MARKETING SCIENCE
Vol. 29, No. 1, January–February 2010, pp. 57–74
ISSN 0732-2399 | EISSN 1526-548X | 10 | 2901 | 0057

DOI 10.1287/mksc.1080.0472

A Larger Slice or a Larger Pie? An Empirical Investigation of Bargaining Power in the Distribution Channel

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This research aims to provide insights into the determinants of channel profitability and the relative power in the channel by considering consumer demand and the interactions between manufacturers and retailers in an equilibrium model. We use the Nash bargaining solution to determine wholesale prices and thus how margins are split in the channel. Equilibrium margins are a function of demand primitives and of retailer and manufacturer bargaining power. Bargaining power is itself a function of exogenous retail and manufacturer characteristics. The parties' bargaining positions are determined endogenously from the estimated substitution patterns on the demand side. The more they have to lose in a negotiation relative to an outside option, the weaker the bargaining position.

We use the proposed bargaining model to investigate the role of the three main factors that have been blamed for the power shift from manufacturers to retailers in recent years (firm-size increases, store-brand introductions, and service-level differentiation). In our empirical analysis of the German market for coffee, we find that bargaining power varies among the different manufacturer-retailer pairs. This result suggests that bargaining power is not an inherent characteristic of a firm but rather depends on the negotiation partner. We are able to confirm empirically previous theoretical findings that there can be cases where the slice of the pie that goes to one of the channel members may decrease, but the overall pie increases and compensates for the smaller share of profits.

Key words: bargaining; distribution channels; competitive strategy; econometric models
History: Received: August 19, 2007; accepted: November 5, 2008; processed by J.-P. Dubé. Published online in *Articles in Advance* February 24, 2009.

1. Introduction

There has been a great deal of discussion about the purported power shift from manufacturers to retailers because of the consolidation of the retail sector, the increase in trade promotions, as well as the rapid growth of store brands (for a comprehensive survey, see Ailawadi 2001). A widely held belief is that "big-box" retailers are squeezing manufacturer margins. This issue of growing power of large and expanding retailers was raised simultaneously by industry participants, the media,[1] and by the competition authorities.[2] Yet there is little evidence that retailers have become more profitable. In fact, it appears that retail margins have fallen over time relative to manufacturer margins, which has been interpreted as evidence that their power has not increased (Messinger and Narasimhan 1995). However, the overall profitability of the distribution channel is not necessarily a zero-sum game. The profitability of manufacturers and retailers is determined both by the total margins in the distribution channel and by the way they are split between them.

The questions we ask in this paper are how to measure power in the distribution channel and what are its drivers. Standard models of channel interactions such as Vertical Nash or Manufacturer Stackelberg tightly specify the behavior of manufacturers and retailers (Kadiyali et al. 2000). Because these behav-

[1] See Lynn (2006).

[2] See Schelings and Wright (1999).

ioral assumptions determine how the overall channel profits are shared, standard models are not well suited to measure power in the distribution channel. We therefore build on the empirical approach of Misra and Mohanty (2006) and recent advances in the theoretical marketing literature that allow the channel members to bargain over wholesale prices (Iyer and Villas-Boas 2003, Dukes et al. 2006). The bargaining process not only determines how the overall channel profits are shared between manufacturers and retailers, but it also affects the prices paid by consumers and therefore the overall channel profitability. As will be shown, our bargaining approach leads to an empirical model that provides the flexibility needed to assess power in the distribution channel.

We further assess the determinants of channel profitability and the relative power in the channel by considering consumer demand and the interactions between manufacturers and retailers in an empirically tractable equilibrium model. The size of the pie is determined by the ability of the channel members to extract surplus from consumers by charging higher prices. The latter is constrained by the possibility of substitution among competing brands and retailers and the option to make no purchase at all. The slice of the pie that goes to manufacturers and retailers is a reflection of their relative power in interacting with each other. A party's stake or its bargaining position (Dukes et al. 2006) is determined by its profits when the negotiations are successfully concluded and when they fail and the manufacturer's product is not carried by the retailer. A party's bargaining position is weaker the more it loses in case of failure. Besides the bargaining positions, there are numerous other factors such as the negotiation skills of the parties, their patience, and their risk tolerance that affect the outcome of the negotiations between manufacturers and retailers. These factors are what is commonly referred to as bargaining power (Iyer and Villas-Boas 2003, Dukes et al. 2006). Taken together, bargaining position and bargaining power determine total channel margins and their split. Our empirical framework thus distinguishes between the bargaining power that is due to exogenous factors and the parties' bargaining positions that arise endogenously from the substitution patterns on the demand side.

We illustrate the proposed approach by analyzing the market for ground coffee in Germany. In this mature product category, several manufacturers compete intensely and sell through a number of retailers. We use sales and marketing-mix data to estimate consumer demand. We then recover retailer and manufacturer margins using our supply-side model. Although our analysis pertains to this particular market and product category, we believe that the results are of broader significance. Key features of the German coffee market are fairly stable demand and oligopolistic structure. Many other mature markets for consumer goods such as laundry detergents, beer, cereals, diapers, and batteries have similar characteristics.

Our first contribution is that we estimate the bargaining power parameter, which plays a crucial role in the recent theoretical literature. Our findings indicate that in the market under investigation, bargaining power lies mainly with manufacturers. On average the manufacturer gets more than half of the pie. At the same time we find that bargaining power varies among the different manufacturer-retailer pairs. This is an interesting result, suggesting that bargaining power is not an inherent characteristic of a firm but rather depends on the negotiation partner.

The theoretical literature suggests that a decrease in bargaining power of the manufacturer decreases the distortion because of double marginalization. Hence, under certain conditions, the presence of a powerful retailer may be beneficial to all channel members (Iyer and Villas-Boas 2003). The empirical analysis we conduct allows us to validate this implication of the theoretical literature. Our second contribution is thus to show in an empirically rich and realistic setting (multiple retailers, multiple manufacturers, heterogeneous consumers) that the overall profitability of the distribution channel is not necessarily a zero-sum game. Furthermore, by conducting numerical simulations based on our empirical estimates, we provide comparative statics-type results that cannot be obtained in an analytically tractable model.[3]

Our third contribution is that we quantify the effect of the bargaining power parameter on channel profits at the heart of the theoretical literature and decompose it into its constituent parts (margins, quantities). Our estimates indicate that the impact of bargaining power is mostly on manufacturer margins and quantities sold. The impact of bargaining power on retail margins is small because retail margins are tied down by the retailer's pricing power relative to consumers, meaning that retailers mostly pass on changes in wholesale prices to consumers. This shows the importance of distinguishing between the pricing power of retailers vis-à-vis consumers and the bargaining power of manufacturers vis-à-vis retailers.

Our fourth contribution is to assess the determinants of bargaining power. Building on the existing literature (Ailawadi and Harlam 2004, Ailawadi 2001, Messinger and Narasimhan 1995), we investigate the three main factors that have been blamed for the power shift from manufacturer to retailers: increase in firm size, store-brand introductions, and service-level differentiation through merchandise assortment. We show how these exogenous retailer and manufacturer

[3] We thank the area editor for making this point.

characteristics affect total margins, and their split directly through demand and also through the bargaining process. We find that large retailer size and positioning store brands close to national brands are associated with more bargaining power of retailers vis-à-vis manufacturers. Manufacturer size, as expected, translates into an increased share of profits going to the manufacturers. Surprisingly, our estimates indicate that a larger assortment makes a retailer less powerful but that this nevertheless benefits both parties. While the slice for the retailers is getting smaller, the size of the pie is increasing.

Our research builds on several recent empirical models that have devoted attention to the analysis of channel interactions within a product category (e.g., Kadiyali et al. 2000, Cotterill and Putsis 2001, Sudhir 2001, Villas-Boas and Zhao 2005). These studies consider a distribution channel with multiple manufacturers selling through a common retailer that sets prices as if it were a local monopolist. Unlike these previous studies, we have data on multiple national retail chains. This allows us to incorporate retail competition in our model (similar to Villas-Boas 2007). Moreover, following the earlier theory literature on distribution channels, these empirical studies posit a specific model of manufacturer-retailer interactions, which imposes a particular distribution of power in the channel. To address this issue, Kadiyali et al. (2000) propose using a conduct parameter approach to let the data determine the appropriate model. Villas-Boas (2007) takes a menu approach, where non-nested tests are used to determine the best-fitting model among various supply-side specifications.

Similar to the conduct-parameter approach, our model nests the traditional models (see Appendix A for details) and thus allows the data to determine the bargaining power in the channel (see also Misra and Mohanty 2006). Methodologically, therefore, the bargaining model compares favorably to the existing structural models of channel interactions. Most important, the bargaining power parameter has a clear-cut behavioral interpretation, whereas the interpretation of the conduct parameter is less clear.

Empirical studies of bargaining are sparse. There is an earlier literature in marketing that has studied bargaining experimentally. Neslin and Greenhalgh (1983) conduct a role-playing investigation in the context of media purchasing and find support for the application of Nash's (1950) bargaining theory to buyer-seller negotiations. Gupta (1989) extends the analysis to situations where the parties are bargaining over multiple issues. Closest in spirit to our paper is Misra and Mohanty (2006). These authors were the first to take a bargaining model to data and empirically assess bargaining power in a channel with multiple manufacturers and a single retailer. We extend their work by allowing for retailer competition and relating the bargaining power parameter to manufacturer and retailer characteristics. Furthermore, we consider a different model setup, which follows closely the theoretical literature on bargaining in distribution channels of Iyer and Villas-Boas (2003) and Dukes et al. (2006).

The remainder of this paper is organized as follows. Section 2 develops the model. We present the data in §3 and discuss the results of our empirical analysis in §4. Section 5 concludes with directions for future research.

2. Model

Consumer demand is modeled using a discrete-choice formulation. On the supply side, we model competition between multiple retailers. In addition to retail competition, we model the bargaining between retailers and manufacturers. We solve the equilibrium conditions and derive the equations to be taken to the data. Before presenting our formal model, we discuss the key assumptions below.

2.1. Key Assumptions

2.1.1. Demand. Consumers select a brand at a given retailer (chain) to maximize their utility. Similar to Villas-Boas (2007), we model retailer-brand combinations as the alternatives in the choice set to allow for chain influences on choice behavior. For example, buying Tchibo at Edeka may be a very different experience than buying Tchibo at Metro because of shelf allocation, display, etc.

2.1.2. Retail Prices. Retailers (chains) are competing with one another in Bertrand-Nash fashion. An alternative assumption would be to think of retailers (chains) as local monopolists, but this may overstate the pricing power of retailers vis-à-vis consumers. The papers by Slade (1995) and Walters and MacKenzie (1988), which are often cited as evidence for the local monopoly assumption, argue that competition between stores is weak because consumers face a transportation cost for traveling from one store to another. Such a transportation cost argument is less appealing when the analysis is conducted at the level of national retail chains. Although geographic location may help to mitigate competition between stores, chains have many stores in the same general region and sometimes even stores that are next to each other. Finally, recent empirical evidence appears to favor a model of competing retailers (see, e.g., Hartmann and Nair 2007), and our demand estimates also imply small but nonzero cross-chain price elasticities.

2.1.3. Wholesale Prices. In the vertical channel there are R retailers who bargain with B manufacturers over the wholesale prices of N products. We follow the literature and focus on one manufacturer-retailer dyad at a time.[4,5] Of course, in reality each retailer can bargain with each manufacturer. Moreover, if the negotiations break down, both parties still have the option to negotiate with all the other manufacturers or retailers or they may restart a previously abandoned negotiation in response to the outcome of another negotiation. This process gives rise to an extremely complicated game of interrelated negotiations, which the theory literature has yet to solve. The problem lies in the fact that the decision-relevant variables for one particular negotiation between a retailer and a manufacturer—namely, the profits that would be realized if the negotiation is successful and the profits in case the negotiation breaks down—depend on the outcomes of all other negotiations.

We model the bargaining between a particular retailer and a particular manufacturer using the generalized Nash bargaining solution. Nash (1950) originally derived this solution concept by postulating a number of axioms (invariance to utility representations, Pareto efficiency, and independence of irrelevant alternatives) that a solution to a bargaining problem should satisfy. Later work has introduced noncooperative games that produce exactly the same outcome (see, e.g., Rubinstein 1982).

All manufacturer-retailer pairs bargain at the same time. Alternatively, one could assume that there is some order in which negotiations take place. However, absent any data, it is not clear that it is better; one could easily imagine situations in which imposing the wrong order on the bargaining process does more harm than good.

To ensure that bargaining is only on wholesale price, and not on nonlinear tariffs, we follow Iyer and Villas-Boas (2003) in assuming that products are not fully specifiable in a contract. This assumption is a reflection of the institutional reality in the grocery industry, where retailers determine in a discretionary manner whether packaging and labeling, for example, are acceptable.

We further assume that retail prices cannot be contracted upon (the theoretical literature refers to this assumption as retail price unobservability; see, e.g., Iyer and Villas-Boas 2003). The bargaining solution over wholesale prices thus treats retail prices as fixed. Manufacturers and retailers have rational expectations, meaning that they anticipate the ultimate equilibrium outcome. We feel that this assumption is particularly well suited for a mature product category such as coffee, where both parties know exactly the game that is being played. One may argue that a more natural assumption is that retail prices are set conditional on all wholesale prices as in a manufacturer Stackelberg game. To translate this assumption into a bargaining context, we have to assume that the bargaining processes are interdependent and allow the wholesale prices to be determined in anticipation of possible changes to all retail prices. As we stated above, modeling interdependent bargaining processes is beyond the current state of the art. We nevertheless explore a sequential setup in Appendix B.

2.2. Demand

Consumers choose among different products or decide to make no purchase in the category. We view a product as a particular brand (indexed by b) sold at a particular retailer (indexed by r). The indirect utility U_{ibrt} of consumer i from purchasing brand $b = 1, 2, \ldots, B$ from retailer $r = 1, 2, \ldots, R$ at time $t = 1, 2, \ldots, T$ is

$$U_{ibrt} = \alpha_{br} - \beta_i p_{brt} + \gamma X_{brt} + \xi_{brt} + \varepsilon_{ibrt}, \qquad (1)$$

where α_{ibr} is a brand-retailer fixed effect capturing the intrinsic preference for brand b at a retailer r, and p_{brt} denotes the price of brand b in retailer r at time t. Additional factors affecting the choice of brand b at retailer r such as retailer promotions, assortment depth, and manufacturer advertising are included in X_{brt}. To capture consumer heterogeneity in price response, we assume that the price coefficient β_i varies across consumers according to

$$\beta_i = \beta + \sigma_p v_i, \quad v_i \sim N(0, 1),$$

where β and σ_p are parameters to be estimated. The term ξ_{brt} accounts for factors that affect consumer utility, are observed by consumers, retailers, and manufacturers, but not by the researcher (Villas-Boas and Winer 1999). Consumer idiosyncratic preferences are captured by ε_{ibrt}, an i.i.d. type I extreme value distributed error term. To allow for category expansion or contraction, we include an outside good (no-purchase option), indexed by $b = r = 0$, with utility $U_{i00t} = \varepsilon_{i00t}$. We rewrite the utility of consumer i for brand b in retailer r as

$$U_{ibrt} = \delta_{brt}(p_{brt}, X_{brt}, \xi_{brt}; \alpha, \beta, \gamma) + \mu_{ibrt}(p_{brt}, v_{i,\alpha}, v_{i,\beta}, v_{i,\gamma}; \Sigma) + \varepsilon_{ibrt}, \qquad (2)$$

where δ_{brt} is mean utility and μ_{ibrt} is the deviation from this mean utility because of consumer heterogeneity in price response (Nevo 2000). Let the deviation from mean utility μ be distributed across consumers according to $F(\mu)$. The aggregate share s_{brt}

[4] As a result, manufacturers charge different wholesale prices to different retailers. The practice is largely consistent with European competition law. In the United States it may, however, conflict with the Robinson-Patman Act (U.S. Code 15 (1936), §13 et seq.).

[5] In the case where one manufacturer bargains with two different retailers we use the contract equilibrium as in O'Brien and Shaffer (1992), where contracts are negotiated secretly between each pair and, while negotiating, both parties have passive conjectures, which means that they take the other pair's terms of negotiations as given.

of brand b in retailer r at time t across consumers is obtained by integrating the consumer-level choice probabilities:

$$s_{brt} = \int \frac{\exp(\delta_{brt} + \mu_{ibrt})}{1 + \sum_{k=1}^{B} \sum_{s=1}^{R} \exp(\delta_{kst} + \mu_{ikst})} \, dF(\mu). \quad (3)$$

2.3. Retail Margins

For the remainder of the analysis we define a product j as corresponding to a brand-retailer pair (b, r); i.e., a product corresponds to a brand b sold at a retailer r. To simplify the notation, we drop the time subscript for the remainder of this section.

Retailer r maximizes the profit from all products sold given by

$$\pi^r = \sum_{j \in \Omega^r} [p_j - p_j^w - c_j^r] M s_j(p), \quad (4)$$

where Ω^r is the set of products sold by retailer r, p_j is the retail price of product j, and p_j^w is the wholesale price. The marginal cost for product j at the retail level is c_j^r. Finally, M is market size and $s_j(p)$ is defined in Equation (3) as the market share of product j.

Assuming a pure-strategy Nash equilibrium in retail prices, the first-order condition for product j is

$$s_j + \sum_{k \in \Omega^r} [p_k - p_k^w - c_k^r] \frac{\partial s_k}{\partial p_j} = 0. \quad (5)$$

Switching to matrix notation, define $[A * B]$ as the element-by-element multiplication of two matrices A and B of the same dimension. Let T^r be an ownership matrix with the general element $T^r(k, j) = 1$ if products k and j are sold by the same retailer, and $T^r(k, j) = 0$ otherwise. Let Δ^r be a matrix with the general element $\Delta^r(k, j) = \partial s_j / \partial p_k$. Δ^r captures demand substitution patterns with respect to changes in the retail prices of all products. Solving Equation (5) yields a vector of the retail price-cost margins m^r for all products:

$$m^r = p - p^w - c^r = -[T^r * \Delta^r]^{-1} s(p), \quad (6)$$

where p, p^w, and $s(p)$ are vectors of retail and wholesale prices, and market shares, respectively.

2.4. Wholesale Margins

The generalized Nash bargaining solution over the wholesale price of product j is defined as the maximand of the so-called generalized Nash product

$$(\pi_j^r(p_j^w) - d_j^r)^{\lambda} (\pi_j^w(p_j^w) - d_j^w)^{1-\lambda}. \quad (7)$$

$\pi_j^r(p_j^w)$ and $\pi_j^w(p_j^w)$ are the profits to the retailer and the manufacturer if the negotiations succeed, and d_j^r and d_j^w are the so-called disagreement payoffs that are obtained if the negotiations fail.

The Nash bargaining solution has the property that the outcome is more favorable to a party the higher its disagreement profit. If, say, the incremental profit of product j to the retailer is small, then the manufacturer must charge a relatively low wholesale price to motivate the retailer to carry the product in the first place. Hence, disagreement profits are an important determinant of the parties' bargaining position or endogenous bargaining power.

The generalized Nash bargaining solution captures bargaining power in another, equally important way, namely, through the bargaining power parameter λ. This parameter captures factors that may influence the outcome of the bargaining process such as the tactics employed by the parties, the procedure through which the negotiations are conducted, the information structure, and differences in time preference between the parties (Muthoo 1999). In our setting λ is the bargaining power of the retailer and $(1 - \lambda)$ that of the manufacturer. The higher λ, the more favorable is the outcome of the bargaining process to the retailer. In the empirical application we let the bargaining power parameter vary by manufacturer-retailer pair in one of the estimated model specifications (see §4.3 for details). To keep notation simple, we chose not to index λ.

If the negotiations succeed and product j is being sold to consumers, then the payoffs to the retailer and manufacturer are, respectively,

$$\begin{aligned} \pi_j^r(p_j^w) &= \underbrace{(p_j - p_j^w - c_j^r)}_{m_j^r} M s_j(p), \\ \pi_j^w(p_j^w) &= \underbrace{(p_j^w - c_j^w)}_{m_j^w} M s_j(p), \end{aligned} \quad (8)$$

where c_j^w represents the marginal costs for product j at the wholesale level. Clearly, the wholesale price determines how the total channel profits $\pi_j^r(p_j^w) + \pi_j^w(p_j^w) = (p_j - c_j^r - c_j^w) M s_j(p)$ are split between the manufacturer and the retailer. That is, the outcome of the bargaining game determines what slice of the pie goes to retailers and manufacturers. The size of the pie is determined by the retail price as the outcome of Bertrand-Nash competition between retailers and, in turn, depends on demand substitution patterns (see Equation (6)). Of course, the size of the pie also depends on the bargaining process between retailers and manufacturers since retail and wholesale prices are determined jointly in equilibrium.

Turning to disagreement profits, recall our assumption that bargaining takes place pairwise between one manufacturer and one retailer at a time. Taken literally, this implies that if the negotiations over the wholesale price of product j break down, then product j simply will not be sold, resulting in disagreement profits of $d_j^r = d_j^w = 0$. In general, disagreement payoffs and the bargaining power parameter jointly affect the outcome. As a consequence of setting disagreement profits to zero, we would capture the power of the parties by the bargaining power parameter alone. Of course, since it reflects both the exogenous bargaining skills and the endogenous disagreement payoffs, it is unclear how to interpret the resulting parameter estimate. Also, if disagreement profits are actually nonzero, contrary to our assumption, then we expect the estimates of all our parameters to suffer from misspecification bias.

To define the disagreement profits, we need to figure out what proportion of the market share of product j, which is the subject of the negotiation between a given retailer r and manufacturer b, will get allocated to the other products carried by the retailer/manufacturer. The way the market share will be allocated to the other products depends on the estimated demand substitution patterns. We first need to define the difference between the market share of the other products if product j is offered and if it is not:

$$\Delta s_k^{-j}(p) = \int \frac{\exp(\delta_k + \mu_{ik})}{1 + \sum_{l \in \Omega \setminus \{j\}} \exp(\delta_l + \mu_{il})} - \frac{\exp(\delta_k + \mu_{ik})}{1 + \sum_{l \in \Omega} \exp(\delta_l + \mu_{il})}\, dF(\mu). \tag{9}$$

Hence, the disagreement profits of a given retailer and manufacturer are given by

$$\begin{aligned} d_j^r &= \sum_{k \in \Omega^r \setminus \{j\}} \underbrace{(p_k - p_k^w - c_k^r)}_{m_k^r} M \Delta s_k^{-j}(p), \\ d_j^w &= \sum_{k \in \Omega^w \setminus \{j\}} \underbrace{(p_k^w - c_k^w)}_{m_k^w} M \Delta s_k^{-j}(p), \end{aligned} \tag{10}$$

where Ω^w is the set of products sold by manufacturer w. What matters is the incremental profit generated by product j when it is sold over when it is not sold.

Taking the derivative of Equation (7) with respect to p_j^w and setting it equal to zero yields the first-order condition:

$$\lambda(\pi_j^r - d_j^r)^{\lambda-1} \frac{\partial \pi_j^r}{\partial p_j^w} (\pi_j^w - d_j^w)^{1-\lambda} + (\pi_j^r - d_j^r)^{\lambda} (1-\lambda)(\pi_j^w - d_j^w)^{-\lambda} \frac{\partial \pi_j^w}{\partial p_j^w} = 0. \tag{11}$$

Simplifying Equation (11) and rearranging terms, we obtain

$$\lambda(\pi_j^w - d_j^w) \frac{\partial \pi_j^r}{\partial p_j^w} + (1-\lambda)(\pi_j^r - d_j^r) \frac{\partial \pi_j^w}{\partial p_j^w} = 0. \tag{12}$$

Substituting for the derivatives $\partial \pi_j^r / \partial p_j^w = -M s_j(p)$ and $\partial \pi_j^w / \partial p_j^w = M s_j(p)$ and solving for $\pi_j^w - d_j^w$ leads to

$$\pi_j^w - d_j^w = \frac{1-\lambda}{\lambda} (\pi_j^r - d_j^r). \tag{13}$$

Equation (13) relates wholesale to retail margins. Intuitively, as retailers and manufacturers bargain over wholesale prices, they determine how profits are split between the channel members.

Stacking Equation (13) for all products thus yields

$$T^w * \begin{bmatrix} s_1 & -\Delta s_2^{-1} & \dots & -\Delta s_N^{-1} \\ -\Delta s_1^{-2} & s_2 & \dots & -\Delta s_N^{-2} \\ \vdots & \vdots & \ddots & \vdots \\ -\Delta s_1^{-N} & -\Delta s_2^{-N} & \dots & s_N \end{bmatrix} \begin{bmatrix} m_1^w \\ m_2^w \\ \vdots \\ m_N^w \end{bmatrix} = \frac{1-\lambda}{\lambda} T^r * \begin{bmatrix} s_1 & -\Delta s_2^{-1} & \dots & -\Delta s_N^{-1} \\ -\Delta s_1^{-2} & s_2 & \dots & -\Delta s_N^{-2} \\ \vdots & \vdots & \ddots & \vdots \\ -\Delta s_1^{-N} & -\Delta s_2^{-N} & \dots & s_N \end{bmatrix} \begin{bmatrix} m_1^r \\ m_2^r \\ \vdots \\ m_N^r \end{bmatrix}, \tag{14}$$

where the ownership matrix T^w has the general element $T^w(k, j) = 1$ if products k and j are sold by the same manufacturer, and $T^w(k, j) = 0$ otherwise. Switching to matrix notation, we have

$$m^w = \frac{1-\lambda}{\lambda} [T^w * S]^{-1} [T^r * S] m^r, \tag{15}$$

where S is the matrix of shares and changes in shares defined above. Comparing the above expression to Equation (16) nicely shows the difference between this formulation and the one where disagreement profits are normalized to zero. In this case, the split of channel profits depends not only on the exogenous bargaining power parameter but also on the relative bargaining positioning that comes from the substitution patterns on the demand side (how likely that the unit of demand in case of disagreement goes to another set of products in one's portfolio) and product market competition.

If both manufacturers and retailers are single-product firms, then $T^r = T^w = I$, where I is the identity matrix, and Equation (15) reduces to

$$m_j^w = p_j^w - c_j^w = \frac{1-\lambda}{\lambda}(p_j - p_j^w - c_j^r) = \frac{1-\lambda}{\lambda} m_j^r. \tag{16}$$

In this case the split of profits is solely driven by the exogenous bargaining power parameter. In fact, the exogenous bargaining power parameter is the share of the channel margin accruing to the retailer. The same result obtains if we specify that disagreement profits are zero ($d_j^w = d_j^r = 0$).

Returning to the general case with multiproduct firms, substituting for retail margins m^r using Equation (6) yields

$$m^w = -\frac{1-\lambda}{\lambda}[T^w * S]^{-1}[T^r * S][T^r * \Delta^r]^{-1}s(p). \quad (17)$$

Adding Equations (6) and (17) and using the fact that channel margins are the sum of wholesale and retail margins, $m = m^w + m^r$, we have

$$p - c^w - c^r = -\left(\frac{1-\lambda}{\lambda}[T^w * S]^{-1}[T^r * S] + I\right)[T^r * \Delta^r]^{-1}s(p), \quad (18)$$

where I is the identity matrix.

Once we specify the marginal costs as a function of observable cost factors and an unobservable shock, Equation (18) becomes the basis for the estimation. Because we cannot separate the marginal cost at the retail level from that at the wholesale level without additional data, we follow the empirical literature and specify the overall marginal cost of product j as $c_j = c_j^r + c_j^w = z_j\theta + \eta_j$, where z is a vector of cost shifters and the term η_j accounts for unobserved (by the econometrician) shocks to marginal cost.

3. Data

3.1. Sales and Marketing Mix

To estimate the demand system, we use data collected by MADAKOM (Cologne, Germany) from a national sample of stores belonging to six major retail chains: Edeka, Markant, Metro, Rewe, Spar, and Tengelmann. These chains account for about 80% of the German food market. Our conversations with both retailers and manufacturers indicate that competition in Germany is at the national level, and thus we define our market at this level, rather than analyzing regional markets. The data contain weekly information on the sales, prices, and promotional support for all brands in the ground coffee category from 2000–2001. In addition, we received monthly brand-level advertising expenditures data for all brands from an anonymous manufacturer. Because strategic pricing and promotion decisions are made at the chain (key account) level, we aggregate the data correspondingly. In what follows, the terms chain and retailer are used interchangeably.

We focus on seven major national brands: Jacobs, Onko, Melitta, Idee, Dallmayr, Tchibo, and Eduscho, which together comprise more than 95% of the market. Table 1 gives an overview of the data.

For the empirical analysis we include an outside good as well. To calculate its share, we use the total sales within each week in each retailer. From the LZ Report (*Lebensmittel Zeitung* 2006) we collected data about the average amount spent per shopping trip in each of the six different retailers. We used this information to estimate retail store traffic and applied this number to calculate market potential.

Table 1 Mean Values and Standard Deviations (in Parentheses) of Sales and Marketing-Mix Data

Brand	Share (%)	Prices	Promotion	Advertising
Jacobs	30.57 (13.49)	7.01 (0.64)	32.65 (26.71)	106.42 (48.91)
Onko	8.39 (8.53)	6.36 (0.81)	25.31 (30.88)	12.93 (19.48)
Melitta	19.67 (14.62)	6.47 (0.65)	31.24 (28.45)	97.56 (49.19)
Idee	1.97 (3.18)	7.93 (0.62)	18.20 (25.97)	9.09 (10.30)
Dallmayr	12.06 (10.56)	7.79 (0.71)	25.52 (29.50)	88.72 (29.40)
Tchibo	14.42 (8.23)	8.03 (0.43)	22.75 (8.39)	83.47 (45.57)
Eduscho	12.92 (7.66)	6.82 (0.42)	28.01 (11.95)	71.65 (52.74)

3.2. Cost

We obtained commodity prices of coffee from the New York Stock Exchange.[6] We then adjusted these dollar prices for the exchange rate. Another adjustment needed was for the tax of 4.328 DEM/kilogram of coffee. Further, there is a 15% weight loss in the process of roasting the coffee that also needs to be taken into account when calculating the cost for one unit of roast coffee. We also tested the inclusion of cost shifters related to packaging costs, transportation, wages, and energy costs. However, it turned out that their inclusion yielded either insignificant or meaningless results, so we decided to retain only coffee cost.

3.3. Determinants of Bargaining Power

The MADAKOM data set contains information on quantities and revenues for over 900 product categories in the six retail chains under investigation. We use this information to derive measures describing both the manufacturers and the retailers by considering all categories excluding ground coffee, thus ensuring that our measures are exogenous to the coffee market.

3.3.1. Firm Size. Firm size is one of the main determinants of profitability and negotiating power. A small manufacturer has less of an impact on a retailer's profitability and is therefore more likely to offer the retailer better terms than a large manufacturer. We expect that larger manufacturers would

[6] There are five contracts: coffee price mean high nearby, coffee price mean high second nearby, coffee price mean high third nearby, coffee price mean high fourth nearby, and coffee price mean high fifth nearby. These contracts differ in the time of expiration, which varies from one day to several months. We selected the contract with the highest correlation with shelf prices, coffee price mean high second nearby.

Table 2 Manufacturer Size (Number of UPCs)

Brand	Average	Std. dev.	Minimum	Maximum
Jacobs/Onko	238.73	8.29	223	259
Melitta	47.86	2.24	42	53
Idee	20.48	1.32	17	23
Dallmayr	19.37	1.94	15	24
Tchibo/Eduscho	47.59	3.68	39	57

command a larger share of channel profits (see, e.g., Hall and Weiss 1967, Kaen and Baumann 2003). The size of a retailer is also an important determinant of its share of channel profits. Larger retailers may be better able to extract price concessions from manufacturers, a phenomenon known as countervailing power (Galbraith 1952).

Manufacturer size is calculated as the number of UPCs per manufacturer across all product categories carried by the six retailers (see Table 2). Alternative variables explored include total manufacturer revenues and sales in substitute product categories. We proxy retailer size by total sales in million DEM (see Table 3). We also tested additional measures of retailer size such as the total floor space, the number of checkouts, the total number of categories carried, or the total number of UPCs offered but they were all highly correlated.

3.3.2. Store Brands. Because one of the major reasons for the alleged shift in retailer power is the growth of store brands in the last decades, store brands have been at the center of attention in existing empirical studies of distribution channels (Raju et al. 1995, Narasimhan and Wilcox 1998, Scott-Morton and Zettelmeyer 2004, Ailawadi and Harlam 2004). Manufacturers have responded to the wide introduction of store brands by adjusting their pricing strategies, mostly by lowering their prices or introducing lower-priced alternatives. We calculate the store-brand share as the unit volume share of store-brand sales in 36 representative categories within each retail chain.

Besides the share of the store brands, another important factor is their positioning vis-à-vis national brands (Scott-Morton and Zettelmeyer 2004). In an extensive empirical study, Pauwels and Srinivasan (2004) found that prices of premium-priced brands increase after the store-brand entry, whereas those of second-tier brands decrease. Arguably, the higher the perceived quality of the store brand, i.e., the more similar it is to the leading brands, the higher the margins that would accrue to the retailer. The more similar store brands are to the national brands, the more likely manufacturers will be to differentiate their products and due to increased differentiation increase retail prices leading to higher margins. Store-brand positioning is thus measured as the price ratio of store brand to the national brands averaged across a representative set of 36 product categories. The idea is that if the store brand is close in terms of quality to national brands, then it can also justify a price close to that of national brands. Table 3 provides descriptive statistics.

Table 3 Retailer Characteristics

Retailer	Size of retailer	Store-brand share	Store-brand positioning	Assortment depth
Edeka	7,057,104 (988,523)	7.87 (0.47)	0.752 (0.027)	9.519 (0.271)
Markant	9,631,890 (1,380,622)	3.54 (0.47)	0.746 (0.065)	10.806 (0.480)
Metro	11,431,924 (1,902,021)	12.15 (1.19)	0.556 (0.019)	14.056 (0.353)
Rewe	1,679,360 (277,300)	14.75 (1.50)	0.665 (0.012)	7.778 (0.396)
Spar	651,485 (138,856)	8.93 (1.03)	0.701 (0.017)	8.415 (0.408)
Tengelmann	2,801,372 (629,895)	15.55 (1.61)	0.588 (0.010)	6.941 (0.339)

Note. Averages and standard deviations are in parentheses.

3.3.3. Assortment. In addition to retailer size and store brands, merchandise assortment is a further dimension of retail differentiation (Dhar and Hoch 1997). In choosing a retailer, consumers trade off the time and effort required to visit the outlet with the probability of finding the items on their shopping list (Baumol and Ide 1956). The assortment of products carried by a retailer increases consumer willingness to pay and thus overall margins, at least up to a point (for an example of decreasing returns to assortment, see Broniarczyk et al. 1998). Because it increases store loyalty, it also may give retailers more clout vis-à-vis manufacturers in negotiating the way profits are split. Assortment depth has been operationalized as the average number of UPCs across all product categories (see Table 3 for data description).

4. Empirical Analysis

4.1. Estimation and Identification

We first estimate demand and then supply. This estimation approach ensures the consistency of the demand estimates even in the presence of supply-side misspecifications in addition to reducing the computational burden. The cost is the efficiency of the estimates. Our demand model explicitly acknowledges the presence of factors unobserved to the researcher that may affect demand such as changes in shelf-space allocation (Besanko et al. 1998, Villas-Boas and Winer 1999). To account for the potential endogeneity of prices because of the presence of these changes in unobserved attributes, and because we use a random-coefficients specification to capture consumer heterogeneity, we use a GMM procedure with the price of raw coffee along with the other exogenous demand shifters interacted with brand and retailer dummies as instruments.

The intuition behind our instrumentation strategy is in line with recent empirical work in similar product categories (Besanko et al. 2005, Villas-Boas and Zhao 2005), which uses factor prices and exogenous product characteristics. The price of raw coffee is determined in worldwide commodity markets and can thus be taken as exogenous to German coffee manufacturers. As raw coffee is the main ingredient of ground coffee, we can expect that the prices will be correlated. Further note that assortment depth, store-brand share, and store-brand positioning are exogenous to unobserved determinants of demand for coffee, by construction, as they are calculated from categories other than coffee. Our estimation results suggest that the instruments used are important in order to consistently estimate demand parameters (the ordinary least-squares price estimates, which we do not report for parsimony reasons, are of much lower absolute magnitude). The R^2 of the first-stage regression is 0.831, and the F-test of the significance of the cost instruments in the first-stage regression is 30.75 with a p-value of 0.000.

4.1.1. Identification. Following an argument analogous to Bresnahan (1982) for identification of oligopoly models, we can establish that the parameters in the demand system are identified. The identification of the price parameter, which is critical for our margin calculation, relies on the fact that unobserved determinants of demand are uncorrelated with input prices. Our estimation procedure ensures that this is indeed the case (see also the above discussion on the instruments used).

Given that demand is identified, we turn to supply and argue that the bargaining power parameter λ is identified given the assumptions on the nature of retail competition. Our estimation equation on the supply side has the form

$$p = z\theta + \frac{1-\lambda}{\lambda}\widetilde{m}^w + m^r + \eta, \qquad (19)$$

where the retail margins m^r are given by Equation (6) as $-[T^r * \Delta^r]^{-1}s(p)$, and the part of the wholesale margins that is independent of λ, $\widetilde{m}^w$ is given by Equation (17) as $-[T^w * S]^{-1}[T^r * S][T^r * \Delta^r]^{-1}s(p)$.

With the substitution patterns from the demand model in hand, our assumptions on retail competition determine m^r and $\widetilde{m}^w$. That is, we have m^w up to the scale factor $(1-\lambda)/\lambda$. As Equation (19) emphasizes, what remains to be estimated on the supply side are the cost parameters θ and the bargaining power parameter λ that enters nonlinearly into Equation (19). An argument analogous to Nevo (1998) for the identification of the conduct parameter in oligopoly models with differentiated products and constant marginal cost establishes that λ is identified. Intuitively, we ask how much does the retail margin, predicted by (known) demand, have to be scaled up to explain the difference between price and cost.

There are several assumptions required to identify the bargaining power parameter. First, we can only identify the impact of bargaining power on the marginal price decisions. If bargaining impacts nonmarginal decisions, like fixed transfers, then it cannot be identified from the pricing decisions. Similarly, our estimation Equation (19) relies on the assumption of independent bargaining processes; without it, the equation would be misspecified and the bargaining power parameter not identified.[7] Finally, identification is conditional on the retail-level game. Under a different retail-level game, different retail margins m^r would be calculated, and in turn, a different bargaining power parameter λ would be obtained. For example, collusive retailers with high bargaining power may be observationally equivalent to competitive retailers with low bargaining power. Considering the institutional reality of the market analyzed, however, we feel comfortable with our assumption that retailers compete in a Bertrand-Nash fashion as opposed to colluding, for example. If we had access to wholesale prices, this assumption could be tested empirically.

Intuitively, there may be more than one way to explain a given difference between price and cost. Hence, just as in other channel models such as Kadiyali et al. (2000) and Villas-Boas (2007), identifying the interactions between manufacturers and retailers relies on the modeling assumptions about how retailers interact with consumers and with each other. To identify the bargaining power parameter λ separately from retail competition, what is needed are wholesale prices and data on the marginal costs of both manufacturers and retailers. However, the latter two, especially, are often impossible to obtain for all market participants.

4.2. Demand Estimates

The demand model estimates are presented in Table 4. On average, price has a significant and negative impact on utility. Consumers are very price sensitive. Our model implies own price elasticities ranging from −5.7 to −6.9, consistent with the ones found in Guadagni and Little (1983), Krishnamurthi and Raj (1991), and other previous empirical studies of the ground coffee category. The estimated cross-chain elasticities range from 0.01 between Spar and Metro up to 0.31 between Metro and Edeka, suggesting that there is competition across chains. Promotion and advertising coefficients are significant and positive, and are thus factors that expand demand. There is a significant and negative time trend in line with industry evidence from Germany that shows that yearly per capita consumption fell by 10% from 1990 to 2002. Assortment depth is positive and significant, consistent with the idea that the service level

[7] We thank an anonymous referee for drawing our attention to this point.

Table 4 Parameter Estimates of Demand Model

Parameter	Estimate	Std. error
Marketing mix		
Price	−1.0329	(0.1335)
Standard deviation	0.1344	(0.0847)
Promotion	0.8507	(0.0547)
Advertising	0.7813	(0.1451)
Trend	−0.0083	(0.0005)
Store-brand share	−2.3334	(0.7504)
Store-brand positioning	−0.1724	(0.2245)
Assortment depth	0.1055	(0.0250)
Brand effects		
Jacobs	0.5105	(0.5622)
Onko	−1.9000	(0.5444)
Melitta	−0.5733	(0.5498)
Idee	−1.2904	(0.5756)
Dallmayr	0.1467	(0.5725)
Tchibo	1.1852	(0.5773)
Eduscho	−0.3207	(0.5608)
Retailer effects		
Edeka	0.5046	(0.0903)
Markant	0.4837	(0.1269)
Metro	0.5479	(0.1771)
Rewe	−0.2852	(0.0352)
Spar	−1.3634	(0.0722)
SSE	0.0389	
Number of obs./parameters	4,279/21	

Table 5 Brand-Retailer Fixed-Effect Estimates of λ

	Edeka	Markant	Metro	Rewe	Tengel.	Spar	Average
Jacobs	0.461	0.538	0.418	0.417	0.376	0.397	0.434
	(0.014)	(0.025)	(0.028)	(0.009)	(0.010)	(0.008)	
Onko	0.615	0.623	0.463	0.512	0.418	0.437	0.511
	(0.020)	(0.019)	(0.026)	(0.041)	(0.010)	(0.011)	
Melitta	0.656	0.804	0.513	0.534	0.453	0.573	0.589
	(0.008)	(0.022)	(0.011)	(0.014)	(0.017)	(0.009)	
Idee	0.377	0.395	0.358	0.317	0.274	0.333	0.342
	(0.007)	(0.008)	(0.021)	(0.011)	(0.017)	(0.019)	
Dallmayr	0.392	0.404	0.325	0.301	0.263	0.320	0.334
	(0.007)	(0.006)	(0.007)	(0.021)	(0.009)	(0.012)	
Tchibo	0.344	0.353	0.358	0.343	0.338	0.332	0.345
	(0.013)	(0.005)	(0.005)	(0.007)	(0.018)	(0.010)	
Eduscho	0.566	0.590	0.577	0.570	0.524	0.541	0.561
	(0.016)	(0.021)	(0.007)	(0.007)	(0.007)	(0.019)	
Average	0.487	0.530	0.430	0.428	0.378	0.419	
SSE	1,059.00						
Number of obs./parameters	4,259/51						

Note. Standard errors are in parentheses.

of a retailer increases consumer willingness to pay. Consumers prefer retailers with smaller private-label programs as evidenced by the negative effect of store-brand share. If retailers do not engage in high-quality programs, which we control for, they usually offer a broader set of inexpensive goods, which makes for a less attractive shopping environment. Store-brand positioning does not have a significant impact on the demand for coffee: in our time period (2000–2001) consumers did not value high-quality private labels, nor had the retailers at that point realized all possible benefits of positioning their private labels closer to national brands.

4.3. Supply Estimates

4.3.1. Magnitude of Bargaining Power. To impose as little structure as possible on the bargaining dynamics between the different parties, we specify the bargaining power parameter as brand-retailer-specific fixed effects (λ_{br}). All estimates of the bargaining power parameter are statistically significant; see Table 5. They are also statistically different for many brand-retailer pairs. Our estimates thus suggest that bargaining power is not an inherent characteristic of a retailer or a manufacturer but varies depending on the identity of the negotiating parties. That is, one manufacturer can be powerful vis-à-vis a particular retailer but not another.

Overall, our estimates indicate that in the market for ground coffee in Germany, power lies predominantly with the manufacturers: with the exception of Melitta and Eduscho, manufacturers are significantly more powerful than retailers ($1-\lambda > \lambda \Leftrightarrow \lambda < \frac{1}{2}$). We also tested whether there is a significant change in the bargaining parameter over time by estimating a year 2000 dummy for each retailer (this is the first year of our data) in addition to the fixed effects reported in Table 5. The estimated interaction effects are significant and positive, thus indicating that the average power of the retailers is lower in the second year of our sample period. Of course, to conclude that there is a definite negative trend, one would need a longer time series. Given the availability of such data, our model can easily be applied to empirically determine how bargaining power has changed over time.

Bargaining power varies significantly across manufacturers. Dallmayr has the highest degree of bargaining power vis-à-vis retailers, closely followed by Idee and Tchibo. It thus appears that market share does not entirely explain bargaining power, especially since we also observe that the top-selling brand, Jacobs, has average bargaining power. Retailer bargaining power also varies significantly. Again, market share does not correlate perfectly with the ability to extract more profits in the channel: the biggest retailer, Metro, does not have the highest overall bargaining power. In fact, Metro has a medium bargaining power parameter that is comparable in size and statistically not different from the bargaining power parameter of Rewe.[8] Edeka and Markant show the highest bargaining power parameters.

[8] A possible explanation why Metro, the largest retailer in our study, does not have the highest bargaining power may be that

Table 6 Manufacturer Margin Shares, Profits, and Bargaining Power

	Jacobs	Onko	Melitta	Idee	Dallm.	Tchibo	Eduscho
Manufacturer margin (m^w)	1.37	1.03	0.76	1.94	2.06	1.94	0.80
Total margin ($m^r + m^w$)	2.37	2.03	1.77	2.95	3.06	2.94	1.80
Manufacturer margin/Total margin ($m^w/(m^r + m^w)$)	0.57	0.49	0.41	0.65	0.66	0.66	0.44
Bargaining power ($1 - \lambda$)	0.57	0.49	0.41	0.66	0.67	0.66	0.44
Market share ($s/(1 - s_0)$)	32.15	5.13	18.74	2.32	12.21	17.31	12.24
Retail price (p)	7.01	6.45	6.47	7.93	7.79	8.03	6.82
Wholesale price (p^w)	6.00	5.45	5.46	6.93	6.78	7.02	5.82

Interestingly, the magnitude of the bargaining power parameter for both manufacturers and retailers is only weakly correlated with the brand and chain constants. This means that brand and chain equity do not fully translate into bargaining power. For example, Onko has the lowest brand constant but not the lowest bargaining power. On the other hand, Tchibo has the highest brand preference but its bargaining power is below that of other brands. Similarly, Metro, which has the highest chain constant, has similar bargaining power to Rewe, which enjoys a much smaller chain preference.

In sum, bargaining power is not an inherent characteristic of a manufacturer and retailer but is specific to a manufacturer-retailer pair. Moreover, bargaining power is distinct from market share, brand equity, and chain equity.

4.3.2. Bargaining Position, Bargaining Power, and Margins in the Channel. Tables 6 and 7 present separately for manufacturers (averaged across retailers) and retailers (averaged across manufacturers) the total margins, share of margins, and bargaining power parameters along with market shares as well as wholesale prices and retail prices for comparison purposes.

Table 6 shows that manufacturer margins vary substantially across brands. We estimate a very small margin for Melitta (0.76) and Eduscho (0.80), whereas the margin goes up to 1.94 for both Idee and Tchibo, and 2.06 for Dallmayr. This finding makes intuitive sense: Dallmayr is a high-price, high-quality brand. It thus seems very reasonable that it has a large margin. In contrast, Eduscho, which has low margins, has been having serious problems over the last few years, and its market share has continuously declined.[9] Furthermore, we observe that the ratios of the manufacturer margin to the total margin and the bargaining power of the manufacturer ($1 - \lambda$) are almost

nonfood items are a large part of the offering at that retailer. Metro makes more than 50% of its sales in nonfood categories. It also has primarily large stores, whereas the other retailers have both small and large stores.

[9] See SevenOne Media (2006).

Table 7 Retailer Margin Shares, Profits, and Bargaining Power

	Edeka	Markant	Metro	Rewe	Spar	Tengelm.
Retailer margin (m^r)	1.01	1.02	1.02	0.99	0.99	0.99
Total margin ($m^r + m^w$)	2.19	2.07	2.46	2.48	2.80	2.51
Retailer margin/Total margin ($m^r/(m^r + m^w)$)	0.49	0.53	0.43	0.42	0.37	0.41
Bargaining power (λ)	0.49	0.53	0.43	0.43	0.38	0.42
Market share ($s/(1 - s_0)$)	21.91	32.67	32.54	5.70	1.90	5.37
Retail price (p)	6.97	6.85	7.24	7.26	7.58	7.37
Wholesale price (p^w)	5.96	5.83	6.22	6.27	6.59	6.38

identical within each brand. This result indicates the absence of a strong effect of the bargaining position of a manufacturer, possibly because of the importance of the outside good relative to the inside goods. Margins and profits are split between manufacturers and retailers according to the respective bargaining power of manufacturers and retailers.

Table 7 reveals that retail margins vary much less across retailers than manufacturer margins vary across manufacturers. Retail margins are tied down by retailer pricing power vis-à-vis consumers. Our findings therefore indicate that no retailer enjoys substantially more pricing power than its peers.

Finally, more bargaining power at the manufacturer goes hand in hand with an increase of the total margin as Table 6 shows. Table 7 further reveals that total margins are smaller for the larger retailers than for the smaller retailers. Total margins are highest at Spar, the smallest retailer, and total margins are lowest at Markant, the second largest retailer. This finding suggests the following: when the total margin decreases, then the slice of the retailer increases. Hence, retailers get a larger piece of a smaller pie or the same piece of a larger pie. We discuss this point in more detail below, where we conduct counterfactual simulations to determine the impact of changes in manufacturer and retailer characteristics in the equilibrium of our model.

4.3.3. Determinants of Bargaining Power. To gain further insights into the determinant of bargaining power between particular pairs of manufacturers and retailers, we directly relate the exogenous bargaining power parameter to the manufacturer and retailer characteristics described in §3. The reported estimates are obtained through the estimation of the bargaining model in Equation (19), where λ is specified as a function of the exogenous variables. Of course, our analysis of the determinants of bargaining power is aimed at detecting correlations between manufacturer and retailer characteristics and bargaining power. Although the existing literature suggests a particular direction of causality, it is conceivable that more bargaining power may lead to an increase in firm size and more or less emphasis on service, at least in the long run.

Table 8 Bargaining Power as a Function of Manufacturer and Retailer Factors

Parameter	Estimate	Std. error
Retailer size	0.0413	(0.0018)
Manufacturer size	−0.0535	(0.0166)
Store-brand share	−0.0974	(0.0580)
Store-brand positioning	0.1965	(0.0331)
Assortment depth	−0.0060	(0.0009)
Brand effects		
Jacobs	0.6091	(0.0955)
Onko	0.6657	(0.0956)
Melitta	0.6385	(0.0716)
Idee	0.3871	(0.0580)
Dallmayr	0.3729	(0.0580)
Tchibo	0.4707	(0.0715)
Eduscho	0.6671	(0.0722)
SSE	1,155.00	
Number of obs./parameters	4,259/21	

Note. To control for the extreme variation in the manufacturer size variable we include brand-specific fixed effects λ_b in the estimation to control for giant manufacturers such as Kraft Jacobs Suchard and Tchibo.

The results in Table 8 are largely in line with our expectations. A larger retailer has more bargaining power as does a larger manufacturer (the effect of an increase in manufacturer size on the estimated bargaining power parameter is negative). The effects of retailer size and that of manufacturer size are comparable in magnitude. Hence, to the extent that retailers have grown faster than manufacturers, our results support a shift of power from manufacturers to retailers.

Store brands have been at the center of attention of existing empirical studies of distribution channels (Raju et al. 1995, Narasimhan and Wilcox 1998, Scott-Morton and Zettelmeyer 2004, Ailawadi and Harlam 2004). The mere presence of store brands does not seem to affect the relative bargaining power of retailers. However, store-brand positioning has a strong positive impact; i.e., retailers gain bargaining power by making their store brands close substitutes to national brands. Since the coefficient of store-brand positioning in demand is not significantly different from zero (see Table 4), retailers can improve their bargaining power through store-brand positioning, and this does not seem to hurt demand for national brands. This result echoes Ailawadi and Harlam's (2004, p. 163) recommendation that "retailers should try to position the store brand on reasonable quality, not just on low price."

Service at the retail level, measured by assortment depth, provides interesting results that work in opposite directions. Assortment depth positively affects demand and, in this way, the bargaining position of a retailer. On the other hand, assortment depth has a negative impact on the bargaining power of the retailer. It seems that a service orientation makes the retailer bargain less aggressively as he is committed to offering a large number of UPCs to maintain the image of carrying a high-variety assortment.

4.3.4. Changes in Bargaining Power and Demand Characteristics. The estimated supply-side parameters give us an idea of the marginal effects on total margins and margin splits from changing exogenous manufacturer and retailer characteristics. Some of these characteristics affect both bargaining power and demand and thus indirectly bargaining position also. The goal now is to assess the total effects in market equilibrium. Using our parameter estimates, we therefore perform what-if analyses to assess how changes in the exogenous manufacturer and retailer characteristics affect the endogenous variables such as total margins and margin splits in equilibrium. We also simulate the response to changes in the price parameter and the brand intercepts to compare the effect of higher market power to higher retailer bargaining power on channel profits and the division of surplus.

Our analysis shows in an empirically rich and realistic setting that the overall profitability of the distribution channel is not a zero-sum game. The recent theoretical literature suggests that an increase in the bargaining power of the retailer decreases the distortion because of double marginalization and hence leads to a more profitable distribution channel (Iyer and Villas-Boas 2003, Dukes et al. 2006). Recall from Table 8 that an increase in retailer size or a decrease in manufacturer size adds to retailer bargaining power. Although these two characteristics enter only in the specification of the bargaining power parameter and not the demand specification, they nevertheless affect the size of the pie: the overall profitability of the channel increases with retailer size but decreases with manufacturer size.

To better understand these effects, consider a 50% increase in retailer size.[10] This moves us further away from a Stackelberg game and thus lowers the wholesale margin relative to the baseline case by around 7%. Given that the wholesale margin is lower, there is a smaller double marginalization distortion and total profits in the channel increase by between 1% and 6% depending on the manufacturer and retailer.

However, not all channel members benefit from a more powerful retailer. Consider again the 50% increase in retailer size. The profits of the various retailers increase by between 5% and 9%. Also, the profits of Idee, Dallmayr, and Tchibo increase by between 1% and 3% and remain almost unchanged for Jacobs. In contrast, the profits of Onko, Melitta, and Eduscho decrease by between 2% and 4%. Recall

[10] To conserve space, we only report the relevant numbers of the counterfactual experiments in the text. The complete tables are available from the authors upon request.

from Table 5 that Idee, Dallmayr, and Tchibo are the brands with the lowest values of the bargaining power parameter, $\lambda \approx 0.3$. Corollary 1 in Appendix A suggests that these manufacturers are close to Stackelberg leaders. Hence, decreasing their bargaining power (or, equivalently, increasing the bargaining power of the retailers vis-à-vis these manufacturers) does a lot to improve channel coordination. Idee, Dallmayr, and Tchibo thus benefit from facing more powerful retailers. In contrast, increasing the bargaining power of Onko, Melitta, and Eduscho beyond its baseline value of $\lambda \approx 0.6$ further distorts pricing. As a consequence, these manufacturers suffer from facing more powerful retailers.

A more powerful retailer may reduce the overall profitability of the distribution channel. Positioning store brands close to national brands increases retail bargaining power and reduces wholesale margins by around 24% for a 50% increase in the store-brand positioning variable and thus the double marginalization distortion.[11] Yet the overall profitability of the distribution channel falls by between 13% and 19% depending on the manufacturer and retailer. This result suggests that the conditions laid out by the theoretical literature for the presence of a powerful retailer to benefit all channel members may be overly stringent in real-world markets.

Indeed, in contrast to the recent theory literature, our estimates indicate that a larger assortment makes retailers less powerful but that this nevertheless benefits both parties. Since assortment depth has a direct, positive effect on demand, an increase in assortment depth leads to a much more profitable distribution channel as Tables 9 and 10 show. Although the increase in assortment depth weakens the bargaining power of the retailer and hence diminishes the retailer's slice of the pie, the profit of the retailer nevertheless increases. That is, the retailer gets a smaller slice of a larger pie. The manufacturer gets a larger slice of a larger pie. In sum, both parties win from more service at the retail level.

We further quantify the effect of the bargaining power parameter on channel profits at the heart of the theoretical literature and decompose it into its constituent parts (margins, quantities). Tables 9 and 10 indicate that the impact of bargaining power is mostly on manufacturer margins and quantities sold. The impact of bargaining power on retail margins is small because retail margins are tied down by the retailer's pricing power relative to consumers, meaning that retailers mostly pass on changes in wholesale prices to consumers. This shows the importance of distinguishing between the pricing power of retailers vis-à-vis consumers and the bargaining power of manufacturers vis-à-vis retailers.

The impact of varying the price parameter and the brand intercepts further reinforces this conclusion. Increasing the price parameter decreases the overall channel profitability as expected (by approximately 92% given a 50% increase in the price coefficient) as consumers become more price sensitive; similarly, increasing the brand intercepts increases the overall channel profitability as consumers value products more (depending on the retailer, by between 32% and 37% given a 50% increase in the brand constant). Interestingly, the impact on the division of profits is very small. A 50% change in the price parameter, for example, changes manufacturers' and retailers' shares of total margins by at most one percentage point. Hence, changes in market power have little effect on the distribution of surplus.

To further quantify the effects of a change in pricing power and a change in bargaining power, we compute the elasticity of the manufacturer's margin share and

Table 9 Percent Changes Relative to the Base Case of a 50% Increase in Assortment Depth on Manufacturer Margins, Total Margins, Prices, Quantities, and Profits

	Jacobs (%)	Onko (%)	Melitta (%)	Idee (%)	Dallm. (%)	Tchibo (%)	Eduscho (%)
Manufacturer margin (m^w)	14	14	13	14	15	15	15
Total margin ($m^r + m^w$)	8	7	6	9	10	9	6
Manufacturer margin/ Total margin ($m^w/(m^r + m^w)$)	5	8	7	5	4	5	7
Equilibrium price	3	2	2	4	4	3	2
Quantity in 1,000 units	36	42	48	27	23	28	48
Manufacturer profit in 1,000 DEM ($m^w s_b M$)	59	66	73	48	43	50	73
Total profits in 1,000 DEM ($(m^r + m^w)s_b M$)	50	55	60	41	37	42	60

Table 10 Percent Changes Relative to the Base Case of a 50% Increase in Assortment Depth on Retailer Margins, Total Margins, Prices, Quantities, and Profits

	Edeka (%)	Markant (%)	Metro (%)	Rewe (%)	Spar (%)	Tengelm. (%)
Retailer margin (m^r)	1	2	2	0	0	0
Total margin ($m^r + m^w$)	8	9	13	7	8	6
Retailer margin/ Total margin ($m^r/(m^r + m^w)$)	−6	−6	−9	−5	−8	−5
Equilibrium price	2	3	4	2	3	2
Quantity in 1,000 units	32	39	46	19	18	17
Retailer profit in 1,000 DEM ($m^r s_r M$)	33	41	49	19	18	17
Total profits in 1,000 DEM ($(m^r + m^w)s_r M$)	41	50	62	26	26	22

[11] The impact of store-brand positioning is much larger than that of retailer and manufacturer size because store-brand positioning has a direct impact on demand.

Table 11 Impact of Changes in Market Power vs. Retailer Bargaining Power (Arc Elasticities)

	Impact on margin share		Impact on total profit	
Brand	Change in β_i	Change in λ	Change in β_i	Change in λ
Jacobs	−0.03	−0.74	−3.64	0.64
Onko	−0.03	−1.02	−3.4	0.36
Melitta	−0.01	−1.43	−3.73	0.16
Idee	0.02	−0.53	−3.92	1.06
Dallm.	0.01	−0.5	−3.77	1.11
Tchibo	−0.01	−0.52	−4.3	1.13
Eduscho	−0.02	−1.27	−4.16	0.24

the total channel profits with respect to β and λ; see Table 11. Looking at the elasticities of channel profits with respect to λ, we confirm the theoretical prediction that a powerful retailer may improve channel coordination and thus increase overall channel profits. The bargaining power parameter λ has a clear effect on the manufacturer's margin share. Interestingly, for the three manufacturers who have the lowest margins, Onko, Melitta, and Eduscho, the share of the pie decreases more than 1%, whereas for the other manufacturers the drop is smaller than 1%. In our model, a retailer becomes powerful in the channel if he has (i) larger bargaining power and/or (ii) larger market power. In terms of the relative importance of those two forces, we conclude from Table 11 that changes in price sensitivity have significantly larger effects on total profits than changes in bargaining power. On the other hand, changes in price sensitivity have almost no effect on the way margins are split between the channel members.

5. Conclusions

In this paper we develop a bargaining model to obtain insights into the determinants of power in the channel. Our interpretation of the generalized Nash bargaining model follows the theoretical papers by Iyer and Villas-Boas (2003) and Dukes et al. (2006). We extend their insights to a rich empirical setting with heterogeneous consumers, and multiple competing manufacturers and retailers. The resulting framework is internally consistent and empirically tractable.

Part of our contribution is to draw a distinction between bargaining position and bargaining power. A party's bargaining position is endogenously determined from the substitution patterns on the demand side. Besides the bargaining positions, there are numerous other factors such as the negotiation skills of the parties, their patience, and their risk tolerance that affect the outcome of the negotiations between manufacturers and retailers. These factors are captured in the estimated bargaining power parameter. Our bargaining model thus provides a rationalization of the conduct parameter approach that is often used to relax the assumptions of a particular vertical interaction between manufacturers and retailers.

In our empirical analysis of the German market for coffee, we find that bargaining power varies among the different manufacturer-retailer pairs. This is an interesting result, suggesting that bargaining power is not an inherent characteristic of a firm but rather depends on the negotiation partner. Our bargaining model also allows us to investigate the role of the three main factors that have been blamed for the power shift from manufacturers to retailers in recent years (firm-size increases, store-brand introductions, and service-level differentiation). We find that firm size, store-brand positioning, and assortment depth can affect the way profits are split in the channel. Moreover, they can also lead to a change in total demand, thus affecting the overall profitability in the channel.

We confirm empirically that manufacturers and retailers are not playing a zero-sum game and should not only focus on the share of profits they obtain but also on total demand. Consistent with the theoretical literature, there can be cases where the slice of the pie that goes to one of the channel members may decrease, but the overall pie increases and compensates for the smaller share of profits. The push towards cooperation between manufacturers and retailers by assigning category captains may be evidence that the channel members have realized that they can share a larger pie by improving coordination in the channel.

In sum, the proposed bargaining framework provides a flexible way to investigate channel interactions empirically. We see a number of ways in which future work can apply and extend our model. For example, one critical assumption we make is that retailers and manufacturers bargain dyad-by-dyad and these bilateral negotiations are independent. Modeling interrelated bargaining between multiple manufacturers and retailers is a task that the theory literature has yet to accomplish. Our empirical framework can then be adapted to take such a model to the data. A second fruitful avenue for future research would be to explore how to incorporate quantity discounts into the negotiation process. Although not relevant for the German market, this issue is very important to allow for abiding by the restrictions imposed by the Robinson-Patman Act (U.S. Code 15 (1936), §13 et seq.). Another question that has been raised in earlier work (Gupta 1989) is that bargaining may take place over multiple issues. Retailer and manufacturers may negotiate not just wholesale price but also other terms, or they may bargain over multiple products (or even categories) simultaneously. Our bargaining model can be extended to capture the full complexity of the negotiations as more data on the contracts between manufacturers and retailers become available.

Appendix A. Vertical Nash and Manufacturer Stackelberg as Special Cases

In a Vertical Nash game, retail and wholesale prices are determined at the same time (Choi 1991). That is, retailers set their prices to maximize retail profits without knowing wholesale prices and manufacturers set their prices to maximize their profits without knowing retail prices. Manufacturers choose wholesale prices taking retail margins on their own products as given. In contrast, in a Manufacturer Stackelberg game, wholesale prices are set first and then retail prices are set after wholesale prices are observed. Manufacturers choose wholesale prices with the knowledge that retail prices will adjust to wholesale prices. Exploiting this, manufacturers are able to commit to maintaining wholesale price levels.

As we show in the remainder of this section, our bargaining game nests the Vertical Nash specification as a special case. Perhaps more surprisingly, it also nests the Manufacturer Stackelberg game.[12] Throughout, we restrict attention to single-product firms ($T^r = T^w = I$) or, equivalently, assume that firms treat each product as a separate profit center.

In the Vertical Nash and Manufacturer Stackelberg games, the retail price is chosen according to the first-order condition:

$$s_j + [p_j - p_j^w - c_j^r]\frac{\partial s_j}{\partial p_j} = 0. \tag{A1}$$

This coincides with the first-order condition in Equation (5) for our bargaining game. In the Vertical Nash and Manufacturer Stackelberg games, the wholesale price is chosen according to the first-order condition:

$$s_j + [p_j^w - c_j^w]\frac{\partial s_j}{\partial p_j}\frac{\partial p_j}{\partial p_j^w} = 0, \tag{A2}$$

where the derivative $\partial p_j/\partial p_j^w$ captures the impact of the wholesale price on the retail price:

$$\frac{\partial p_j}{\partial p_j^w} = \begin{cases} 1 \quad \text{if Vertical Nash,} \\ \dfrac{\partial s_j/\partial p_j}{2(\partial s_j/\partial p_j) + (p_j - p_j^w - c_j^r)(\partial^2 s_j/\partial p_j^2)} \\ \quad \text{if Manufacturer Stackelberg.} \end{cases} \tag{A3}$$

Intuitively, $\partial p_j/\partial p_j^w = 1$ in the Vertical Nash game means that retail and wholesale prices move in lock step, thereby ensuring that retail margins remain fixed (Besanko et al. 1998). In the Manufacturer Stackelberg game, by contrast, the expression for $\partial p_j/\partial p_j^w$ is found by implicitly differentiating equation (A1) to determine how the retail price optimally adjusts to the wholesale price. Equilibrium retail and wholesale prices in the Vertical Nash and Manufacturer Stackelberg games are obtained by jointly solving Equations (A1) and (A2).

[12] Similar results have also been obtained by Iyer and Villas-Boas (2003), albeit in a simpler model with a single manufacturer and a single retailer. Misra and Mohanty (2006) also show that the Manufacturer Stackelberg game is a special case of their setup where the retail price is set after bargaining has taken place.

To see how the Vertical Nash and Manufacturer Stackelberg games are related to our bargaining game, we combine Equations (A1) and (A2) to yield

$$m_j^w = \frac{1}{\partial p_j/\partial p_j^w} m_j^r. \tag{A4}$$

Recall that in our bargaining game, wholesale and retail margins are related according to

$$m_j^w = \frac{1-\lambda}{\lambda} m_j^r. \tag{A5}$$

Therefore our bargaining game yields the same equilibrium prices if

$$\frac{1-\lambda}{\lambda} = \frac{1}{\partial p_j/\partial p_j^w} \quad \Leftrightarrow \quad \lambda = \frac{\partial p_j/\partial p_j^w}{1+\partial p_j/\partial p_j^w}. \tag{A6}$$

In the Vertical Nash game, in particular, $\partial p_j/\partial p_j^w = 1$ implies $\lambda = \frac{1}{2}$. We therefore have

Proposition 1. *Equilibrium prices and margins in the bargaining game with the bargaining power parameter λ set to $\frac{1}{2}$ are identical to those in the Vertical Nash game.*

Turning to the Manufacturer Stackelberg game, inspecting Equation (A3) shows that prices and margins cannot generally be matched unless we allow the value of the bargaining power parameter to vary across products. To construct the appropriate bargaining power parameter, consider retail and wholesale prices p^{MS} and $p^{w,\,\mathrm{MS}}$, respectively in the equilibrium of the Manufacturer Stackelberg game and define

$$\lambda_j = \left.\frac{\partial s_j/\partial p_j}{3(\partial s_j/\partial p_j) + (p_j - p_j^w - c_j^r)(\partial^2 s_j/\partial p_j^2)}\right|_{p^{\mathrm{MS}},\, p^{w,\,\mathrm{MS}}}, \tag{A7}$$

where the right-hand side is evaluated at the equilibrium of the Manufacturer Stackelberg game. Using these product-specific values for the bargaining power parameter, we obtain

Proposition 2. *Equilibrium prices and margins in the bargaining game with product-specific bargaining power parameters λ_j set according to Equation* (A7) *are identical to those in the Manufacturer Stackelberg game.*

Of course, the Manufacturer Stackelberg game leads to double marginalization. Hence, our bargaining game can (but does not have to) replicate the double-marginalization solution.

To gain further insights, assume that demand is linear. Then the curvature of the demand function $\partial^2 s_j/\partial p_j^2 = 0$, and we have $\partial p_j/\partial p_j^w = \frac{1}{2}$ independent of the slope of the demand function $\partial s_j/\partial p_j$. We thus obtain

Corollary 1. *If demand is linear, then equilibrium prices and margins in the bargaining game with the bargaining power parameter λ set to $\frac{1}{3}$ are identical to those in the Manufacturer Stackelberg game.*

As expected, the Manufacturer Stackelberg game, which allows the manufacturer to precommit, gives less bargaining power to the retailer than the Vertical Nash game.

From an empirical perspective, Propositions 1 and 2 and Corollary 1 are important because they show that under the assumption of single-product firms our bargaining model nests both the Vertical Nash and the Manufacturer Stackelberg specification. Moreover, we can test whether the data are consistent with the restrictions on the bargaining power parameter that these two games entail. As the data reject either one of these restrictions, it becomes evident that bargaining over wholesale prices plays a crucial role in "splitting the pie" between manufacturers and retailers. That is, assuming either a Vertical Nash or a Manufacturer Stackelberg game unduly restricts how overall channel profits are split between manufacturers and retailers.

Appendix B. Supply Under Observed Retail Prices

In the main paper, we assume that bargaining between competing manufacturers and retailers over wholesale prices takes place without manufacturers observing the prices retailers set to consumers. This assumption of retail prices unobservability implies that retail and wholesale prices are determined in a game with simultaneous moves. Put differently, even if we assumed that retail prices are determined after wholesale prices, our model would remain unchanged as long as we maintain that retail prices are unobservable. This is, in fact, the setup that is used in recent theory papers. Iyer and Villas-Boas (2003), for example, note that in their setup "the wholesale price that is the result of the bargaining process is *not* a function of the actual retail price charged by the retailer" (p. 88, italics added). Similarly, the condition that determines wholesale prices in the model of Dukes et al. (2006, p. 89) "follows from the generalized Nash bargaining solution if retailers' pricing decisions take place simultaneously with negotiations. This implies that the bargaining solution treats retail prices as fixed."

An alternative specification of the supply side assumes that retail prices are observed by the manufacturers when they bargain over wholesale prices with retailers. Formally, the game becomes one of sequential moves. Although this setup may seem more familiar at first glance because it resembles the "manufacturer-moves-first" paradigm of Manufacturer Stackelberg models, the recent theory papers make the opposite assumption of retail prices unobservability that leads to a game with simultaneous moves. The reason is that in a bargaining setting, it is extremely difficult to devise an internally consistent model with sequential moves.

Below we spell out the details of the model with sequential moves and illustrate its problems. We also present a set of estimates.

B.1. Bertrand-Nash Competition

As in the main paper, retail prices are determined in a Bertrand-Nash fashion. For ease of reference we repeat the derivations below.

Retailer r maximizes the profit from all products sold given by

$$\pi^r = \sum_{j\in\Omega^r} [p_j - p_j^w - c_j^r] M s_j(p). \tag{B1}$$

Assuming a pure-strategy Nash equilibrium in retail prices, the first-order condition for product j is

$$s_j + \sum_{k\in\Omega^r} [p_k - p_k^w - c_k^r] \frac{\partial s_k}{\partial p_j} = 0. \tag{B2}$$

Switching to matrix notation and solving Equation (B2) yields a vector of the retail price-cost margins m^r for all products:

$$m^r = p - p^w - c^r = -[T^r * \Delta^r]^{-1} s(p), \tag{B3}$$

where Δ^r is a matrix with the general element $\Delta^r(k, j) = \partial s_j / \partial p_k$.

B.2. Bargaining Under Retail Price Observability

As in the main paper, the generalized Nash bargaining solution over the wholesale price of product j is defined as the maximand of the so-called generalized Nash product:

$$(\pi_j^r(p_j^w) - d_j^r)^{\lambda} (\pi_j^w(p_j^w) - d_j^w)^{1-\lambda}. \tag{B4}$$

$\pi_j^r(p_j^w)$ and $\pi_j^w(p_j^w)$ are the profits to the retailer and the manufacturer, respectively, if the negotiations succeed and d_j^r and d_j^w are the so-called disagreement payoffs that obtain if the negotiations fail. As in the main paper, we have

$$\begin{aligned} \pi_j^r(p_j^w) &= (p_j - p_j^w - c_j^r) M s_j(p), \\ \pi_j^w(p_j^w) &= (p_j^w - c_j^w) M s_j(p), \end{aligned} \tag{B5}$$

and

$$\begin{aligned} d_j^r &= \sum_{k\in\Omega^r\setminus\{j\}} (p_k - p_k^w - c_k^r) M \Delta s_k^{-j}(p), \\ d_j^w &= \sum_{k\in\Omega^w\setminus\{j\}} (p_k^w - c_k^w) M \Delta s_k^{-j}(p). \end{aligned} \tag{B6}$$

Taking the derivative of Equation (B4) with respect to p_j^w and setting it equal to zero yields the first-order condition:

$$\lambda(\pi_j^w - d_j^w) \frac{\partial \pi_j^r}{\partial p_j^w} + (1-\lambda)(\pi_j^r - d_j^r) \frac{\partial \pi_j^w}{\partial p_j^w} = 0. \tag{B7}$$

We continue to maintain our assumption that there are no derivatives of disagreement profits with respect to wholesale prices. Although this assumption is natural if the Bertrand-Nash competition and the Nash bargaining take place at the same time, in the current sequential setup there is really no justification for it other than that it renders the model somewhat more tractable.[13]

Below we solve the bargaining game for the nonzero disagreement profits case and derive our estimation equation. As in the main paper, the zero-disagreement profits specification ($d_j^w = d_j^r = 0$) is obtained as a special case.

The difference to the case of unobserved retail prices is that from Equation (B5); we now have

$$b8 \frac{\partial \pi_j^r}{\partial p_j^w} = M s_j(p) \left(\frac{\partial p_j}{\partial p_j^w} - 1 \right) + m_j^r M \frac{\partial s_j}{\partial p_j^w}$$

and

$$\frac{\partial \pi_j^w}{\partial p_j^w} = M s_j(p) + m_j^w M \frac{\partial s_j}{\partial p_j^w},$$

whereas in the case of retail price unobservability in the main paper, we had $\partial \pi_j^r / \partial p_j^w = -M s_j(p)$ and $\partial \pi_j^w / \partial p_j^w = M s_j(p)$. Unlike in the game with simultaneous moves, if retail prices are observed, then the parties take into

[13] We have relaxed this assumption and rederived the model. The details are available upon request.

account retail price reactions to wholesale prices. Hence, there is a nonzero derivative of retail with respect to wholesale prices $\partial p_j/\partial p_j^w$.

This nonzero derivative captures the idea that manufacturers are able to commit to maintaining wholesale price levels. Intuitively, manufacturers lead and retailers follow. Whether this ability to precommit is appropriate given the advent of big-box retailers, and thus the potential increase of countervailing bargaining power of the retailers, has been questioned in the literature (Dukes et al. 2006).

Substituting the above derivatives into Equation (B7) yields

$$\lambda(\pi_j^w - d_j^w)\left(Ms_j(p)\left(\frac{\partial p_j}{\partial p_j^w}-1\right)+m_j^r M\frac{\partial s_j}{\partial p_j^w}\right)$$
$$=(1-\lambda)(\pi_j^r-d_j^r)\left(Ms_j(p)+m_j^w M\frac{\partial s_j}{\partial p_j^w}\right), \qquad \text{(B8)}$$

where from Equations (B5) and (B6), we have

$$\pi_j^r - d_j^r = m_j^r M s_j(p) - \sum_{k\in\Omega^r\setminus\{j\}} m_k^r M\Delta s_k^{-j}(p),$$
$$\pi_j^w - d_j^w = m_j^w M s_j(p) - \sum_{k\in\Omega^w\setminus\{j\}} m_k^w M\Delta s_k^{-j}(p),$$

and we set $d_j^w = d_j^r = 0$ to obtain the zero-disagreement profits specification.

Equation (B8) relates wholesale to retail margins. Stacking Equation (B8) for all products yields a system of equations that is linear in wholesale margins. Hence, we can solve it to obtain wholesale margins as a function of retail margins:

$$m^w = m^w(m^r;\lambda,\Delta^r,\Delta^p),$$

where λ is the exogenous bargaining power parameter, Δ^r is the above-defined matrix of derivatives of market shares with respect to retail prices, and Δ^p is the matrix of derivatives of retail prices with respect to wholesale prices to be defined shortly. Using the fact that channel margins are the sum of wholesale and retail margins and substituting for the retail margin from Equation (B3), we obtain

$$p - c^w - c^r = \underbrace{-[T^r * \Delta^r]^{-1}s(p)}_{m^r}$$
$$+\underbrace{m^w(-[T^r*\Delta^r]^{-1}s(p);\lambda,\Delta^r,\Delta^p)}_{m^w}. \qquad \text{(B9)}$$

Once we specify the marginal costs as a function of observable cost factors and an unobservable shock, Equation (B9) becomes the basis for the estimation.

We finally have to compute $\partial p_j/\partial p_j^w$ in Equation (B8). The matrix Δ^p with general element $\Delta^p(i,j) = \partial p_j/\partial p_i^w$ contains the pass-through of wholesale prices to retail prices. To get the expression for Δ^p, we totally differentiate Equation (B2) with respect to all prices p_k, $k = 1,\ldots,N$ (with variation dp_k) and a wholesale price p_f^w (with variation dp_f^w):

$$\sum_{k=1}^{N}\underbrace{\left[\frac{\partial s_j}{\partial p_k}+\sum_{i=1}^{N}\left(T^r(i,j)\frac{\partial^2 s_i}{\partial p_j\partial p_k}(p_i-p_i^w-c_i^r)\right)+T^r(k,j)\frac{\partial s_k}{\partial p_j}\right]}_{g(j,k)}dp_k$$
$$\underbrace{-T^r(f,j)\frac{\partial s_f}{\partial p_j}}_{h(j,f)}dp_f^w = 0. \qquad \text{(B10)}$$

Table B.1 Bargaining Power as a Function of Manufacturer and Retailer Factors

Parameter	Estimate	Std. error
Retailer size	0.2228	0.0106
Manufacturer size	−0.2114	0.1149
Store-brand share	0.7943	0.3548
Store-brand positioning	1.6071	0.1894
Assortment depth	−0.0039	0.0057
Brand effects		
Jacobs	0.5982	0.6576
Onko	0.436	0.6574
Melitta	0.477	0.4836
Idee	−0.7956	0.3898
Dallmayr	−0.7836	0.3898
Tchibo	−0.3337	0.4873
Eduscho	0.4489	0.4879
SSE	1,467.19	

Putting all $j = 1,\ldots,N$ products together, let G be the matrix with general element $g(j,k)$ and let H_f be the N dimensional vector with general element $h(j,f)$. Then we can rewrite (B10) as $G\,dp - H_f\,dp_f^w = 0$. Solving for the derivatives of all retail prices with respect to the wholesale price, the fth column of Δ^p is obtained:

$$\frac{dp}{dp_f^w} = G^{-1}H_f. \qquad \text{(B11)}$$

Again, we substitute for retail margin using Equation (B3). Stacking all N columns together, $\Delta^p = G^{-1}H$ contains the derivatives of all prices with respect to all wholesale prices.[14]

To compute a reaction of a retail price to a certain wholesale price in the current sequential setup the parties involved in a pairwise negotiation take into account the direct impact on retail price but also the retail price reaction to the retail prices of competing products (see Equation (B10)). This reaction is inconsistent with the bilateral bargaining setup, where each retailer-manufacturer pair negotiates independently from the others. This point has been made by Dukes et al. (2006). They note that retailers maximize category profits and as such internalize cross-price effects across competing products. If retail prices were chosen subsequent to negotiations over wholesale prices, then the allocation of this effect across two independent bargaining processes is arbitrary. The main modeling contribution of the present paper is thus to show that these issues can be resolved in a model with unobserved retail prices.

B.3. Estimation Results

Table B.1 presents the results from estimating the model with sequential moves. Little changes in comparison to the model with simultaneous moves in Table 8 in the main paper. Importantly, the determinants of bargaining power are very similar in sign and significance. The only change in sign is store-brand positioning, whose coefficient was insignificant in our leading specification and now becomes positive and significant in the model with sequential moves.

[14] Inspection of Equation (B8) shows that we also have to compute $\partial s_j/\partial p_j^w$. Let Δ^w be the matrix with general element $\Delta^w(k,j) = \partial s_j/\partial p_k^w$, and note that $\Delta^w = \Delta^{p'}\Delta^r$.

Somewhat surprisingly, the brand effects are for the most part no longer significant in the model with sequential moves; instead, the coefficients on the various determinants of bargaining power are larger in absolute value. In sum, none of our substantive results changes.

References

Ailawadi, K. 2001. The retail power-performance conundrum: What have we learned? *J. Retailing* **77**(3) 299–318.

Ailawadi, K., B. Harlam. 2004. An empirical analysis of the determinants of retail margins: The role of store-brand share. *J. Marketing* **68** 147–165.

Baumol, W., E. Ide. 1956. Variety in retailing. *Management Sci.* **3**(1) 93–101.

Besanko, D., J.-P. Dubé, S. Gupta. 2005. Own-brand and cross-brand retail pass-through. *Marketing Sci.* **24**(1) 123–137.

Besanko, D., S. Gupta, D. Jain. 1998. Logit demand estimation under competitive pricing behavior: An equilibrium framework. *Management Sci.* **44**(11, Part 1) 1533–1547.

Bresnahan, T. 1982. The oligopoly solution is identified. *Econom. Lett.* **10** 87–92.

Broniarczyk, S., W. Hoyer, L. McAlister. 1998. Consumers' perceptions of the assortment offered in a grocery category: The impact of item reduction. *J. Marketing Res.* **35** 166–176.

Choi, C. 1991. Price competition in a channel structure with a common retailer. *Marketing Sci.* **10**(4) 271–296.

Cotterill, R., W. Putsis. 2001. Do models of vertical strategic interaction for national and store brands meet the market test? *J. Retailing* **77** 83–109.

Dhar, S., S. Hoch. 1997. Why store brand penetration varies by retailer. *Marketing Sci.* **16**(3) 208–227.

Dukes, A., E. Gal-Or, K. Srinivasan. 2006. Channel bargaining with retailer assymetry. *J. Marketing Res.* **18** 84–97.

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

Guadagni, P., J. D. C. Little. 1983. A logit model of brand choice calibrated on scanner data. *Marketing Sci.* **2**(3) 203–238.

Gupta, S. 1989. Modeling integrative, multiple issue bargaining. *Management Sci.* **35**(7) 788–806.

Hall, M., L. Weiss. 1967. Firm size and profitability. *Rev. Econom. Statist.* **49**(3) 319–331.

Hartmann, W., H. Nair. 2007. Retail competition and the dynamics of consumer demand for tied goods. Working paper, Stanford University, Stanford, CA.

Iyer, G., M. Villas-Boas. 2003. A bargaining theory of distribution channels. *J. Marketing Res.* **40** 80–100.

Kadiyali, V., P. Chintagunta, N. Vilcassim. 2000. Manufacturer-retailer channel interactions and implications for channel power: An empirical investigation of pricing in a local market. *Marketing Sci.* **19**(2) 127–148.

Kaen, F., H. Baumann. 2003. Firm size, employees and profitability in U.S. manufacturing industries. Technical report, University of New Hampshire, Durham.

Krishnamurthi, L., S. Raj. 1991. An empirical analysis of the relationship between brand loyalty and consumer price elasticity. *Marketing Sci.* **10**(2) 172–183.

Lebensmittel Zeitung. 2006. Markt- und Strukturzahlen der Nahrungs- und Genussmittelbranche. LZ Report 2005/2006, Deutscher Fachverlag, Frankfurt am Main, Germany.

Lynn, B. C. 2006. Breaking the chain: The antitrust case against Wal-Mart. *Harper's Magazine* (July 31), http://www.harpers.org/archive/2006/07/0081115.

Messinger, P., C. Narasimhan. 1995. Has power shifted in the grocery channel? *Marketing Sci.* **14**(2) 189–223.

Misra, S., S. Mohanty. 2006. Estimating bargaining games in distribution channels. Working paper, University of Rochester, Rochester, NY.

Muthoo, A. 1999. *Bargaining Theory with Applications*. Cambridge University Press, Cambridge, UK.

Narasimhan, C., R. Wilcox. 1998. Private labels and the channel relationship: A cross-category analysis. *J. Bus.* **71**(4) 573–600.

Nash, J. F. 1950. The barganing problem. *Econometrica* **18** 155–162.

Neslin, S. A., L. Greenhalgh. 1983. Nash's theory of cooperative games as a predictor of the outcomes of buyer-seller negotiations: An experiment in media purchasing. *J. Marketing Res.* **20**(4) 368–379.

Nevo, A. 1998. Identification of the oligopoly solution concept in a differentiated-products industry. *Econom. Lett.* **59** 391–395.

Nevo, A. 2000. Mergers with differentiated products: The case of the ready-to-eat cereal industry. *RAND J. Econom.* **31**(3) 395–421.

O'Brien, D., G. Shaffer. 1992. Vertical control with bilateral contracts. *RAND J. Econom.* **23**(3) 728–746.

Pauwels, K., S. Srinivasan. 2004. Who benefits from store brand entry? *Marketing Sci.* **23**(3) 364–390.

Raju, J., R. Sethuraman, S. Dhar. 1995. The introduction and performance of store brands. *Management Sci.* **41**(6) 957–978.

Rubinstein, A. 1982. Perfect equilibrium in a bargaining model. *Econometrica* **50** 97–110.

Schelings, R., J. Wright. 1999. "Sui Generis?": An antitrust analysis of buyer power in the United States and European Union. George Mason Law and Economics Research Paper 05-30, George Mason University, Arlington, VA.

Scott-Morton, F., F. Zettelmeyer. 2004. The strategic positioning of store brands in retailer-manufacturer negotiations. *Rev. Indust. Organ.* **24** 161–194.

SevenOne Media. 2006. BranchenSpecial Kaffee. Report (October), SevenOne Media, Unterföhring, Germany.

Slade, M. 1995. Product rivalry and multiple strategic weapons: An analysis of price and advertising competition. *J. Econom. Management Strategy* **4** 445–476.

Sudhir, K. 2001. Structural analysis of competitive pricing in the presence of a strategic retailer. *Marketing Sci.* **20**(3) 244–264.

Villas-Boas, S. B. 2007. Vertical relationships between manufacturers and retailers: Inference with limited data. *Rev. Econom. Stud.* **74**(2) 625–652.

Villas-Boas, M., R. Winer. 1999. Endogeneity in brand choice models. *Management Sci.* **45**(10) 1324–1338.

Villas-Boas, M., Y. Zhao. 2005. Retailers, manufacturers, and individual consumers: Modeling the supply side in the ketchup marketplace. *J. Marketing Res.* **42**(1) 83–95.

Walters, R., S. MacKenzie. 1988. A structural equations analysis of the impact of price promotions on store performance. *J. Marketing Res.* **25** 51–63.