induce truthful reporting.

Having established that an increase in θ increases the likelihood that the optimal strategy calls for setting $\beta_1 = 1$, that is that the manufacturer will renew the contract even if the retailer reports $z = z_1$ in the first period, we look at how other factors affect the choice of optimal β_1.

An increase in δ, that is the difference between the retailer's profit shocks z_1 and z_2 will also decrease $\frac{\partial E(\Pi)}{\partial \beta_1}$, making $\beta_1 = 0$ more likely. This follows as a greater δ provides greater incentives to be able to induce truthful reporting. An increase in both shocks simultaneously has the same effect. The same is also true for an increase in regular fixed cost, F. The greater the sum the manufacturer must finance, the more incentives to induce truthful reporting.

On the other hand, an increase in the incremental profitability of the manufacturer, $\Delta\pi_m$, and/or in the variable profitability of the retailer, π_B^{var}, will increase $\frac{\partial E(\Pi)}{\partial \beta_1}$, decreasing the likelihood of $\beta_1 = 0$ being optimal. In other words, the more second period revenue at stake, the less likely it is that the optimal contract will involve cutting off the retailer after period one. We summarize this in the following proposition:

Proposition 1. *Increased manufacturer and/or retailer profitability makes it harder to induce truthful reporting.*

The inability to induce truthful reporting follows from $\beta_1 = 1$ becoming a more profitable strategy than $\beta_1 = 0$.

This also implies that any change that affects profitability will affect the possibilities to induce truthful reporting. In particular, looking at the effect of retail competition on the determination of β_1, we can see that $\frac{\partial^2 E(\Pi)}{\partial \beta_1 \partial \gamma} = \theta\left(\frac{\partial \Delta\pi_m}{\partial \gamma} + \frac{\partial \pi_B^{var}}{\partial \gamma}\right)$. If this is positive, then intensified retail competition makes it harder to induce truthful reporting. Thus, the effects of intensified retail competition on the truthfulness of reporting depends on its effect on overall profits of the manufacturer and the retailer. If truthful reporting cannot be induced, then the extractable surplus is diminished.

Corollary 1. *If intensified retail competition increases the sum of manufacturer and retailer profits, then intensified retail competition weakens the manufacturer's ability to extract surplus from the retailer.*

When $\beta_1 = 1$ is the more profitable strategy, a larger share of overall profits remain with the retailer.

Increased retail competition can in general increase industry profits, by reducing the distortions from double marginalization. With the demand function used in section 3, this will not be the case. Looking at the derivative

$\frac{\partial^2 E(\Pi)}{\partial \beta_1 \partial \gamma}$, the second term is always negative, whereas with the given demand function the first term is positive when $\frac{\gamma}{\beta} > \frac{1}{2}$. We can rewrite the derivative as $\frac{\partial^2 E(\Pi)}{\partial \beta_1 \partial \gamma} = -\theta \frac{(\alpha-m)^2 3\beta(\beta-\gamma)^2}{2(2\beta-\gamma)^3(\beta+\gamma)^2}$. This is negative. While the increase in downstream competition increases manufacturer profits after a certain threshold, the negative effect on retail profits is stronger. Thus higher intensity of retail competition makes $\beta_1 = 0$ a more profitable strategy for the manufacturer. Thus we find in this case that intensified retail competition improves the manufacturer's position, as it becomes easier to induce truthful reporting.

We can explain this by the fact that the more intense retail competition is, the smaller the market expansion effect of the second retailer is. Then the manufacturer suffers less from terminating the second retailer. However, terminating B increases double marginalization. This works in the opposite direction of the market expansion effect. Nevertheless, in this setting, the decrease in market expansion dominates double marginalization.

However, if an increase in retail competition would not reduce the market expansion effect of the second retailer as much as above, then this result would be overturned (see subsection 3.6.3 for a case where this happens). Whereas one might intuitively expect increased downstream competition always to be beneficial for the manufacturer, this effect may be reversed when the manufacturer faces switching costs, in the form of inability to sign up an alternative retailer.

3.4.2 Time consistency

We showed above that for certain parameter values, the analysis will be similar to Bolton and Scharfstein (1990) in that the optimal contract will be characterized by $\beta_1 = 0$, $\beta_2 = 1$, $R^2 + R_2 = \pi_B^{var} - z_1 + \bar{\pi}_B$ and $R_1 = R^1 = \pi_B^{var} - z_1$. However, there is a problem with this analysis.

Proposition 2. *In the presence of strategic considerations with respect to financing of the supply chain, the ex ante optimal solution will only under some parameter values call for the termination of the retailer, if the retailer reports low profits. Even then the solution is not time-consistent.*

This is unlike the Bolton and Scharfstein (1990) contract, where the external financier would always terminate the entrepreneur in case of low reported profits.

While the manufacturer's contract may seem ex ante optimal, there is a problem of time-inconsistency. Provided that the retailer after period 1 reports low profits, the manufacturer will prefer to renege on his termination threat, since the manufacturer, by extending credit for the next period, can earn an additional profit of $\Delta\pi_m - F + \pi_B^{var} - z_1$. Under lemma 1 and previous assumptions this is strictly positive. In fact, the additional profit the manufacturer earns is enough for the manufacturer to want to finance the retailer's fixed cost F even if the retailer had no intention of repaying.[10] The termination threat is not credible.

[10]Thus, if one were to reverse the bargaining position, putting all the bargaining power with the retailer, F could be viewed as a slotting allowance paid by the manufacturer to the retailer in order to have the retailer stock his product. There's a burgeoning literature on

Knowing this, the retailer would in any case report $z = z_1$. The retailer may report high costs for two reasons. Either because costs have truly been high, in which case we say that the retailer is *non-performing*. It may also be that the retailer is opportunistically trying to initiate a renegotiation of the contract, by reporting z_1 even though the true realization was z_2. This will be termed *opportunistic behavior*.

Either way, the manufacturer has problems committing to a policy inducing truthful reporting by the retailer, due to the strategic consideration of additional wholesale profits. Without this additional strategic profit incentive the problem does not occur.

Proposition 3. *The presence of strategic considerations with respect to financing of the supply chain promotes opportunistic behavior by the retailer.*

The retailer will be prone to act opportunistically as it is in the manufacturer's interest to continue funding the retailer. Thus the termination threat will not be credible, and thus not time consistent.

The effect of the manufacturer's inability to commit can be illustrated by setting $\beta_1 = \beta_2 = 1$. In this case, the retailer's repayment will be the same in each period, $R_1 = R^1 = R_2 = R^2 = \pi_B^{var} - z_1$. The retailer may report truthfully, but repayment will not depend on this report.

This time-inconsistency of the solution is a defining contribution of our paper. The manufacturer's inability not to lend to the retailer is compatible with the findings of the literature explaining trade credit, as pointed out in the introduction.

3.4.3 The manufacturer's profit

Looking at the outcomes of the contract, assuming for the moment that the manufacturer can commit to it, the following incremental profit from financing the retailer will be realized, conditional on β_1:

$$E\left(\Pi|\beta_1 = 1\right) = 2\left(\Delta\pi_m - F + \pi_B^{var} - z_1\right) \tag{17}$$

$$E\left(\Pi|\beta_1 = 0\right) = (2-\theta)\left(\Delta\pi_m - F + \pi_B^{var} - z_1\right) + (1-\theta)^2\delta. \tag{18}$$

Expected profits are given by the larger of the two conditional expected profits, when M can commit to the specified strategy.

If the profit maximizing contract specifies $\beta_1 = 0$, but the manufacturer is unable to commit to this, then expected profit will be given by (17) rather than by (18).

The difference between these is

$$E\left(\Pi|\beta_1 = 0\right) - E\left(\Pi|\beta_1 = 1\right) = (1-\theta)^2\delta - \theta\left(\Delta\pi_m - F + \pi_B^{var} - z_1\right). \tag{19}$$

slotting allowances, cf. Shaffer (1991); Foros and Jarle Kind (2008).

The first term of the difference is always positive, just as the sum of the terms within the second set of brackets under lemma 1. As these bracketed terms are subtracted, the sign of the difference is ambiguous.

As $\theta \to 0$, the difference equals $\delta > 0$, that is committing to cutting off the retailer after a report of low profits is optimal, as discussed in the section on the determination of β_1.

When the difference is positive, it gives the sum the manufacturer would be willing to pay for a commitment device which would enable him to commit to $\beta_1 = 0$. When the difference is negative there are no problems in the sense that the optimal strategy is time consistent.

3.4.4 The retailer's profit

Looking at the profits of retailer B, we know from the previous sections that ignoring financing aspects, profits per active period would be given by (1), reproduced here for convenience: $\pi_i^{duo} = \pi_B^{var} - F - z_k$. Adding financing to this, given the optimal contract, B's combined profits over the two periods are given by the following expressions, where z^s denotes the realization of z in period s.

$$\left(\Pi_B^{duo} | z^1 = z_1\right) = \pi_B^{var} - R_1 - z_1 + \beta_1 \left(\pi_B^{var} - R^1 - z^2\right) \tag{20}$$

$$\left(\Pi_B^{duo} | z^1 = z_2\right) = \pi_B^{var} - R_2 - z_2 + \beta_2 \left(\pi_B^{var} - R^2 - z^2\right). \tag{21}$$

For both rows, the sum of the three first terms are the realized profits for period 1, while the terms inside the brackets represent profits in period 2, conditional on being active.

From above we know that there are two candidates for optimal contract, abstracting for the time inconsistency problem for the moment. Substituting the two solutions into the above expressions gives final profits.

$$\left(\Pi_B^{duo} | z^1 = z_1, \beta_1 = 0\right) = 0 \tag{22}$$

$$\left(\Pi_B^{duo} | z^1 = z_2, \beta_1 = 0\right) = (1 + \theta) z_1 - \left(\theta z_2 + z^2\right) \tag{23}$$

$$\left(\Pi_B^{duo} | z^1 = z_1, \beta_1 = 1\right) = z_1 - z^2 \tag{24}$$

$$\left(\Pi_B^{duo} | z^1 = z_2, \beta_1 = 1\right) = 2z_1 - \left(z_2 + z^2\right). \tag{25}$$

Taking expectations over the second period cost shock gives expected profits:

$$E\left(\Pi_B^{duo} | z^1 = z_2, \beta_1 = 0\right) = z_1 - z_2 \tag{26}$$

$$E\left(\Pi_B^{duo} | z^1 = z_1, \beta_1 = 1\right) = (1 - \theta)(z_1 - z_2) \tag{27}$$

$$E\left(\Pi_B^{duo} | z^1 = z_2, \beta_1 = 1\right) = (2 - \theta)(z_1 - z_2). \tag{28}$$

From these expressions we can clearly see B's incentive to renegotiate at the end of period one. As renegotiation essentially means reporting $z^1 = z_1$

and then renegotiating to set $\beta_1 = 1$, B's profit will increase in expectation by $(1-\theta)(z_1 - z_2)$, regardless of the actual realization of z^1. If $z^1 = z_1$ this stems from the gained additional period of financing (expected profits increasing from 0 to the expression given by (27)), whereas if $z^1 = z_2$ the retailer gains from a lower repayment in period 1 (the gain is given by the difference between (28) and (26)).

3.5 Increasing credibility through an outside option

Above we showed that the manufacturer may lose some profits due to hold-up by retailer B. This occurs as B realizes that reporting low profits after period one is safe, as the manufacturer will not with-hold funding in the second period, even if the manufacturer's strategy may stipulate this. This happens as it is in the manufacturer's self-interest to continue funding. Not continuing the relationship would result in the manufacturer losing his increase in wholesale profits in that period, as it has been assumed that he can not sign up another retailer for that period. This could be due to negotiation complexities, difficulty in finding suitable partners, or other switching costs.

However, given that this inability may cause a loss of profits, it is fair to ask whether this inability to sign up an alternative retailer couldn't be addressed.

We can envisage the manufacturer investing in technology making it faster to sign up a new retailer. In particular, assume that the manufacturer can take measures enabling it to sign up a new retailer, should it find one, so that it is operational immediately at the start of period 2, should the manufacturer terminate B at the end of period 1. We keep assuming that the manufacturer can make a take it or leave it offer to the new retailer. The measures may include investing in staff resources to keep open the possibility to sign up an alternative retailer, setting up regional channel management offices, or buying the services of a consultant for the same purpose. These measures are collectively termed an investment in an outside option.

Given that the investment has been made, assume that there is some probability that a new retailer is found. Further, assume that given that an alternative retailer is signed up, there is some probability that it will need the same kind of financing as B would have needed, but that it also may be "deep pocketed" in the sense of not needing financing. Assume that the retailer signed up is otherwise identical to B, that is it faces the same costs and the same demand.

Summarizing, given that the investment has been made, and B reported low profits after period one and was terminated, the manufacturer faces the following potential outcomes for the second period, with their associated probabilities:

Scenario one is the same as described in the previous section, that is upon terminating B no replacement is found. The second scenario replaces B with an identical retailer, with the same need for funding. Scenario 3 involves replacing B with a retailer with no need for funding by the manufacturer.

Given that scenario 1 is realized, the manufacturer will earn a lower profit than in a situation where he kept retailer B.

Scenario	Probability	Outcome
1.	λ_1	No replacement found
2.	λ_2	Replacement found, needs funding
3.	$\lambda_3 = 1 - \lambda_1 - \lambda_2$	Replacement found, doesn't need funding

Table 2: Scenarios under the outside option.

With scenario 2, the manufacturer is essentially in the same situation in period 2 as when financing B, and will thus earn incremental profit from financing the new retailer of $\Delta\pi_m - F + \pi_B^{var} - z_1$. The first term is the increase in per period wholesale profit from having two rather than one retailers, while the second term is the gross investment in the retailer, and the two last terms are the repayment from the retailer.

Scenario 3 is the most profitable for the manufacturer, as the manufacturer doesn't have to suffer the financing cost of scenario 2. In this case, incremental profit from adding the new retailer is simply $\Delta\pi_m$.

Thus, given that B is terminated, we define $E(\phi)$ as the manufacturer's expected gross profit from the outside option. It is given by

$$E(\phi) = \lambda_1 \times 0 + \lambda_2 (\Delta\pi_m - F + \pi_B^{var} - z_1) + (1 - \lambda_1 - \lambda_2) \Delta\pi_m.$$

This can be rearranged to yield:

$$E(\phi) = \lambda_2 (\pi_B^{var} - z_1 - F) + (1 - \lambda_1) \Delta\pi_m. \tag{29}$$

This is the sum of the expected financing cost (negative) and the expected increase in wholesale profit (positive).

In order to see whether keeping B signed up despite a report of z_1 after period 1 is profitable in this setting, define ψ as the manufacturer's period 2 incremental profit from keeping B signed up in the absence of the outside option.

$$\psi = \Delta\pi_m - F + \pi_B^{var} - z_1. \tag{30}$$

This is positive under lemma 1, as we have seen earlier. To judge whether terminating B after a report of z_1 after period 1, that is whether a contract with $\beta_1 = 0$ is a time consistent strategy involves comparing $E(\phi)$ from (29) with ψ from (30). The strategy of setting $\beta_1 = 0$ is time consistent if and only if the following holds:

$$E(\phi) > \psi > 0.$$

Not only must $E(\phi)$ be positive, but it must be greater than the "inside option" of continuing with B.[11] Substituting and rearranging yields the following expression:

[11] Further, assume that B cannot renegotiate once the realization of ϕ is known.

$$(1-\lambda_2)\left(F-\pi_B^{var}+z_1\right)>\lambda_1\Delta\pi_m. \tag{31}$$

Both the left and right hand sides are weakly positive. The inequality will not hold for all parameter values, but for a range of values it will.

It is worth emphasizing that the analysis of financial contracting without the outside option amounted to a special case of the setting in this section, with $\lambda_1 = 1$ and $\lambda_2 = 0$. Under this special case the inequality will not hold, and $\beta_1 = 0$ is not a time consistent policy. However, as λ_1, the likelihood of not finding a replacement decreases, $E(\phi)$ increases, making $\beta_1 = 0$ a more credible policy.

The intensity of retail competition, measured by γ also affects the credibility of a strategy of $\beta_1 = 0$. In our example in section 3, an increase in intensity of competition will always make $\beta_1 = 0$ a more credible strategy under the outside option. This happens as an increase in γ at low intensity of competition, $\gamma \in [0, \beta/2]$ actually decreases profits of the manufacturer from having a second retailer. This implies that the opportunity cost of not having a retailer decreases. In the section on financial contracting without the outside option we also showed that an increase in γ under this demand formulation makes $\beta_1 = 0$ more profitable. Thus the value of the outside option, making this strategy time consistent increases as γ increases.

Furthermore, an increase in z_1, the cost shock will make $\beta_1 = 0$ a more credible strategy. This follows, as an increase in z_1 makes it less profitable to finance a retailer, and by setting $\beta_1 = 0$ the manufacturer can avoid this cost.

3.5.1 The equilibrium contract with the outside option

We have thus shown conditions under which $\beta_1 = 0$ is a time consistent policy. What is the overall profit maximizing policy? Given that the outside option makes terminating B after period 1 less costly, we can conclude that having the option increases the manufacturer's expected profitability. Formally, the manufacturer's problem, earlier given by (11) must now be augmented with $\theta(1-\beta_1)E(\phi)$, that is the expected profit, given that B reports z_1 and is terminated, taking into account the probability that z_1 is reported. The new maximization problem is thus given by :

$$\begin{aligned}\max_{\beta_k, R_k, R^k} E(\Pi) = \Delta\pi_m - F + \theta\left[R_1 + \beta_1\left(R^1 - F + \Delta\pi_m\right) + (1-\beta_1)E(\phi)\right] \\ + (1-\theta)\left[R_2 + \beta_2\left(R^2 - F + \Delta\pi_m\right)\right]. \end{aligned} \tag{32}$$

The IC and LL constraints of B are the same as in the previous section, and substituting the IC constraint and the expression for $E(\phi)$ into the above equation and rearranging yields the following expression:

$$\max_{\beta_k, R_k, R^k} E(\Pi) = \Delta\pi_m - F + R_1 + \theta E(\phi)$$
$$+ \beta_1 \left\{ R^1 + \theta \left[\lambda_1 \Delta\pi_m - F - \lambda_2 \left(\pi_B^{var} - z_1 - F \right) \right] - (1-\theta)\bar{\pi}_B \right\}$$
$$+ \beta_2 \left[(1-\theta)\left(\bar{\pi}_B - F + \Delta\pi_m \right) \right]. \quad (33)$$

First, looking at R_1, the first period payment given that z_1 is reported, we have $\frac{\partial E(\Pi)}{\partial R_1} = 1$. Since this is positive, profits are increasing in R_1, and R_1 will again be set in accordance with the LL constraint, $R_1 = \pi_B^{var} - z_1$, just as was the case without the outside option.

$\frac{\partial E(\Pi)}{\partial \beta_2}$ is the same as without the outside option, and so β_2=1 is still part of the contract.

As the retailer's constraints haven't changed, R_2 and R^2, the repayments given first period report of z_2 haven't changed from the setting without the outside option.

Finally, $\frac{\partial E(\Pi)}{\partial \beta_1}$ is now different from the case without the outside option. It is now given by

$$\frac{\partial E(\Pi)}{\partial \beta_1} = \theta \left[\lambda_1 \Delta\pi_m + (\lambda_1 + \lambda_3) \pi_B^{var} - F \right] - \theta z_2 - \left(1 + \theta^2 - \theta \right) \delta$$
$$+ \theta\lambda_2 (F + z_1). \quad (34)$$

Comparing this to the expression without the outside option, (16) we see that adding the outside option added the λ_1 and $(\lambda_1 + \lambda_3)$ multipliers on the first row, and the terms on the second row. Analyzing this expression, and comparing it to the situation without the outside option, it is instructive to remember that the situation without the outside option is a special case with $\lambda_1 = 1$ and $\lambda_2 = \lambda_3 = 0$.

The first row of (34) is smaller than the case without the outside option, but to this the positive second row is added. While the derivative of profits with respect to β_1 still depends on parameter values, it is now lower for any given parameter values, implying that a contract with $\beta_1 = 0$ will be a profit maximizing contract for a wider range of parameter values than before. In particular, the greater λ_2 and/or λ_3 are (that is the greater the likelihood of finding a new retailer), the likelier it is that $\beta_1 = 0$ will be the solution maximizing expected profit. In particular, if $\lambda_1 = 0$, (or in general, if λ_1 is small enough), then $\beta_1 = 0$ will be a profit maximizing time consistent solution, since then the profit from terminating B will always be positive, as a replacement will be found for sure, and with probability λ_3 this replacement will not need financing. The following proposition summarizes the discussion:

Proposition 4. *Introducing an outside option reduces, but does not completely eliminate contractual opportunism on behalf of the retailer.*

3.5.2 Profits under the outside option

Given that the outside option exists, we have seen that the manufacturer will set the same terms as when the option does not exist, with the notable exception of the setting of β_1.[12] This will be zero for a larger parameter space than without the outside option, that is the contract will more often call for a termination of B. More importantly, this will be a time consistent policy for some parameter values, unlike the situation without the outside option.

The manufacturer's expected incremental profit from adding B in the first period, given the outside option is then given by the following expressions, contingent on β_1 :

$$E(\Pi|\beta_1 = 1) = 2(\Delta\pi_m - F + \pi_B^{var} - z_1) \quad (35)$$

$$E(\Pi|\beta_1 = 0) = (2-\theta)(\Delta\pi_m - F + \pi_B^{var} - z_1) + (1-\theta)^2\delta + \theta E(\phi) \quad (36)$$

Comparing these two by taking the difference gives the following expression:

$$E(\Pi|\beta_1 = 0) - E(\Pi|\beta_1 = 1) = (1-\theta)^2\delta + \theta[(1-\lambda_2)(F - \pi_B^{var} + z_1) - \lambda_1\Delta\pi_m] \quad (37)$$

As explained in the discussion on the optimal β_1, this may or may not be greater than zero, that is the profit maximizing β_1 may be zero or one. However, looking at the manufacturer's profit functions, it becomes clear that adding the outside option makes $\beta_1 = 0$ a more profitable policy compared to the situation without the outside option. This can be seen by comparing the difference in profitability conditional on $\beta_1 = 0$ under the outside option (36) and without the outside option (18). Looking at this difference, the expected value of the outside option is $\theta E(\phi)$. However, this underestimates the value of the outside option, as it doesn't take into account the time inconsistency problem when the outside option is not available.

Given that the outside option makes $\beta_1 = 0$ a time consistent policy, that is the inequality $E(\phi) > \psi$ holds, the value of the outside option to the manufacturer is given by the difference in profits from a contract with $\beta_1 = 0$ and $\beta_1 = 1$, that is by (37). This is positive when $E(\phi) > \psi$ holds, because then the sum of the terms inside the square brackets will be positive. This implies that the requirement that the outside option makes $\beta_1 = 0$ a time consistent policy is not only a necessary, but also a sufficient condition for $\beta_1 = 0$ being a profit maximizing strategy.

The outside option is valuable for the manufacturer for two reasons: *Option value* and *exercise value*.

Proposition 5. *The outside option is valuable, since its mere existence disciplines the retailer.*

The mere option to replace the retailer increases the manufacturer's profit when z_2 is realized in period 1, as the retailer then will report truthfully, thanks to the presence of the manufacturer's outside option.

[12] The terms were presented in table 1 on page 80.

Proposition 6. *If retailer B report low profits in the first period, then the outside option will also increase expected profits when exercised.*

The outside option is thus not only an option used to discipline retailer B, but it will actually be exercised in equilibrium with positive probability. When exercised, the option will increase expected profits.

What affects the value of the outside option? Comparative statics on the difference (37) reveals the following insights.

An increase in the cost shock, z_1 makes the outside option more valuable. This follows as an increase in z_1 increases the cost of financing a retailer, and given that the outside option isn't available, this financing cost will be incurred by the manufacturer in both periods. The outside option will reduce this to a probabilistic event, occurring with probability θ in the first period and $[1 - \theta(1 - \lambda_2)]$ in the second period.

The intensity of competition, γ has a positive effect on the value of the outside option. The greater the intensity of downstream competition, the more valuable is the outside option to the manufacturer.

The value of the outside option is obviously affected by the λ parameters. An increase in λ_1, the probability of not finding a replacement decreases the value of the outside option. On the other hand, increasing λ_3, the probability of finding a replacement that does not need financing increases its value.

Retailer opportunism can not be eliminated under all parameter values. Given that the outside option is able to get rid of post contractual opportunism, this may still result in a loss of surplus for the manufacturer. While the outside option that induces truthful reporting in expectation yields additional surplus to the manufacturer, it will with probability $\theta\lambda_1$ result in the manufacturer only having one retailer in the second period. If this is realized, then consumers as well as the manufacturer will suffer. Thus the outside option's effect on social surplus may be negative ex post.

3.5.3 Interpreting the outside option

We have characterized the outside option as an abstract ability to sign up new retailers. While this ability may be explained with organizational skills as suggested earlier, we can also make other interpretations. The λ-parameters, indicating the probability of finding a new retailer, can also be seen as macroeconomic indicators. The probability of finding a retailer who doesn't need manufacturer financing may be higher during a boom. Another interpretation would have these probabilities as functions of the manufacturer's investment in the brand and/or the product. A more highly valued brand will find it easier to attract retailers in better financial shape.

Another interpretation of this model could be that the manufacturer will be certain to find a replacement, but only for a fraction of period 2 if B is terminated after period 1. This fraction is given by $(1 - \lambda_1)$. The retailer needs financing for $\frac{\lambda_2}{1-\lambda_1}$ of the fixed costs. In terms of this interpretation, the new retailer that is signed up will need financing for $\frac{\lambda_2}{1-\lambda_1}F$ (assuming that fixed costs are a

linear function of time). Under this interpretation there is no uncertainty over the outcome from terminating B, and we can write $E(\phi) = \phi$. As long as we assume risk neutrality for the manufacturer this interpretation gives the exact same outcomes as the analysis presented above.

Yet another way of thinking about the outside option is in terms of the manufacturer establishing a direct sales channel. This direct sales channel is less effective than selling through B, and thus the manufacturer will lose some profits compared to the situation of having B. Assuming that the inefficiency is known we can write $E(\phi) = \phi$. In this case the λ parameters capture the efficiency of the direct sales channel, with a higher λ_1 meaning greater inefficiency, while a greater λ_2 signals greater fixed costs of the direct sales channel. This interpretation is similar to the modeling of Chiang et al. (2003).

3.6 Robustness of the results

Above we have shown that in the presence of strategic product market considerations, the contract proposed in Bolton and Scharfstein (1990) may seem optimal under some parameter values, but without the outside option it will not be time consistent. We showed that this is the case when lemma 1 holds, that is when the manufacturer's profits from the retailer's investment exceeds the cost of the retailer's investment.

We showed that lemma 1 holds under the demand formulation of Singh and Vives (1984), when wholesale pricing is linear. Manufacturer profits increase due to market expansion and reduction in double marginalization when adding a second retailer.

Below we discuss the effects of relaxing our initial product market assumption for the validity of lemma 1, and thus for our results.

3.6.1 The role of market expansion and competition

Market expansion and intensity of competition are related. An increase in γ, the measure of competition, reduces double marginalization, but also reduces market expansion. In the limit, when $\gamma \to \beta$ adding the second retailer does nothing to increase market size, but removes the double marginalization problem. We call this *cannibalization*. When $\gamma = 0$ adding a retailer replicates the existing retailing monopoly in another market. We call this the case of *separate monopolies*. We showed that our results are affected by retail competition intensity, but there are parameter values supporting our results for all values of γ. Thus our results hold both under separate monopolies and under cannibalization.

3.6.2 The role of linear wholesale contracts

In our baseline model we assumed that the manufacturer was restricted to linear pricing. If we relax this assumption, and allow for two-part tariffs, then the validity of our results depends on the intensity of downstream competition.

Two-part tariffs can completely remove the double marginalization problem (cf. Tirole, 1988, chapter 4). Thus one motivation for adding the second retailer is removed under two-part tariffs. Only if adding B expands the retail market will it be profitable for the manufacturer to add him.

In other words, if adding B only leads to cannibalization, then under a two-part tariff the manufacturer's profits would not increase. Rather, manufacturer profits decrease, as adding the retailer increases costs, while revenue stays constant.

Clearly, if adding retailer B doesn't increase the manufacturer's profits, the manufacturer wouldn't do this. Thus, we restrict us here to cases of separate monopolies, and modest cannibalization (low and intermediate values of γ), that is cases when the market expansion effect of adding B is big enough for the manufacturer to find this profitable. Our analysis below is based on a uniform two-part tariff which allows a deep pocketed retailer to break even in expectation.

If adding B mainly increases market size, as in the separate monopolies case ($\gamma = 0$), then the termination threat is still time inconsistent. In fact, $\Delta\pi_m$ will then be even higher than under linear wholesale pricing, making financing B even more attractive. Thus, the termination threat becomes less credible.

For positive, but low and intermediate values of γ, the contract will depend on parameter values. First, looking at the situation without the outside option, the results are as follows.

Just as under linear wholesale prices, under the two-part tariff there are cases where the termination threat appears optimal, but time inconsistent, as well as cases where the manufacturer will find it profitable to set a policy of $\beta_1 = 1$ from the start, that is to commit to fund the retailer for two periods, no matter what. In addition to these familiar results, the termination threat will be profit maximizing and time consistent under certain parameter values.

The termination threat may be credible under the two-part tariff even without the outside option, since for certain values of γ, adding the second retailer would be barely profitable for the manufacturer in the absence of the need to finance the retailer (or in the absence of asymmetric information). That is, $\Delta\pi_m$ would be positive in expectation, if the realization of the cost shock z could be observed. However, since B will always report high costs in period two, the manufacturer would then want to refrain from financing B in the second period. The analogue of lemma 1 will not always hold under the two-part tariff.

Adding the outside option has a similar effect under the two-part tariff, as under linear wholesale pricing. It will make $\beta_1 = 0$ a profit maximizing and time consistent solution for a wider range of parameter values, thus increasing the profitability of the manufacturer.

Looking more closely at our results, we know that for higher values of γ, the manufacturer's profit of adding the second retailer is lower. Thus the higher the value of γ, the more likely it is that $\beta_1 = 0$ is a time consistent, profit maximizing strategy, as terminating the retailer then imposes less of an opportunity cost.

3.6.3 The role of the demand function

We used the demand specification of Singh and Vives (1984), due to the attractive features described earlier. Employing an alternative demand specification, similar to that used in Motta (2004), where each retailer's demand is given by $D_i = \alpha - (1+\gamma)\, p_i + \gamma p_j, \quad i \neq j, \gamma \geq 0$ we obtain similar results. Under this specification, adding a second retailer will always increase market size. In addition, double marginalization will be reduced whenever the competition intensity variable $\gamma > 0$. The alternative model thus has a stronger positive effect on manufacturer profits than the benchmark Singh and Vives (1984) model. Thus, under the alternative specification, the incentives for the manufacturer to add retailer B are stronger than in the benchmark case. Thus the termination threat is even less credible than in the benchmark case. Further, it is never time consistent without the outside option under the alternative specification, unlike under Singh and Vives, where under the two-part tariff $\beta_1 = 0$ is a time consistent profit maximizing solution under certain parameter values.

Under the alternative specification, the effect of intensity of competition on the financial contract is different from the benchmark case. There $\frac{\partial^2 E(\Pi)}{\partial \beta_1 \partial \gamma} = \theta \left(\frac{\partial \Delta \pi_m}{\partial \gamma} + \frac{\partial \pi_B^{var}}{\partial \gamma} \right) < 0$, that is the more intense downstream competition is, the less likely it is that $\beta_1 = 1$ is a profit maximizing strategy. Under our alternative formulation the sign of the derivative is the opposite, that is the more intensive retail competition is, the more likely it is that the manufacturer sets $\beta_1 = 1$ and continues to fund the retailer, no matter what. Thus, an increase in downstream competition can actually hurt the manufacturer, by making it harder to induce truthful reporting. This effect is not present in our benchmark model.

This curious difference can be understood against the differences in the measure of competition intensity, γ. Whereas an increase in γ always increases $\Delta \pi_m$ in our alternative formulation, this is not the case in our benchmark case. In the benchmark case, $\Delta \pi_m$ under linear contracts is a U-shaped function of γ. Furthermore, the effect of increased retail competition on combined manufacturer and retailer profits is always negative in the benchmark model, whereas the effect is the opposite under our alternative specification.

Under the alternative specification the manufacturer is thus more locked in with the retailer than in the benchmark case. Under this lock-in the manufacturer may then somewhat surprisingly, have to leave more surplus to the retailer if retail competition increases.

Thus, the more intense downstream competition is, the less likely it is that the manufacturer would refuse to finance the retailer. This is interesting in light of the empirical results of Valta (2012), who finds that firms facing more competition in the product market have a higher cost of bank lending. The results of Valta (2012), in combination with our results here would have the empirical implication that firms in highly competitive environments would be more dependent on suppliers for financing than firms in less competitive environments.

3.6.4 The role of duopoly

Throughout we have assumed that the manufacturer is adding a second retailer. This assumption is not crucial for our results. For example under separate monopolies, it is not crucial that we are adding a second retailer. Adding any retailer, be it the first or the nth retailer has the same effect, that is the termination threat will not be credible without the outside option. The manufacturer's switching costs allows the retailer to capture part of the profits.

If the retailers are not separate monopolies, then as long as the market expanding effect is sufficiently strong, or the reduction in double marginalization is large enough from adding a retailer, the same effect may be observed. The time inconsistency problem will occur as long as the effect of adding the retailer has a larger effect on the manufacturer's profits than on the potential retailer's profits (see lemma 1). On the other hand, if the downstream market is nearly competitive already, the manufacturer will have little additional incentives to finance another retailer, and then theses issues will not be as problematic.

3.6.5 The roles of manufacturer and retailer

Throughout the paper, we have analyzed supply chain financing in a setting where a monopolist manufacturer finances the entry of a retailer. The main results from this analysis are also valid if we reverse the setting such that a downstream monopolist finances the entry of a manufacturer.

When a monopolist retailer lends to a manufacturer to facilitate upstream competition, the same issues as previously discussed will arise, namely the financier will have too strong incentives to lend to the borrower, even if the borrower reports low profits in the first period. Thus, termination after period one will not be a credible threat. Furthermore, the result of Corollary 1 is valid for certain parameter values, that is intensified competition between manufacturer A's and B's products increases the sum of manufacturer and retailer profits, weakening the retailer's possibility to extract surplus from the manufacturer.

These results can be seen as directly relevant for analyzing private label brands. Our model of how a retailer can gain from adding a second supplier has clear parallels to supermarkets' use of private label products. We can interpret our model as one where the retailer has an existing relationship with a brand name manufacturer and then wishes to add a private label manufacturer. By lending to the private label manufacturer to assist with the manufacturer's fixed costs, the retailer may gain much. Competition between the manufacturers will allow the retailer to capture more of the surplus. Furthermore, lending money serves as a signaling device to the potential private label manufacturer, allowing the manufacturer to assess the profitability of the deal. The lending of money entails the retailer sharing in the risks of the manufacturer. This may increase the number of potential manufacturers, thus lowering costs.

3.7 Concluding discussion

We have presented a model of strategic supply chain financing, where an upstream firm lends to a downstream firm, here labeled manufacturer and retailer. The contracting occurs under uncertainty about the retailer's performance, here modeled as a shock to fixed cost. The retailer is cash constrained and the manufacturer may finance the retailer's fixed costs.

We have shown that the manufacturer's strategic considerations have important implications for financial contracting. Our model of the basic financial contracting is based on the seminal work of Bolton and Scharfstein (1990). We have shown that the termination threat suggested there is no longer always ex ante optimal when incorporating the manufacturer's strategic considerations, and even when the threat would seem optimal, it is not time consistent. While we have mainly discussed the issue in terms of the manufacturer lending to the retailer, qualitatively similar results apply where a retailer lends to a manufacturer. This setup has direct relevance for private label products. Nevertheless, our concluding discussion focuses on our benchmark model of a manufacturer lending to a retailer.

The retailer may hold up the manufacturer through opportunistic behavior, by reporting high costs, since the manufacturer would forgo positive profits by terminating the retailer. This possibility of hold up stems from the manufacturer's investment in the relationship with the retailer.

The risk of opportunistic behavior is affected by the increase in manufacturer profits from having retailer B signed up, as well as by retailer verifiable profit. The larger the increase in manufacturer profits from having retailer B, the costlier it is for the manufacturer to discontinue the retailer. On the other hand, the lower the verifiable retail profit is, the more profitable it is for the retailer to opportunistically report high costs.

If most of the (verifiable) profits are realized at the manufacturer level, this will facilitate the hold up problem. Then the manufacturer has much to lose, while the retailer has little to gain. This is the case in our main analysis, as the manufacturer is a monopolist, while the retailers are oligopolists.

A corollary of the hold up problem, and the manufacturer's inability to refrain from financing the retailer is that having the manufacturer finance the retailer increases the likelihood that there will be a retailer. The manufacturer will finance the retailer in situations where an external financier would not.

While our main analysis focused on the case of a monopolist manufacturer and a duopoly of retailers, the hold up problem will be present as long as the manufacturer's incremental profits from adding the retailer exceed the retailer's own gross profits.

Our result that the manufacturer has more incentives to lend than an external investor, due to the externality of the investment decision on wholesale profits, is similar to the results of the trade credit literature. This has not previously been analyzed in the Bolton and Scharfstein (1990) framework. Furthermore, whereas the trade credit literature typically has assumed that the manufacturer is less prone to opportunistic behavior by the retailer than an

external financier, due to lending being in-kind and/or the manufacturer having an informational advantage (cf. Petersen and Rajan (1997); Burkart and Ellingsen (2004)), we show that the manufacturer lending cash may be more prone to opportunistic behavior than an external financier would be.

Additionally, the excessive incentives also help explain why we observe manufacturers financing retailer activities, and not only financing retailers' acquisition of inventory. More generally, we help explain the existence of supply chain financing. Observing Amazon lending to sellers on its platform (Ecommerce-Bytes, 2012) is compatible with our findings. By adding more sellers Amazon can capture more surplus. Furthermore, our result that the incentive to add more sellers can be stronger under intense competition, combined with the fact that companies in highly competitive industries face a higher cost of bank debt (Valta, 2012) provides a further explanation why Amazon engages in this sort of financing. Conversely, observing Starbucks lending to suppliers to increase coffee production (Financial Times, 2012b) is also compatible with our findings.

Additionally, there are important policy implications from the manufacturer's strategic incentives to continue to fund the retailer in a situation where external financiers would not. The fact that the manufacturer may not want to terminate the retailer in case of a report of high costs points to welfare gains from the manufacturer acting as a financier, compared to retailers relying on external finance. These welfare gains follow from the continued availability of lower retail prices and more variety thanks to downstream competition. This would suggest that separation of banking and commerce, the subject of a long, still ongoing debate in the US,[13] has some significant drawbacks. This is contrary to the findings of the paper on strategic use of trade credit by Lehar et al. (2012), who suggest that separation of banking and commerce is supported by the potential for trade credit to act as a collusive device.

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[13] Cf. the press release by the National Association of Industrial Bankers worrying that policymakers want to "regulate ILCs (Industrial loan companies) to the point of extinction" http://www.industrialbankers.org/wp-content/uploads/2011/05/Time-to-Take-Shackles-off-Industrial-Banks-May-16-2011-_News-Release_.pdf, accessed September 13, 2012. This in a context whereby the Dodd-Frank act instructed the Government Accountability Office to evaluate the consequences of repealing the exemptions of ILCs from the limitations of the Bank holding company act, which "restricts the type of activities that these companies may conduct." (Government Accountability Office, 2012)

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3.A Appendix

In the first two sections of this appendix we show how to derive the profits used in section 3.3 to calculate $\Delta\pi_m$.

3.A.1 Equilibrium under retail market monopoly

When retailer A acts as a monopolist, selling manufacturer M's products, the unfolding of events is as follows:

1. The manufacturer sets wholesale price w.
2. The retailer sets retail price p_A and demand is realized.

Stage 2: Retailer sets prices.

Solving by backwards induction, A sets retail price p_A to maximize profits, given by (8), reproduced here for convenience: $\pi_A = (p_A - w) D_A - F - z$. Demand, D_A is given by (7), with $\gamma = 0$ under monopoly. Thus p_A is given by the first order condition $\frac{\partial \pi_A}{\partial p_A} = (p_A - w) \frac{\partial D_A}{\partial p_A} + D_A = 0$. With the given functional form this yields the retail price

$$p_A^{mono}(w) = \frac{\alpha + w}{2}. \tag{38}$$

Substituting p_A^{mono} from (38) into (7) yields the demand:

$$D_A^{mono}(w) = \frac{\alpha - w}{2\beta}. \tag{39}$$

Stage 1: The manufacturer sets wholesale prices.

The manufacturer, here not financing any retailers, faces the following problem: $\max_w \pi_m = (w - m) D_A$. The wholesale price is given by the first order condition $\frac{\partial \pi_m}{\partial w} = (w - m) \frac{\partial D_A}{\partial w} + D_A = 0$. This yields the wholesale price:

$$w^{mono} = \frac{\alpha + m}{2}. \tag{40}$$

Substituting (40) into the expressions for retail price (38) and demand (7) gives the following equilibrium price and quantity:

$$p_A^{mono} = \frac{3\alpha + m}{4} \tag{41}$$

$$D_A^{mono} = \frac{\alpha - m}{4\beta}. \tag{42}$$

Substituting the above equations, (40), (41) and (42) into the profit functions allows us to finally calculate the profits of the retailer and the manufacturer. The profits are given by:

$$\pi_A^{mono} = \frac{(\alpha - m)^2}{16\beta} - F - z_k \tag{43}$$

$$\pi_m^{mono} = \frac{(\alpha - m)^2}{8\beta}. \tag{44}$$

3.A.2 Equilibrium under retail market duopoly

Under retail duopoly, both retailer A and B are active. In this section we abstract away the financing aspect and focus on the product market.

The unfolding of events is as follows:

1. The manufacturer sets wholesale price w.
2. The retailers simultaneously set retail prices p_i and demand is realized.

Stage 2: Retailers set prices.

Solving by backwards induction, retailers set prices to maximize profits, given by (8). The retail price of retailer i is thus given by the first order condition $\frac{\partial \pi_i}{\partial p_i} = (p_i - w) \frac{\partial D_i}{\partial p_i} + D_i = 0$. The substitutability parameter γ is non-negative under competition. Retailer i's price is given by the reaction function:

$$p_i = \frac{w}{2} + \frac{(\beta - \gamma)\alpha + \gamma p_j}{2\beta}, i \neq j. \tag{45}$$

The reaction function of j is similar, and substituting that into (45) yields the simultaneously set retail prices in terms of wholesale price and parameters:

$$p_A = p_B = p^{duo}(w) = \frac{(\beta - \gamma)\alpha + \beta w}{2\beta - \gamma}. \tag{46}$$

The identical retail prices mean that the demand facing each of the retailer separately, given by (7) boils down to

$$D_i^{duo} = \frac{\alpha - p^{duo}}{\beta + \gamma}. \tag{47}$$

Stage 1: The manufacturer sets wholesale prices.

In the first stage, the manufacturer sets wholesale price to maximize profits, keeping in mind the effect of wholesale prices on retail prices, and thus on demand. Ignoring the manufacturer's need to finance B for the moment, the manufacturer's problem is $\max_w \pi_m = (w - m)(D_A + D_B)$. With A and B charging the same price, they will face the same demand, this can be rewritten as $\max_w \pi_m = (w - m) \times 2D_i$. Wholesale price is then given by the first order condition $\frac{\partial \pi_m}{\partial w} = (w - m) \times 2\frac{\partial D_i}{\partial w} + 2D_i = 0$. This yields the wholesale price:

$$w = \frac{\alpha + m}{2}. \tag{48}$$

Equilibrium prices and quantity Substituting (48) into the retail price expression (46) and substituting the result of this into the simplified demand expression (47) gives equilibrium price and quantity:

$$p^{duo} = \frac{(3\beta - 2\gamma)\alpha + \beta m}{2(2\beta - \gamma)} \tag{49}$$

$$D_i^{duo} = \frac{\beta(\alpha - m)}{2(2\beta - \gamma)(\beta + \gamma)}. \tag{50}$$

It is worth noting that D_i is the demand of one retailer. Thus the demand facing the manufacturer is two times this.

Substituting the above equations, (48), (49) and (50) into the profit functions gives the profits of the retailers and the manufacturer:

$$\pi_i^{duo} = \frac{\beta(\beta - \gamma)(\alpha - m)^2}{4(2\beta - \gamma)^2(\beta + \gamma)} - F - z^k \tag{51}$$

$$\pi_m^{duo} = \frac{\beta(\alpha - m)^2}{2(2\beta - \gamma)(\beta + \gamma)}. \tag{52}$$

The retailer's variable profit is given by

$$\pi_i^{var} = \frac{\beta(\beta - \gamma)(\alpha - m)^2}{4(2\beta - \gamma)^2(\beta + \gamma)} \tag{53}$$

3.A.3 The incentive compatibility constraint

The complementarity incentive compatibility constraint is given by

$$\pi_B^{var} - z_1 - R_1 + \beta_1 \left(\bar{\pi}_B - R^1\right) \geq \pi_B^{var} - z_1 - R_2 + \beta_2 \left(\bar{\pi}_B - R^2\right). \qquad (54)$$

Substituting the expression for R_2 in (15) derived from the IC constraint (12) gives the following expression:

$$\pi_B^{var} - z_1 - R_1 + \beta_1 \left(\bar{\pi}_B - R^1\right) \geq \pi_B^{var} - z_1 - R_1 + \beta_1 \left(\bar{\pi}_B - R^1\right).$$

The left hand side and the right hand side are identical, and thus the constraint is not violated.

4 ESSAY 3: MARKET SHARE REQUIREMENTS AND BUYER GROUPS: A BARGAINING POWER APPROACH[13]

Abstract

We model the use of market share requirements in buyer alliances as a device for rent shifting. By requiring its members to buy a certain share of their products from the buyer alliance, the alliance can strengthen the members' bargaining power against local producers. The result of the requirement is that a positive but limited number of local products are distributed, and retailers capture more of the incremental surplus. Welfare is better than under exclusive dealing, but lower than is the case with no vertical restraints. The results are derived in a setting of a setting of food retailing, an industry where concerns over buyer power have been raised across Europe and the US.

JEL Classification: D21, D43, L13, L42, L81.

Keywords: Vertical restraints, loyalty discounts, market share contracts, bargaining, buyer groups, retailing.

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4.1 Introduction

Buyer power and marketing practices in food retailing have caused concern in many economies lately. The Federal Trade Commission (2001, 2003) reports on marketing practices in the US in general, airing concerns about the potential abuse of buyers' monopsony power. Reports by the OECD (1998, 2008) highlight issues raised in a number of countries. Dobson Consulting (1999) is a detailed study for the European Commission on buyer power in EU food retailing. Björkroth et al. (2012) investigate retailer-producer relationships in Finland, again focusing on issues of buyer power and possible abuse of market power. Office of Fair Trading (2007) is a detailed study of the buyer power of buyer alliances in the UK. Currently, legislation in the UK is being amended to give the Groceries Code Adjudicator the power to fine retailers who "abuse their suppliers" (Telegraph, 2012). The German competition authority is conducting an inquiry into buyer power of retailers (Die Welt, 2013). In Finland, the competition law is being amended as a result of concerns about buyer power (Finnish Government, 2012).

In many countries, grocery stores are operated by independent entrepreneurs. These independent retailers often form buyer groups to coordinate their procurement operations. Examples of buyer groups in the food sector include the Independent Grocers Alliance (IGA) in the US, Kesko in Finland, ICA in Sweden.

One rationale for forming such buyer groups is to increase the bargaining power of the members in relation to suppliers. In this paper we look at one particular tool that can be used to increase bargaining power. We look at the effect of market share requirements in contracts between independent retailers and their wholesaler, acting as a buyer alliance. These requirements stipulate that the retailer must purchase a certain share of the products it sells from the buyer alliance, or from producers named by the alliance. Alternatively, they may require a retailer to carry a range of products chosen by the wholesaler, amounting to a certain share of total products carried. The crucial point is that the requirement restricts the retailers ability to procure products directly from suppliers. The requirement may be an absolute requirement, i.e. if the retailer wants to purchase from the alliance, he must obey it. Alternatively, the requirement can also take the form of conditional rebates, e.g. loyalty rebates such that the retailer receives a rebate conditional on reaching a certain market share for the buyer alliance. These conditional rebates can be substantial.

We model the bargaining between suppliers, independent retailers and their buyer alliance in the following way. In the absence of the alliance, each individual retailer negotiates with suppliers directly. In this setting, the individual retailer's bargaining power may be limited, and thus suppliers may be able to capture most of the surplus. With the buyer alliance, bargaining with suppliers can be transferred from the retailers to the alliance. Dana (2012) shows that this may increase the retailers' bargaining power over suppliers, as the suppliers now have to deal with only one party, rather than many small ones.

While transferring all contracting to the buyer alliance can be profitable for

the retailers, this incurs some costs. If the buyer alliance does not carry all the products a retailer might want to sell, then allowing the retailer to deal with some suppliers directly can be beneficial. Thus the contract between the retailer and the buyer alliance can include a market share requirement, allowing the retailer to negotiate over the supply of a limited amount of products with producers directly. A specific example is provided by the growing trend of *local food*, which appeals to the preference of some consumers for locally produced food.[1] Allowing a retailer wanting to sell local food to deal directly with local producers may in such cases be welfare improving.

We show that by letting the retailer negotiate directly with the producers for a share of the overall products carried, more surplus may be created. The direct negotiations may result in the retailer carrying *local products* (analogous to local food), in addition to *generic* (non-local) *products*. If supply of local products is constrained compared to the local demand, then without restrictions on the retailer's ability to acquire local products, the suppliers may be able to extract most of the incremental profit of the local products. By imposing a requirement on the retailer to purchase a certain number of products from the buyer alliance (or from specified suppliers), the retailers ability to purchase local products can be constrained. The constraint, while imposed by the wholesaler, improves the retailers' bargaining position, by offering a credible commitment device to constrain their purchases. An individual retailer trying to commit himself to the same kind of constraint without a contract would have incentives to renege on the commitment, similar to a cartel member's incentives to cheat on the cartel. The wholesaler can co-ordinate the actions of the individual retailers, and can thus ensure that the retailers stick to the collectively desirable outcome.[2]

That market share requirements are indeed used in retailer-buyer alliance contracts is well known in the business press (cf. Kauppalehti, 2004). However, the use of market share requirements in a buyer alliance setting has not been analyzed in the academic literature before. Our analysis of market share requirements in this setting, and its effects on surplus creation and sharing constitute the contribution of this paper. The previously mentioned numerous official inquiries across countries into the possible abuse of buyer power highlight the importance of the issue.

4.1.1 Previous literature

On a general level, our paper draws on the industrial organization literature on vertical relationships and vertical restraints. Telser (1960) is an early entry discussing why an upstream firm might want to use vertical restraints that limit the freedom of downstream firms, in order to limit downstream competition, thus maximizing joint profits. Fershtman and Judd (1987) laid the foundations

[1] Martinez et al. (2010) provide a detailed description of the local food phenomena in the US. In Finland the government's official policy is to increase the production of local food and increase its market share (Finnish Government, 2011).

[2] The outcome is in the retailers' collective interest, but not in the interest of producers and consumers.

for the strategic delegation literature, showing that the delegation of decisions to agents can increase profits, if duopolists compete á la differentiated Bertrand, while profits decrease under Cournot competition. Fershtman et al. (1991) on the other hand showed how even the collusive outcome could be achieved under delegation and Cournot competition. While Fershtman and Judd (1987) and Fershtman et al. (1991) showed how incentives and delegation in general can affect competition, Bonanno and Vickers (1988) extended the idea explicitly into the realm of vertical relationships, showing that two duopolist manufacturers have incentives to commit to vertical separation, i.e. having retailers rather than selling directly. With wholesale prices above cost and a fixed fee, competition is softened.

In addition to efficiency gains from vertical restraints, the literature thus also identifies practices that may be collusive or exclusive in nature. Shaffer (1991) demonstrates how strategic delegation can be used in vertical relationships to soften downstream competition, when strong retailers can extract slotting fees from competitive suppliers. Secrieru (2006) is a recent review of this literature. Two other recent survey articles, Bresnahan and Levin (2012) and Lafontaine and Slade (2007) summarize the literature on vertical integration looking at both industrial organization aspects, as well as aspects related to the theory of the firm.

More specifically, our paper analyzes market share contracts, thus contributing to the literature on contracts which condition terms of trade on the buyer achieving a certain market share for the supplier's products. The literature on market share contracts is closely related to the literature on exclusive dealing. The market share contract can be viewed as a generalization of the exclusive dealing contract, such that the market share contract can condition on market shares of less than 100%. Marvel (1982) is an early entry, explaining how exclusive dealing can be used by a manufacturer to ensure that his investments in demand generating activities benefiting the retailer also benefit the manufacturer. In the absence of exclusive dealing, the retailer might divert the demand to a competing product, robbing the manufacturer of the returns on his investment. The same motivation for exclusive dealing is also explored in Besanko and Perry (1993).

While exclusive dealing and market share contracts have been partially explained with the potentially pro-competitive argument of inducing investment in the relationship, there are also other views. Bernheim and Whinston (1998), Rasmusen et al. (1991), Segal and Whinston (2000), Fumagalli and Motta (2006), Simpson and Wickelgren (2007) explore the potential for profitable foreclosure using exclusive dealing contracts, while Chen and Shaffer (2011) show how this may be achieved using market share contracts.

A third explanation for exclusive dealing or market share contracts involves rent shifting. This line of argument is closest to our case.

Mathewson and Winter (1987) is a seminal paper, showing that a small monopolist retailer receiving offers from competing manufacturers may be able to increase his profits by allowing for exclusive dealing clauses. Allowing exclusive dealing leads to producers competing for the privilege of supplying the retailer,

thus enabling the retailer to capture a greater share of profits. This theme is similar to that explored in our paper, but in our case the retailer increases competition between producers by limiting the share he can buy from them directly, and this affects the bargaining between seller and buyer. Mathewson and Winter (1987) on the other hand have the sellers make take it or leave it offers.

While Mathewson and Winter (1987) show how a buyer can shift rents to itself from suppliers, there is also a strand of the literature where rents are shifted by the contracting parties from suppliers not party to the contract. In these cases, the supplier that enters an agreement of exclusive dealing or a market share contract with a buyer will actually want there to be other suppliers, as there will not be any rents to shift otherwise, as pointed out in Marx and Shaffer (2008).

Aghion and Bolton (1987) is an example of the above. They show how exclusive dealing can be used by a coalition of an incumbent seller and a buyer to extract profits from a potential entrant. Here the incumbent and seller contract before a potential entrant enters. By committing the buyer to pay the incumbent damages in case of breach of contract, the coalition may be able to extract profits from the entrant. Marx and Shaffer (2008) are similar in spirit in that they model the contracting between a seller and a buyer as a device for extracting surplus from a second seller, who negotiates later with the buyer. Where Aghion and Bolton (1987) use an exclusive dealing contract to shift rents, Marx and Shaffer (2008) also allow for market share contracts. Marx and Shaffer (2008) show that a seller facing a competitor and a buyer may use market share contracts to shift rents from his competitor. We share the theme of contracting parties extracting profits from agents not party to the agreement with Aghion and Bolton (1987) and Marx and Shaffer (2008), even though it occurs in a rather different setup in our case. Further, Aghion and Bolton (1987) and Marx and Shaffer (2008) view the contracts as affecting bargaining power only indirectly, through their reduction of the buyer's gain from trade with other parties, while in our case the contract affects bargaining power directly.

Mills (2010) shows how conditioning wholesale price on market share can induce the retailer to provide extra effort, depending on the retailer's type.0Majumdar and Shaffer (2009) show that a dominant supplier facing a competitive fringe may have an incentive to condition payments on the market share the retailer gives its products when demand is uncertain.

The above mentioned papers on market share contracts consider the contracting between a supplier and a buyer (often a retailer). Our paper is different from these papers in that we consider market share contracts between a buyer alliance (wholesaler) and an individual buyer (retailer), such that the contract maximizes the joint profit of the contracting parties. This is done by squeezing the suppliers, whose products are sold by the retailer.

By incorporating a buyer alliance in our model, we also draw on, and contribute to the literature on buyer alliances. Mathewson and Winter (1997) is an early contribution, focusing on the externalities alliance members may impose

on buyers not part of the alliance. Dana (2012)[3] is an important contribution, showing how horizontally heterogeneous buyers facing horizontally differentiated sellers may benefit by committing to buy jointly from one seller through a buyer alliance. By acting as a single alliance, the buyers appear more indifferent with respect to which seller to choose, thus encouraging more competitive behavior by the sellers. We share the idea that a buyer alliance can be used to increase competition between suppliers. However, whereas in Dana (2012) the members of the alliance commit to source 100% of their requirements from the alliance, we allow for smaller market share requirements. Further, and more importantly, Dana (2012) has the alliance committing to buy exclusively from one supplier. This requirement is absent from our model. Also, Dana (2012) assumes that the products bought through the alliance are horizontally differentiated, but related. In our model the products may be identical, differentiated or independent. Unlike us, in Dana (2012) the sellers make take it or leave it offers, whereas we have bargaining over terms. Thus our approach is quite different. Chen and Li (2013) analyze when it is optimal for a buyer alliance to commit to buy exclusively from one supplier, allowing for the preferences of the buyers to remain private knowledge.

A crucial difference between our approach and that of Dana (2012) and Chen and Li (2013) is the role played by the buyer alliance. In Dana (2012) and Chen and Li (2013) the alliance mainly acts as a device to coordinate agreements between buyers and producers, possibly imposing the requirement that the buyers buy exclusively from the producer. In contrast, our buyer alliance is a wholesaler, and the market share requirement we analyze is a requirement that the buyers buy at least a certain share from the wholesaler, who then may buy from the suppliers in whatever way feasible. We thus focus more on the internal contracts of the buyer alliance, and its effects on members' dealing with outside suppliers, where Dana (2012) and Chen and Li (2013) deal with external contracts, that is contracts between the alliance and suppliers.

In a manner similar to Dana (2012) and Chen and Li (2013), Marvel and Yang (2008) analyze how buyers by grouping together can dilute their differences and thus induce more competitive behavior by sellers. Marvel and Yang (2008) show that by grouping together, buyers induce oligopolistic sellers to compete in non-linear pricing, thus competing more fiercely than under linear pricing.

Foros and Jarle Kind (2008) analyze slotting allowances in the context of buyer alliances, noting that buyer alliances may make increased wholesale prices more observable. Foros and Jarle Kind (2008) thus show that the buyer alliance can foster the kind of observability of wholesale contracts that is an assumption in the model of Shaffer (1991). When wholesale prices are observable, an increase in wholesale prices can soften competition. The producers' increased profits may then be rebated back to the retailers in the form of slotting allowances.

Doyle and Han (2012) develop the ideas of Foros and Jarle Kind (2008) further, by analyzing the stability of the buyer alliance in a dynamic setting. Doyle and Han (2012) allow for minimum purchase clauses or exclusive dealing

[3] And preceding working papers, e.g. Dana (2004).

as an alternative, but the focus of their analysis is still on the buyer alliance as a device for facilitating downstream collusion, rather than the rent shifting theme of our paper.

Related to the articles on buyer alliances, Inderst and Shaffer (2007) show that horizontally differentiated retailers may have an incentive to merge in order to obtain better terms from differentiated suppliers. This happens as the merged entity will show less of a preference for either supplier, and by committing to exclusive dealing the merged entity induces more competition among suppliers. Inderst and Shaffer (2007) show that the weaker the retailer's bargaining power against the suppliers is, the more profitable it is for the retailer to adopt exclusive dealing.

While many of the above cited papers feature the buyer committing to exclusive dealing or to purchase a significant share from one supplier as a device to induce more competition among suppliers of substitutable goods,[4] Marx and Shaffer (2010) has a slightly different approach to the issue. In Marx and Shaffer (2010) the retailer may limit shelf space directly, thus creating scarcity of shelf space. This scarcity induces producers of unrelated products to compete with each other for the scarce shelf space. The competition between producers allows the retailer to capture more of the surplus. We explore the same theme in this paper, as the market share requirement constrains how many products the retailer can purchase directly from the producer. However, where Marx and Shaffer (2010) have bargaining taking place directly between retailer and supplier, we add the buyer alliance to the picture. The buyer alliance affects the bargaining, as it affects the outside options of both the retailer and the supplier. Further, whereas Marx and Shaffer (2010) have a single market (single retailer) bargaining situation, our paper has bargaining in many markets (many retailers). This difference introduces upstream competition between the retailers in our model, meaning that the retailers do not have unilateral incentives to reduce capacity.

In the introduction we presented a number of official reports into buyer power in food retailing. In addition to these policy oriented contributions, there is also a number of academic articles describing the overarching theme, prominent among these are Dobson and Waterson (1999), Dobson et al. (2001, 2003).

Methodologically, we model the bargaining between the retailer and the producer as a Nash-bargaining game. Similarly to Stenbacka and Tombak (2012), we look at how a party by committing to certain actions can increase his bargaining power. Stenbacka and Tombak (2012) study this in the context of outsourcing, where a firm can increase its bargaining power against unions by outsourcing a higher share of the production. De Fontenay and Gans (2008) also study bargaining in conjunction with outsourcing, noting that "applications of bargaining theory to strategy and supply chain management are in their infancy."

In modeling the effect of the market share contract on the bargaining power

[4]These substitutes are not necessarily perfect substitutes, but nevertheless substitutable to some degree.

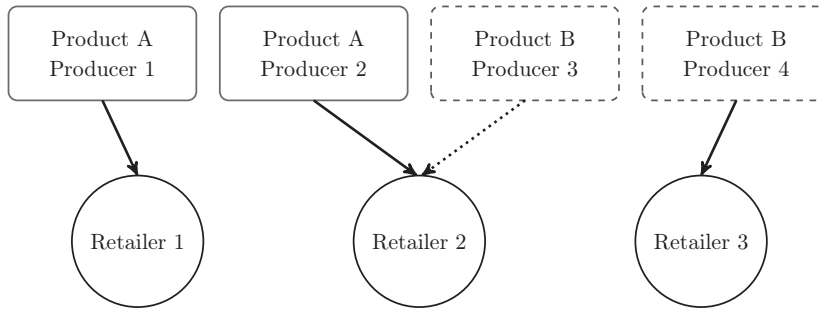

Figure 3: A stylized model

in a Nash-bargaining setting, we differ from the previously presented literature on vertical restraints. There bargaining power in general has been taken as given, and the restraints have mainly had an effect on the outside options (cf. Marx and Shaffer, 2008), or the surplus to be split (cf. Marx and Shaffer, 2010) in so far as bargaining approaches have been used. We allow the actions to directly affect the bargaining power.

4.1.2 Structure of the paper

The structure of the paper is as follows. Section 4.2 gives a simple example to develop intuition, section 4.3 presents the model that is then analyzed in sections 4.4 and 4.5. Section 4.6 concludes.

4.2 A simple example

The general idea of our paper can be demonstrated with the following example, illustrated in figure 3.

Consider a local procurement market consisting of three monopolist retailers,[5] a wholesaler, two producers of product A, and two producers of product B. The demand for products A and B is independent. Each individual retailer can purchase each of the product either directly from the producer, or they can purchase the product from the wholesaler. A product purchased from the producer is termed a *local product,* while a product bought from the wholesaler is termed a *generic product.* Retailers have unit demand, and each producer is capacity-constrained so that they produce one unit. A *local product* generates a combined retailer and producer profit of Π_l and a generic product produces a smaller profit of Π_g.

Without a market share requirement, each of the three retailers would want to purchase both product A and product B as local products. However, with

[5]The downstream markets the retailers operate in are distinct, e.g. due to distance keeping end customers from considering other retailers than the local retailer. While the retailers are local monopolists in the downstream market, in the upstream market they are small, i.e. monopoly does not imply monopsony. This modeling of the retailers' positions in the up- and downstream markets is similar to for example Mathewson and Winter (1987), Mills (2010).

three retailers wanting to buy one unit each, while there are only two units of each product supplied, the retailers will compete with each other for the scarce supply. This is illustrated in figure 3, where without loss of generality, retailer 1 and 2 buy product A from producers 1 and 2 respectively, while retailer 2 and 3 buy product B from producers 3 and 4. Retailer 2 is the only one to carry both products here, but retailers 1 and 3 would like to do it as well. All producers get their products distributed. In the limit, if the producers could make take-it-or-leave-it offers, each of the producers would make an offer which made the retailer indifferent between buying the product as a local or generic product. The producers would then capture the entire incremental surplus arising from selling the product as a local product instead of a generic one.

Now consider the situation where a market share requirement is in place, requiring the retailer to purchase a certain share of the products he carries from the wholesaler. The requirement could constrain the retailers such that each retailer can buy at most one local product, i.e. they have to choose between carrying product A or B. The previously independent products are now homogeneous in the eyes of the retailer. Each product generates the same surplus, Π_l, and the choice to carry product A is at the same time a choice not to carry product B. Thus the market is now characterized by four producers of local products, and three retailers. Now the producers have to compete for the privilege to supply a retailer. With the producers making take-it-or-leave-it offers, the wholesale price is driven down such that retailers capture the entire incremental surplus. In terms of figure 3, producer 3 will not get its product distributed (the dotted arrow illustrates that he only delivers to retailer 2 absent the market share agreement). As no producer wants to be in the situation of producer 3, they will undercut each other until all incremental surplus is transferred to the retailers.

It is worth noting that without the market share requirement, no single retailer would have an incentive to unilaterally constrain themselves to only carry one product. With the other two retailers still carrying two products each, supply (four units) would still exceed demand (five units). The unilateral choice to carry one product would thus not increase the retailer's profits. However, if all retailers can agree to purchase only one local product, they can collectively improve their profits. The market share requirement is one device for doing this.

While the market share requirement provides a way for retailers to collectively benefit from carrying fewer local products, one might be concerned about whether this is an equilibrium, i.e. whether an individual retailer would have an incentive to deviate from the agreement and purchase more local products than allowed. This could indeed be the case. However, given that the requirement is part of the agreement between the retailer and the wholesaler, deviation might not be desirable. If the retailer-wholesaler relationship is valuable for the retailer, then the threat of termination, or reduced discounts can add to the incentives to stick to the agreement. Furthermore, if the retailers interact repeatedly, then the repeated interaction can be enough to sustain the agreement.

This section has shown a simple version of our model, giving the basic in-

tuition behind our general model. In our general model we assume that the retailer and producer negotiate in order to split the profit, and that bargaining power is affected by the supply of a particular product and the demand for the product, with or without the market share requirement. We then model how the market share requirement is set optimally, so as to trade off the loss in profit from carrying fewer products, against the increase in profit from grabbing a larger share of profit from any given product.

4.3 A general model

Having demonstrated the general idea of the paper with the help of a simple example, we now turn to a more general model for analyzing market share contracts.

Consider a market $\mathcal{A}$, consisting of a number of areas. Each area $a \in \mathcal{A}$ has R^a number of retailers. A fraction λ of all retailers are big, while $1-\lambda$ are small. Each retailer $r \in \{0, 1, ..., R^a\}$ acts as a local monopolist, i.e. they are sufficiently far away from each other to serve distinctive groups of customers. In each area, J^a number of different local products are produced (e.g. strawberries and tomatoes). For each product $j \in \{0, 1, ..., J^a\}$, there is M^a number of producers. The total number of producer-product pairs in an area is thus given by $J^a M^a$.

Retailers belong to a buyer group, that is they purchase centrally from a wholesaler.[6] Each individual retailer decides on what products to sell (and hence buy), maximizing the sum of own profits and wholesaler profits.[7]

Some consumers have a preference for local products, resulting in a higher willingness to pay for the local product. A local product is characterized as a product being clearly identified as being produced in the same area as the consumer. A local product j is sold by an individual producer i to a local retailer r.

In addition to local products, there are generic products. A generic product is any product not satisfying the full list of distinctive features of a local product. A generic product is bought by the retailer from the wholesaler. The wholesaler may have bought the product from a producer from the same area as the retailer, but it may also be bought from other areas, or from outside market $\mathcal{A}$.

Producers are capacity constrained, such that they can produce one unit of each product j they produce. As an alternative to selling the products to a

[6] We do not model the formation of a buyer group, but take it as given. In the words of Chen and Li (2013): "the focus on our research is on the optimal purchasing strategy of a buyer group instead of the formation of the group."

[7] The assumption that the retailer maximizes the sum of own and wholesaler profits can be given many interpretations. One is joint ownership, i.e. the wholesaler owning the retailer, giving the retailer appropriate incentives, or the retailer owning the wholesaler. The latter would be relevant for the cases of ICA in Sweden and Kesko in Finland, where federations of retailers are major owners of the wholesalers (Hakon Invest 2013, Kauppalehti 2012). Another justification can be that either party can extract the profits from the other through the use of two-part tariffs. If the wholesaler for example owns the retailer's premises, then the wholesaler can extract the profits from the retailers through the rent for the premises.

retailer, the producers may sell the products to the wholesaler.

Each small retailer has unit demand for each of the J^a products, that is they will buy either nothing or one unit of product j. Each big retailer has demand for $\kappa \geq 1$ units of each product j, that is they will buy either κ or zero units of it. In addition to these products, each small retailer buys X^S amount of outside goods from the wholesaler. For the big retailers the number of outside goods is X^B. The outside goods are independent of the J^a potentially local products. Z^B and Z^S gives the number of goods actually bought locally by the big and small retailers, while $J^a - Z^B$ and $J^a - Z^S$ are bought through the wholesaler.

A product sold as a local product generates total producer surplus (the sum of producer, wholesaler, and retailer profit) denoted by Π_l. A generic product generates total producer surplus of Π_g. As we assume that some consumers value the local product more highly than the generic product, we have $\Pi_l > \Pi_g$. Thus the social optimum would be a situation where each retailer would sell all J^a products as local products (provided that there is enough supply).

The wholesaler and the retailers may agree on a vertical restraint in the form of a market share requirement. A market share requirement stipulates that as a condition of buying from the wholesaler, a retailer must purchase at least a share $\sigma \in [0, 1]$ of all the products it sells from the wholesaler, leaving the retailer free to buy directly from producers the remaining $1 - \sigma$. Alternatively, the requirement may also be such that significant loyalty rebates, or marketing support or other benefits are conditional on achieving a market share of σ, such that not receiving the conditional benefits is prohibitively expensive. The requirement is set so as to maximize the profits of the retailer-wholesaler coalition.

Given the market share requirement, retailers and producers bargain over a supply contract, whereby the producer agrees to supply the retailer a local product. If the producer and retailer fail to agree, the producer may then sell the product to the wholesaler, who can sell the product on to retailers as a generic product.[8]

When an individual retailer bargains with a producer, the retailer's bargaining power is given by $\beta_l \in [0, 1]$, which is a function of the aggregate supply and aggregate demand of the product, while the producer's bargaining power is given by $1 - \beta_l$. Specifically, β_l is given by

$$\beta_l = \max\left\{1 - \frac{b}{\tilde{b}}, 0\right\}, \tag{1}$$

where $\tilde{b}$ is the ratio of supply over demand:

$$\tilde{b} \equiv \frac{M^a}{R^a\left(1 - \lambda + \lambda\kappa\right)}.$$

Supply is here given by the total number of producers of product j, M^a, each producing one unit. Demand is given by the number of retailers, R^a, of whom a fraction $1 - \lambda$ demand one unit, and a fraction λ demand κ units of product j.

[8] Björkroth et al. (2013) report that many primary producers have few alternatives to the retail channel.

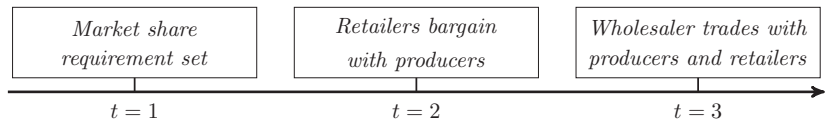

Figure 4: Timeline

The retailer's bargaining power, β_l is increasing in the supply of the product and decreasing in the demand for it. The sensitivity of bargaining power with respect to the ratio of supply and demand is given by the parameter b. The higher b is, the lower is the retailer's bargaining power for a given ratio of supply and demand, and the more is the bargaining power affected by a change in the ratio. If $b = \frac{6}{10}$, then if supply equals demand $\beta_l = \frac{4}{10}$. If $b = 1$, then if supply equals demand $\beta_l = 0$ and the producer has all the bargaining power. More generally, $\beta_l > 0$ whenever $b < \tilde{b}$.

The detailed timing of the game, illustrated in figure 4 is as follows.

1. The retailers and wholesaler set the market share requirement, such that a retailer wanting to purchase from the wholesaler has to purchase at least a share $\sigma \in [0, 1]$ of all the products it sells from the wholesaler. σ is set so as to maximize joint profits of the retailer-wholesaler coalition.

2. Each producer i bargains with a retailer r over the price of a local product j. This is illustrated in figure 5. If they agree, retailer r purchases the product from the producer, and sells it as a local product. Joint surplus is Π_l, split between the retailer-wholesaler coalition, who receives $\pi_l^{r,j}$ and the producer, who receives $\pi_l^{i,j}$.

3. If the producer and retailer do not agree, then the producer's outside option is to sell the product to the wholesaler, and the product becomes a generic good. The wholesaler can in addition buy non-local goods, which are perfect substitutes for the generic good, available in unlimited quantity. The non-local goods are also sold as generic goods. The retailer can buy product j from the wholesaler if he has not bought it from the producer. The product is sold by the retailer as a generic good. Joint surplus is Π_g, split between the retailer-wholesale coalition, who receives $\pi_g^{r,j}$ and the producer, who receives $\pi_g^{i,j}$.

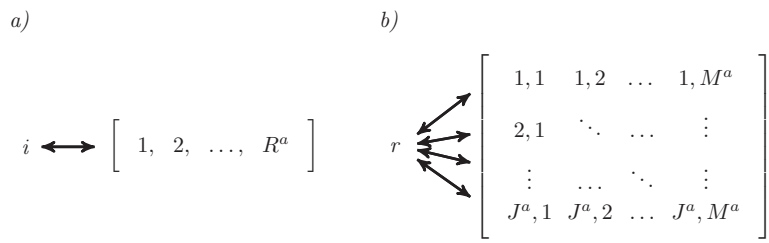

Figure 5: a) Producer i can bargain with one of the R^a retailers. b) Retailer r can bargain with one of the M^a producers of each of the J^a products. As long as there is enough supply, each retailer will bargain with J^a producers, absent the market share contract.

4.4 The bargaining game

In this section we present the result of the bargaining between the retailer-wholesaler coalition and producer over supply of a representative product j. In terms of our model, we present period 2 and 3 of the game, taking β_l as given. Solving the bargaining game by backward induction, we start with period 3.

4.4.1 Period 3 - Selling a generic good

If producer i selling product j has not agreed with a retailer in period 2, the producer sells the product to the wholesaler. This yields a surplus of Π_g, split between the producer, who receives $\pi_g^{i,j}$, and the retailer-wholesaler coalition, who receives $\pi_g^{r,j}$.

4.4.2 Period 2 - Selling a local good

If producer i selling product j approaches retailer r, they bargain over selling the product to r, thus enabling selling of the product as a local product, generating a total profit of Π_l. The bargaining problem is given by

$$\begin{aligned} \max_{\pi_l^r, \pi_l^{i,j}} \Omega_l^{ijr} &= \left(\pi_l^{r,j} - \pi_g^{r,j}\right)^{\beta_l^j} \left(\pi_l^{i,j} - \pi_g^{i,j}\right)^{\left(1-\beta_l^j\right)} \qquad (2) \\ st. \qquad & \pi_l^{r,j} + \pi_l^{i,j} = \Pi_l \end{aligned}$$

The outside options are given by $\pi_g^{r,j}$ and $\pi_g^{i,j}$, that is by the outcomes of stage 3. This results in the following Nash bargaining solution:

$$\pi_l^{i,j} = (1-\beta_l)\left(\Pi_l - \Pi_g\right) + \pi_g^{i,j} \qquad (3)$$

$$\pi_l^{r,j} = \beta_l\left(\Pi_l - \Pi_g\right) + \pi_g^{r,j} \qquad (4)$$

Each party gets his outside option, that is the profit they would earn should bargaining fail and the product would be sold as generic. In addition to this,

each party gets a share of $\Pi_l - \Pi_g$, the *local premium,* that is the increase in surplus that follows from selling the product as local instead of generic.

The producer's share of profit is declining in the wholesaler's bargaining power, while it is increasing in the own outside option. The reverse is true for the retailer.

If the retailer has all the bargaining power, $\beta_l = 1$, then the retailer captures the entire local premium. The producer's payoff is then given by his share of the surplus if bargaining reaches period 3.

Conversely, if the producer has all the bargaining power, $\beta_l = 0$, then the producer captures the entire local premium. The retailer only gets the surplus he would get in period 3.[9]

4.5 The impact of the market share contract

In this section we introduce a market share requirement in stage 1 of the game. The market share requirement is set so as to maximize the profits of the retailer-wholesaler coalition. We first study the outcome of the game absent the market share requirement, and then the outcome with the requirement.

Given the outcome of periods two and three, the profits of a small and a big retailer are respectively given by

$$\phi^S = Z^S \pi_l^{r,j} + \left(J^a - Z^S\right) \pi_g^{r,j} + X^S \pi_g^{r,j} \quad (5)$$

$$\phi^B = \kappa \left[Z^B \pi_l^{r,j} + \left(J^a - Z^B\right) \pi_g^{r,j} + X^B \pi_g^{r,j} \right]. \quad (6)$$

that is for the Z^S and Z^B products they sell as local, they make a profit of $\pi_l^{r,j}$ per unit. For the $J^a - Z^S$ and $J^a - Z^B$ products, which could have been local, but are bought as generic, they make a profit of $\pi_g^{r,j}$ per unit. For the outside goods, X^S, X^B they make the same profit of $\pi_g^{r,j}$ per unit. The retailers face the constraint $Z^S, Z^B \leq J^a$, as they can not buy more than J^a local products (one of each j for the small retailer, and κ of each j for the big retailer).

Further, $\pi_l^{r,j}$ is given by (4). Substituting this into the profit functions yields:

$$\phi^S = Z^S \beta_l \left(\Pi_l - \Pi_g\right) + \left(J^a + X^S\right) \pi_g^{r,j} \quad (7)$$

$$\phi^B = \kappa \left[Z^B \beta_l \left(\Pi_l - \Pi_g\right) + \left(J^a + X^B\right) \pi_g^{r,j} \right]. \quad (8)$$

It is in this setting that the retailer-wholesaler coalition considers whether to implement a contract with a market share requirement or not. We begin by looking at the outcomes without the contract, after which we look at the outcome with a contract, and compare the two.

[9]Note that the above described the bargaining between a producer and a retailer for one unit of product j. This is an accurate description of bargaining between a producer and a small retailer, demanding one unit. If on the other hand a big retailer demands $\kappa > 1$ unit, then we assume that the big retailer bargains simultaneously with multiple producers, where the result of each bargaining is the same.

4.5.1 Equilibrium without market share requirements.

Without the market share contract in place, each individual retailer seeks to maximize profits (given by (7) and (8)) by choosing the number of local products to buy, Z^S and Z^B for the small and big retailers respectively, subject to the constraint that the number of local products bought is smaller or equal to the number of local products produced, that is $Z^S, Z^B \leq J^a$. As each retailer seeks to maximize own profits, without taking into account the effect their decision has on the other retailers, they want to set $Z^S = J^a, Z^B = J^a$, since $\pi_l^{r,j} \geq \pi_g^{r,j}$. In other words, each retailer wants to sell each of the J^a products as local. This happens, as they know that for a given product j, if they buy it as local, they will make a profit of $\pi_l^{r,j}$ on that product, but if they do not, they will have to buy it as generic, making a profit of $\pi_g^{r,j}$. From (4) we know that $\pi_l^{r,j} \geq \pi_g^{r,j}$.

Thus it is a dominant strategy for each individual retailer to buy as many local products as possible (up to J^a), even though the retailers would be collectively better off if they could limit the number of local products each of them buy, as this would increase their bargaining power, β_l, and thus the profit per local product, $\pi_l^{r,j}$.

Substituting our definition of β_l from (1) into (4) allows us to express the retailer's profit from a local product as

$$\pi_l^{r,j} = \max\left\{1 - \frac{b}{\tilde{b}}, 0\right\}(\Pi_l - \Pi_g) + \pi_g^{r,j}. \tag{9}$$

If retailers are strong enough, that is $b < \tilde{b}$, then $\beta_l > 0$ and thus $\pi_l^{r,j} > \pi_g^{r,j}$. This means that the retailer makes a strictly greater profit from selling a local good rather than a generic good. If not, then $\pi_l^{r,j} = \pi_g^{r,j}$, and the producer captures the entire local premium.

In the following sections we analyze the consequences for the retailers and the producers of two different scenarios without the market share contract: Excess supply and excess demand for local products.

4.5.1.1 Equilibrium when supply exceeds demand

When the supply of local product j exceeds demand for it, that is $M^a > R^a(1 - \lambda + \lambda\kappa)$, then all products can not be sold as local products.

All retailers will be able to buy the product locally, that is $Z^B = Z^S = J^a$. Substituting this into (7) and (8) gives retailer profit of

$$\phi_{nc}^S = J^a\beta_l(\Pi_l - \Pi_g) + \left(J^a + X^S\right)\pi_g^{r,j} \tag{10}$$

$$\phi_{nc}^B = \kappa\left[J^a\beta_l(\Pi_l - \Pi_g) + \left(J^a + X^S\right)\pi_g^{r,j}\right], \tag{11}$$

where the subscript nc indicates no (market share) contract, and β_l is given by (1). As long as $b < \tilde{b}$, then $\beta_l > 0$. In this setting, with supply exceeding demand, $\tilde{b} > 1$. This implies that as long as the retailers are not too weak (b is not too much greater than 1), their bargaining power, β_l will be positive and they will capture part of the local premium.

The sum of all retailers profits is given by $\Phi_{nc} = R^a \left[(1-\lambda)\,\phi_{nc}^S + \lambda\phi_{nc}^B\right]$. This can be expressed as

$$\Phi_{nc} = R^a \left\{(1-\lambda+\lambda\kappa)\,J^a \left[\beta_l\left(\Pi_l - \Pi_g\right) + \pi_g^{r,j}\right] + \left[(1-\lambda)\,X^S + \lambda\kappa X^B\right]\right\} \tag{12}$$

We will later on compare this to profits with a market share requirement.

When the retailers' bargaining power is very sensitive to changes in the ratio of supply and demand (b is large), then β_l may still be zero if supply is not significantly larger than demand. Retailer profit then reduces to

$$\phi_{nc}^S = \left(J^a + X^S\right)\pi_g^{r,j} \tag{13}$$

$$\phi_{nc}^B = \kappa\left(J^a + X^B\right)\pi_g^{r,j}. \tag{14}$$

4.5.1.2 Equilibrium when demand exceeds supply

When demand is greater or equal to supply, all M^a producers of product j will get their products distributed through a retailer as local products, i.e. as long as $R^a\left(1-\lambda+\lambda\kappa\right) \geq M^a$. When the inequality is strict, some retailers will not get the product locally, and will buy the generic variety instead. With demand exceeding supply $\tilde{b} < 1$.

The number of local products for each retailer, Z^B and Z^S is on average given by $\tilde{b}J^a < J^a$, that is not all retailers will carry all J^a products. Substituting this into (7) and (8)gives average retailer profits of

$$\phi_{nc}^S = \tilde{b}J^a\beta_l\left(\Pi_l - \Pi_g\right) + \left(J^a + X^S\right)\pi_g^{r,j} \tag{15}$$

$$\phi_{nc}^B = \kappa\left[\tilde{b}J^a\beta_l\left(\Pi_l - \Pi_g\right) + \left(J^a + X^B\right)\pi_g^{r,j}\right]. \tag{16}$$

As previously, β_l is given by (1). In this setting, when the sensitivity of the retailer's bargaining power is relatively low, $b \in \left(\frac{1}{2}, 1\right)$, then $\beta_l \geq 0$ and the retailers may capture part of the local premium. More exactly, when $b \in \left(\frac{1}{2}, \tilde{b}\right)$, then $\beta_l > 0$.

The above are only averages, since we have not specified in more detail how local products are allocated to the individual retailers when all retailers' demands can not be fulfilled. Nevertheless, regardless of how the products are allocated, total profits of all retailers are given by

$$\Phi_{nc} = R^a\left\{(1-\lambda+\lambda\kappa)\,\tilde{b}J^a\beta_l\left(\Pi_l - \Pi_g\right) + \left[(1-\lambda)\left(J^a + X^S\right) + \lambda\kappa\left(J^a + X^B\right)\right]\pi_g^{r,j}\right\} \tag{17}$$

When $b \geq \tilde{b}$, then $\beta_l = 0$ and the producers capture the entire local premium. This reduces profits to

$$\phi^S = \left(J^a + X^S\right)\pi_g^{r,j} \tag{18}$$

$$\phi^B = \kappa\left(J^a + X^B\right)\pi_g^{r,j}. \tag{19}$$

4.5.1.3 Summarizing the game without market share requirements

When market share requirements are not in place, each retailer bargains independently with a local producer for a product j. Without the market share requirement, coordination between retailers is absent. With each small retailer having demand for one unit, and each big retailer having demand for κ units, the individual retailer's bargaining power may get driven down to zero if there are too many retailers in relation to the number of producers, and the sensitivity of bargaining power to the ratio of supply and demand, b, is high. This happens as the individual retailers compete with each other for the limited supply of each available product. More specifically, $\beta_l = 0$ if $M^a \leq bR^a(1 - \lambda + \lambda\kappa)$, or equivalently, when $b \geq \tilde{b}$. The inequalities are more likely to hold, the higher the sensitivity of bargaining power to the ratio of supply and demand is, the more retailers there are, the greater the share of large retailers, the greater quantities large retailers demand, and the fewer producers there are.

For a given supply and demand, the maximum number of products will be sold as local. If demand exceeds supply, producers will be able to sell all their products as local. If supply exceeds demand, then all retailers will sell all potentially local products as local products. Some potentially local products will in this case be sold as generic products, but this will not be a welfare loss, as there is no demand for these local products. These results hold regardless of the sensitivity of bargaining power to the ratio of supply and demand, captured by b.

4.5.2 Equilibrium with market share requirements.

When the market share requirement is in place, each retailer can at most purchase locally a share of $1 - \sigma$ of all products it carries. Each small retailer r purchases X^S products from the wholesaler, in addition to the J^a products, which may be purchased locally or from the wholesaler, while each big retailer purchases X^B products from the wholesaler, in addition to the J^a potentially local products. This implies that the share of local products for the small retailer is given by

$$1 - \sigma \geq \frac{Z^S}{J^a + X^S}, \tag{20}$$

while it for the big retailer is given by

$$1 - \sigma \geq \frac{\kappa Z^B}{\kappa\left(J^a + X^B\right)}. \tag{21}$$

Our assumption that the small retailer demands a maximum of one unit of each product j and the big retailer demands κ units of each product j implies that $Z^S, Z^B \leq J^a$.

Consider first the case where $\sigma = 0$. This is equivalent to the situation where no market share requirement is in place. On the other hand, if $\sigma = 1$, then the retailer can not purchase anything locally, and period 2 in the game is

eliminated, as the retailer can not buy anything directly from the producer, as the retailer essentially has an agreement of exclusive dealing with the wholesaler.

Looking at intermediate values of σ, we get to analyze the actual effects of a market share requirement.

Our simple example from section 4.2 indicated that the retailer-wholesaler coalition wants to limit the number of products a retailer can purchase locally, in order to induce upstream competition between the J^a different products sold by the $J^a M^a$ local producers. By limiting the number of products each retailer can purchase locally, demand for local products is reduced, thus increasing the bargaining power of retailers when bargaining with producers.

Thus when the retailers are constrained in how many local products they may carry, the previously J^a independent local products become interdependent. This happens as a retailer, constrained by the market share contract, on the margin is considering whether to buy a particular product *j,* he takes into account not only the direct profit he can make from that product, but also the potential profit of product $-j$ which is foregone if buying product j. Products j and $-j$ will thus be competing for the same slot in the retailer's set of products sold. In the retailer's eyes the previously independent products have become substitutes.

This affects the bargaining between retailers and producers. When previously the bargaining strength of the retailer was given by the supply and demand for the given product *j,* the constraint on the retailer means that bargaining power is now given by the total supply of all J^a local products, and the total demand for all local products. Thus bargaining power is in this setting given by

$$\beta_l = \max\left\{\frac{M^a J^a - bR^a\left[(1-\lambda)\,Z^S + \lambda\kappa Z^B\right]}{M^a J^a}, 0\right\}. \tag{22}$$

The number of local products demanded by each retailer, Z^B and Z^S can also be expressed in terms of their shares of the total number of products sold. Given that the market share requirements are binding, we can by rearranging (21) and (20), express Z^S and Z^B as

$$Z^S = (1-\sigma)\left(J^a + X^S\right) \tag{23}$$

$$Z^B = (1-\sigma)\left(J^a + X^B\right). \tag{24}$$

Substituting these expressions into (22) and rearranging yields the following expression for bargaining power:

$$\beta_l = \max\left\{\frac{M^a J^a - bR^a\,(1-\sigma)\left[(1-\lambda)\left(J^a + X^S\right) + \lambda\kappa\left(J^a + X^B\right)\right]}{M^a J^a}, 0\right\}. \tag{25}$$

In order to maximize profits, the retailer-wholesaler coalition should set the share purchased from the wholesaler, σ, so that it maximizes the profits given by the profit functions (7) and (8), taking into account its effect on bargaining

power (25). Substituting the expressions for Z^S (23) and Z^B (24) into profit functions (7) and (8) yields the retailer-wholesaler coalition's period 1 problem:

$$\begin{aligned} \max_{\sigma} \phi_c^S &= \left(J^a + X^S\right)\left[(1-\sigma)\,\beta_l\left(\Pi_l - \Pi_g\right) + \pi_g^{r,j}\right] && (26)\\ st. \quad & (1-\sigma)\left(J^a + X^S\right) \leq J^a && (27)\\ \max_{\sigma} \phi_c^B &= \kappa\left(J^a + X^B\right)\left[(1-\sigma)\,\beta_l\left(\Pi_l - \Pi_g\right) + \pi_g^{r,j}\right] && (28)\\ st. \quad & (1-\sigma)\left(J^a + X^B\right) \leq J^a && (29) \end{aligned}$$

These profit functions have a straightforward interpretation. Out of the total number of products sold, $\left(J^a + X^S\right)$ and $\left(J^a + X^B\right)$, a share σ are generic products, which yield a profit of $\pi_g^{r,j}$. This profit per product is independent of σ. On the other hand a share $1-\sigma$ are local products. The number of local products demanded is constrained by the number of different products available, J^a. Hence the constraints, that we hereby denote *demand constraints*. The subscript c indicates a market share contract.

Each local product yields a profit of $\beta_l\left(\Pi_l - \Pi_g\right)$ per unit more than if it is bought as a generic product. This profit is a function of the bargaining power of the local retailers, β_l, which in turn is a function of the share of products the retailer must purchase from the wholesaler. Looking at the expression for bargaining power (25), we can see that $\frac{\partial \beta_l}{\partial \sigma} > 0$. On the other hand, the larger is σ, the fewer local products can be carried. The determination of σ is thus a trade-off between on the one hand increasing profit per local product, and on the other increasing the share (number) of local products, $1-\sigma$.

The first order condition for the profit functions can be expressed as

$$(1-\sigma)\,\beta_l^{'} - \beta_l \leq 0, \tag{30}$$

where $\beta_l^{'} = \frac{\partial \beta_l}{\partial \sigma}$. The inequality is an equality when the demand constraints are not binding. Thus we have the profit maximizing market share requirement given by

$$\sigma^* \geq 1 - \frac{\beta_l(\sigma)}{\beta_l^{'}(\sigma)}. \tag{31}$$

Substituting the expression for β_l from (25) and taking the derivative and rearranging yields the share of products that can be bought locally:

$$(1-\sigma^*) \leq \frac{M^a J^a}{2bR^a\left[(1-\lambda)\left(J^a + X^S\right) + \lambda\kappa\left(J^a + X^B\right)\right]}. \tag{32}$$

The inequality is strict when the demand constraints are binding, that is when both small and large retailers want to carry all J^a products. On the other hand, and more interestingly, when the demand constraints are not binding, then the above inequality becomes an equality. In this case, each retailer carries fewer than J^a local products.

Looking more closely at the expression, we see the following. The share of local products, $1-\sigma^*$ is increasing in the number of producers M^a, and in the

number of local products, J^a. The more producers there are, the more local products can the retailers buy, without diluting profits too much. The share of local products is decreasing in R^a. The more retailers there are in the area, the fewer local products each of them can buy. The share is also decreasing in X^S, X^B. The more products the retailers carry, the smaller the share of local products allowable, in order to maintain bargaining power. For similar reasons, the share of local products is decreasing in κ. The larger volumes the big retailers buy, the fewer local products they can be allowed.

Furthermore, the share of local products is decreasing in λ. The larger the share of retailers that are big, the smaller the share of local products will be. This is because more large retailers implies more demand. More demand in turn implies lower bargaining power.

Finally, the share of local products is decreasing in b, the sensitivity of the retailer's bargaining power to the ratio of supply and demand. For a given ratio of supply and demand, the share of local products is thus increasing in the retailer's bargaining power. The stronger the individual retailers are (the lower b is), the larger the share that can be bought locally.

4.5.2.1 Product volumes and profits

To see to what extent the market share contract affects the distribution of products as local or generic, we examine the market share requirement in detail. Given the market share requirement set by the retailer-wholesaler coalition, $(1-\sigma)$, given by (32), and given the definition of Z^S and Z^B, the number of local products the retailers purchase, given by (23) and (24), we can rearrange the market share contract to obtain the following expression:

$$R^a \left[(1-\lambda) Z^S + \lambda\kappa Z^B\right] \leq \frac{M^a J^a}{2b}. \tag{33}$$

From the previous discussion we remember that this inequality is an equality whenever $Z^S, Z^B < J^a$. The left hand side of the expression gives what we term the *constrained demand,* that is the total number of local product units bought, when the retailers are constrained by the market share contract. This constrained demand is given by the number of retailers, R^a, of whom a fraction $1-\lambda$ buy Z^S products, and a fraction λ buys κ units of Z^B products. This constrained demand is equal[10] to the total supply of local products, divided by $2b > 1$. Supply is given by the number of producers per product, M^a, multiplied by the number of products, J^a.

Thus, when the market share constraint is binding, each retailer purchases fewer than J^a products. With $b > \frac{1}{2}$, constrained demand is strictly less than supply, and some potentially local products will be sold as generic products, resulting in a welfare loss.

Proposition 1. *The market share contract constrains demand, such that some products which could be sold as local will be sold as generic instead.*

[10] Less in case $Z^S, Z^B = J^a$

The greater b is, the smaller will the constrained demand be. The following proposition provides an interpretation.

Proposition 2. *The weaker the retailers are, the more the retailer-wholesaler coalition will constrain demand, and the fewer products will be sold as local.*

There is thus a welfare loss[11] compared to a situation without the market share contract, where all products are sold as local, as long as demand at least equals supply. The welfare loss occurs, as it is privately optimal for the retailer-wholesaler coalition to constrain demand, in order to shift rents through the market share requirement, even though the socially optimal would call for no constraints. Proposition 2 has a corollary reflecting on the welfare loss:

Corollary 1. *The welfare loss is decreasing in the retailers bargaining power. Stronger retailers implies a lower welfare loss.*

This can be seen from (33), where the right hand side decreases in b. Inequality (33) also allows us to view the product choice from the retailers' perspective, that is we can see under what conditions each retailer will carry all J^a local products, that is when $Z^S, Z^B = J^a$. We know that when this is the case, the inequality in (33) is strict. Substituting $Z^S, Z^B = J^a$ into the inequality and rearranging gives us the following necessary (but not sufficient) condition for all retailers to carry all J^a products:

$$R^a \left[(1-\lambda) + \lambda\kappa\right] < \frac{M^a}{2b}. \tag{34}$$

Put simply, the left hand side gives the demand, whereas the right hand side gives supply divided by $2b > 1$. Demand is given by the number of retailers, R^a; weighted by the the share of small and big retailers, $1-\lambda$, λ; and the volume demanded by big retailers, κ. This must be strictly less than the number of producers per product, M^a, divided by $2b > 1$. The higher b is (the more sensitive retailers' bargaining power is to changes in the ratio of supply and demand), the less likely this is to hold. The fewer producers and the more retailers there are, and the larger the share of the retailers that are big, and the more each big retailer demands, the less likely this condition is to hold. Thus, we see that $Z^S, Z^B = J^a$ only when supply strictly exceeds demand.

We can also re-express (34) in terms similar to those used when studying the absence of the market share contract:

$$\tilde{b} > 2b. \tag{35}$$

If and only if this holds, the market share contract will not be binding and $Z^S, Z^B = J^a$. As a comparison, without the market share contract, $Z^S, Z^B = J^a$ always holds when demand is less than supply, that is when $\tilde{b} \geq 1$, regardless of b. When the market share contract doesn't bind, the outcome is the same as in the situation without the market share contract.

[11] A welfare loss in terms of the sum of producer, retailer and wholesaler profits being lower. In addition, consumers can buy fewer local products.

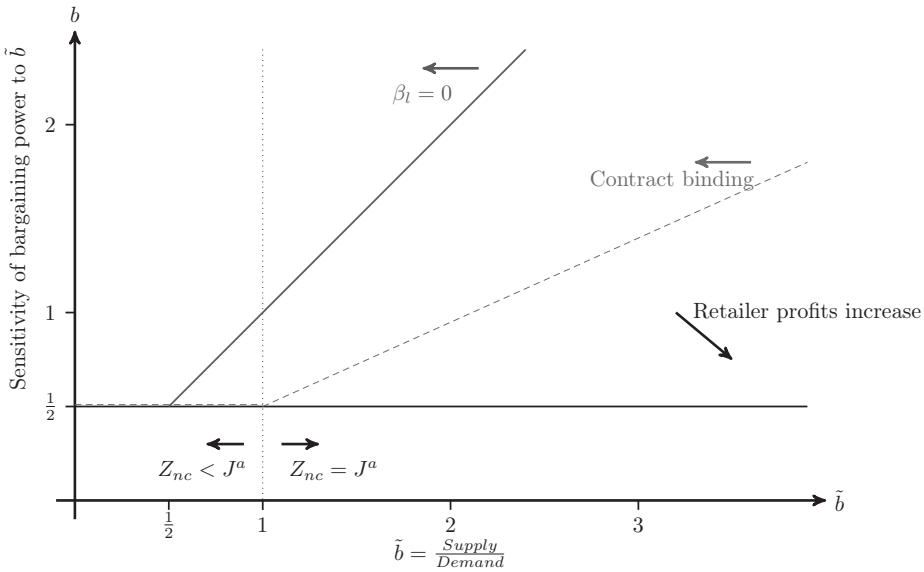

Figure 6: Bargaining power and market share contract

We summarize this comparison in figure 6. The figure delineates three regions: To the left of the solid blue line $b > \tilde{b}$, and absent the market share contract producers capture the entire local premium. To the left of the dashed red line, the market share contract is binding, and $Z^S, Z^B < J^a$ under the contract. To the right of the dashed red line the contract is not binding, and $Z^S, Z^B = J^a$ also when the contract is in place. Absent the contract $Z^S, Z^B = J^a$ to the right of the vertical dotted line.

4.5.2.2 Binding market share contract

When the market share contract is binding we obtain β_l by substituting the expression for constrained demand from (33) into the general expression for bargaining power, (22). This yields

$$\beta_l^* = \frac{1}{2}. \tag{36}$$

Comparing this to the situation of no market share contract, where $\beta_l = \max\left\{1 - \frac{b}{\tilde{b}}, 0\right\}$, it is immediate that β_l is greater under the binding market share contract (with $\tilde{b} < 2b$) than without the market share contract. Thus the market share contract increases the bargaining power of the retailer.

Profits per product are obtained by substituting (36) into (4). This gives retailer profit per product of

$$\pi_l^{r,j} = \frac{\Pi_l - \Pi_g}{2} + \pi_g^{r,j}. \tag{37}$$

The retailer gets half the local premium for the $Z^S, Z^B < J^a$ local products he carries. This is strictly more than in the absence of the market share contract.

The retailers' profits are obtained by substituting β_l^* from (36) and (32) into the profit functions from (26) and (28). This yields

$$\phi_c^S = \left(J^a + X^S\right)\left[\frac{M^a J^a\left(\Pi_l - \Pi_g\right)}{4bR^a\left[(1-\lambda)\left(J^a + X^S\right) + \lambda\kappa\left(J^a + X^B\right)\right]} + \pi_g^{r,j}\right] \quad (38)$$

$$\phi_c^B = \kappa\left(J^a + X^B\right)\left[\frac{M^a J^a\left(\Pi_l - \Pi_g\right)}{4bR^a\left[(1-\lambda)\left(J^a + X^S\right) + \lambda\kappa\left(J^a + X^B\right)\right]} + \pi_g^{r,j}\right] \quad (39)$$

The profits of both types of retailers increase in the number of producers, M^a. Profits decrease in b, that is the more sensitive bargaining power is to the ratio of supply and demand, the lower the profit. The profits per retailer also decrease in R^a, the number of retailers, as well as in λ, the share of big retailers. The more (big) retailers there are, the less profit will there be for any individual retailer. While the expression for the number of local products is a bit unwieldy, the expression is much clearer when we look at the sum of all retailers profits. The sum of retailer profits is given by $\Phi_c = R^a\left[(1-\lambda)\,\phi_c^S + \lambda\phi_c^B\right]$. This can be expressed as

$$\Phi_c = \frac{M^a J^a}{4b}\left(\Pi_l - \Pi_g\right) + R^a\left[(1-\lambda)\left(J^a + X^S\right) + \lambda\kappa\left(J^a + X^B\right)\right]\pi_g^{r,j} \quad (40)$$

The retailers buy a total of $\frac{M^a J^a}{2b}$ local products, as shown in (33), on which they earn an additional profit of $\frac{\Pi_l - \Pi_g}{2}$, as previously pointed out.

Taking the difference between the situation with and without the market share contract allows us to analyze the effect of the market share contract on retailer profits. Defining the difference as $\Delta = \Phi_c - \Phi_{nc}$ gives us the difference for two cases, when demand exceeds supply ($\tilde{b} < 1$), and when supply exceeds demand ($\tilde{b} \geq 1$):

$$\Delta|\left(\tilde{b} < 1\right) = \frac{\tilde{b} - 4b\left(\tilde{b} - b\right)}{4b\tilde{b}} M^a J^a\left(\Pi_l - \Pi_g\right) \quad (41)$$

$$\Delta|\left(\tilde{b} > 1\right) = \frac{\tilde{b} - 4b\left(\tilde{b} - b\right)}{4b\tilde{b}} R^a\left(1 - \lambda + \lambda\kappa\right) J^a\left(\Pi_l - \Pi_g\right). \quad (42)$$

While these expressions are a bit unwieldy, we may notice the following. Both are always positive, as long as the market share contract is binding (when it is not, profits are the same with or without contract). Both are increasing in b, the bargaining power's sensitivity to the ratio of supply and demand. For a given ratio of supply and demand, the more bargaining power the producers have, the more valuable is the contract to the retailers. Δ is decreasing in $\tilde{b}$, the ratio of supply to demand. The fewer producers there are in relation to retailers, the more valuable is the market share contract for the retailers.

4.6 Conclusions

We have given a new interpretation to market share contracts in the context of buyer groups. We have shown that a buyer group, here termed wholesaler, by imposing a market share requirement on its buyers, here termed retailers, can make both better off. This happens, as the market share requirement creates scarcity of retailer demand for local products, by limiting the number of local products they may buy. This is similar to the argument of Marx and Shaffer (2010), that retailers may want to limit their capacity to be able to extract slotting fees. In our case, the scarcity is induced by the market share requirement between individual retailers and their joint wholesaler. The coalition of retailer and wholesaler can extract surplus from their suppliers, through the scarcity of capacity induced by the market share requirement. The weaker the retailers are, the more the agreement restricts demand. The scarcity of capacity creates a link between previously unrelated products, benefiting the retailer-wholesaler coalition, to the detriment of producers and consumers.

However, where Marx and Shaffer (2010) show that an individual retailer may have an incentive to unilaterally restrict capacity for certain products, the mechanism is quite different in our case. While the retailers are local monopolists in our case, they are still small in the upstream market when procuring products. Thus an individual retailer would not benefit from unilaterally restricting his buying in the upstream market. The only effect would be that he would end up buying fewer products, without affecting his terms of trade significantly. However, the market share contract between retailers and wholesaler co-ordinates the retailers actions, such that when they all constrain their demand, they all benefit. We might be worried whether this is an equilibrium, i.e. whether any single retailer would have an incentive to deviate, once the agreement is in place. Given that the relationship with the wholesaler is valuable to the retailer, and the wholesaler conditions the continuation of the relationship on the retailer honoring the market share contract, the retailers' incentives to honor the contract can be quite high.[12] It could thus be that the wholesaler is in a unique position to make the co-ordinated solution a stable outcome, with the threat of terminating the retailer being a disciplining device supporting stability.[13] One might further expect that repeated interaction among the retailers would help sustain the outcome.

While the result of our model leads to the exclusion of some producers from the market for local products, this is not the main purpose of the market share requirement. The purpose is rather to shift rents from producers to the retailer-wholesaler coalition. The rent-shifting motive thus, rather than aim at exclu-

[12]There is a clear analogy with a traditional sellers' cartel in an otherwise competitive market. Without the cartel co-ordinating sellers, no individual seller has a unilateral incentive to decrease output. However, with a cartel (and adequate sanctions for cheaters) all sellers may find it beneficial to decrease output. In our case buyers (retailers) co-ordinate inputs.

[13]This would suggest that retailers for whom local products are important, but for whom the services of the wholesaler are not that crucial, would choose to stay out of the buyer alliance, operating independently, while those who are more dependent on the wholesaler would stay within the alliance.

sion, needs to include producers, in order for there to be rents to shift, as pointed out by Marx and Shaffer (2008).

Our result, that the weaker the retailers are, the more they will want to limit themselves, by setting a higher market share requirement (vis á vis the wholesaler), is a result that is common to many studies of buyer power in vertical relationships. Inderst and Shaffer (2007) show that a weak retailer is more likely to adopt exclusive dealing, while Marx and Shaffer (2010) show that a weak retailer is more likely to unilaterally restrict shelf space. The common theme is that the weak retailer needs to constrain himself more in order to capture parts of the surplus, whereas a strong retailer will have a greater incentive to increase total surplus, knowing that his strength will enable him to capture a large part of the surplus.

In a narrow sense we have addressed the literature on vertical relationships, as detailed above. In a broader sense, we have addressed the strategic delegation literature, in the sense of analyzing the optimal share of decisions (purchases from suppliers) to be delegated to the retailer, and what share to make centrally, by the wholesaler. Qualitatively our results would be the same if the wholesaler decided directly on the number of local products a retailer may carry. Given that retailers can carry a limited number of products, our results would also stay the same if the wholesaler decided on what products the retailer must carry, as this would indirectly set the number of local products a retailer could carry.

Why would the retailer-wholesaler coalition then want to impose a market share contingent contract, rather than make contracting directly contingent on the number of local products the retailer may carry? In our setting, the wholesaler serves two types of retailers, big and small. Using a market share requirement allows the big and small retailers to have a different number of local products. While our model doesn't explicitly address why it might be desirable for the big retailer to carry more local products than the small retailer, one can speculate that there might be good reasons for this. If the wholesaler also cares about own profit, then allowing a big retailer, who purchases more from the wholesaler to also purchase more local products may provide an incentive for retailers to increase their purchases. Big retailers may also be better at selling greater number of products.

Furthermore, our model has several areas. We can interpret this as the wholesaler operating nationally, while the areas relevant for local product considerations are smaller regions. A uniform market share requirement then makes sense, given that the number of producers and retailers in the different areas vary, as long as the ratio of producers to retailers is roughly the same in each area. This is similar to the argument in Mills (2010), where rebates conditional on market shares is used instead of quantity discounts in order to simplify the supplier's problem, when dealing with retailers of various sizes. Furthermore, a uniform market share requirement across areas may be a more credible commitment device for the retailer-wholesaler coalition, than fixing a retailer specific number of products a retailer may procure directly. The simplicity and the uniform nature of the market share contract may thus explain why wholesalers

prefer this sort of contract.[14]

We have shown the effect of the market share conditioning contract in the setting of "local products," based on the concept of "local food." While this implies that the good might be materially different if sold as a local rather than a generic product, our model also allows for other interpretations. There might be some products which simply can not be sold as generic products, in the sense that the wholesaler does not want to carry them. If these products still may be sold by the local retailer if he procures them directly from the producer, the market share contract will again strengthen the retailer's hand in the negotiations. Thus a more general interpretation would be that the presence of any product that can be sold more profitably through a direct transaction between the retailer and the producer can make a market share contract worthwhile for the retailer-wholesaler coalition.

Furthermore, the market share contract can also have the effect that suppliers who would rather deal with individual retailers are forced to deal with the wholesaler. The markets share contract gives the individual retailers a credible commitment device not to deal with too many suppliers directly. As suppliers realize this, they are forced to deal with the wholesaler. For some products, bargaining at the wholesale rather than retail level may yield higher profits for the retailer-wholesaler alliance. This conclusion is compatible with the survey answers reported in a study by the Finnish Competition and Consumer Authority (Björkroth et al., 2013). The study reports that many producers were not able to negotiate directly with individual retailers, but only with the wholesalers.

We have conducted our analysis in a setting of inelastic demand. Nevertheless, qualitatively similar results could be achieved when analyzing a setting where retailers face downward sloping demand for the products and wholesale prices are set non-cooperatively.

While we have above shown that the use of market share requirements in retailer-wholesale contracts may have a rent shifting motive, care is called for when drawing policy implications. Comparing the situation with market share requirements to a situation with no restraints on the retailer showed indeed that the supply of local products is reduced, and producers and consumers are worse off as a result. However, taking an exclusive dealing contract as the counterfactual, more local products are offered under the market share contract than under exclusive dealing, and producers, the retailer-wholesaler coalition and consumers are better off.

Whether market share requirements in retailer-wholesale contracts are used by a dominant group or a non-dominant group is also important when evaluating the implications. A dominant group has a better ability to shift rents through the above described mechanism than a non-dominant one. If a non-dominant group wants to limit its demand in the procurement market, it will by definition have a smaller effect than when a dominant group limits its demand. We have modeled the retailer-wholesaler group as consisting of local

[14] In the case of franchisee-franchisor contracts, McAfee and Schwartz (1994) note that they are "strikingly uniform."

downstream monopolists. Qualitatively similar results could be expected if the retailer-wholesaler group consisted of retailers with significant downstream market power, competing against other retailers. If the retailers within the group also compete with each other downstream to some extent, and consumers value variety, then the market share contract might also soften this competition. This softening of competition could occur if different retailers utilize their freedom to buy a limited number of local products and concentrate on different products. Then consumers preferring one set of products would be targeted by one retailer, while another retailer could target consumers preferring another set of products. Absent the market share contract both groups might be targeted by both retailers. On the other hand, if the retailers were operating in highly competitive downstream markets against retailers not part of the same buyer group, there might be little scope for the kind of rent shifting described above.

Furthermore, the previous literature has shown other motivations for market share contracts than the specific one we have addressed here. Some have been benign as to the welfare consequences of market share contracts, while others have found them to be anti-competitive. Thus our interpretation of market share contracts as a way of rent shifting from producers to retailer-wholesalers is likely to be one of many components influencing the use of these contracts. Thus careful analysis is called for when evaluating the competitive effects of market share contracts.

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FRANS SAXÉN

ESSAYS ON THE ECONOMICS OF RETAILING: PAYMENTS, FINANCE AND VERTICAL RESTRAINTS

Much of the analysis of industrial organization implicitly assumes that firms sell directly to final consumers. However, many firms do not sell directly to the final consumers, but rather use intermediaries, such as wholesalers and retailers to distribute their products. The presence of such intermediaries affects significantly market outcomes. In particular, the contracts between manufacturers and retailers may significantly affect market outcomes, e.g. volumes and prices. Characteristic for these contracts is that they may contain vertical restraints, restrictions on what the retailers may do once they have acquired the products for resell. Another characteristic feature of these contracts is that they are typically devised by sophisticated contracting parties, who have strategic objectives.

The reason for manufacturers, or upstream firms to impose vertical restraints on retailers, or downstream firms is that the actions of the downstream firms affect the upstream firm's profits. While vertical restraints may affect the profitability of the contracting parties, they may also affect other agents, such as consumers and suppliers.

In this dissertation I focus on three distinct aspects of vertical relations. I look at how providers of payment cards affect competition between retailers, through the no surcharge rule; how suppliers can expand their output by financing the establishment of new retailers; and how buyer alliances can extract surplus from suppliers through the use of market share contracts.

Common to these essays is the strategic behavior by agents on one level affecting market outcomes at another vertical level.

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