Uncertainty, Bargaining power and Bargaining Solutions: An empirical application

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Abstract

We compare the traditional model for structurally estimating bargaining power solutions assuming certainty on the disagreement payoffs against a model assuming evenly distributed bargaining power and uncertainty on disagreement profits. We find substantial differences in the distribution of the rent resulted from each of these models and it was hinted how the assumptions may have a role on the identification of the rent's distribution.

1 Introduction

The grocery retail sector is characterized by a seemly steady commercial relationship between manufacturers and retailers. However, and given the increasing concentration process, in particular among retailers, this sector is under the constant watch of competition authorities (e.g., Bundeskartellamt 2014), specially due to potential abuse of buyer power against smaller manufacturer, which also has motivated the European Commission to launch a program to avoid unfair trade practices (EU Commission 2016). Nevertheless, conflicts could even exist in the bargainings from evenly powerful firms; conflicts that rarely trascend to the public knowledge, e.g. in 2018 the German grocery retailer EDEKA dropped from its assortment a part of the porfolio of products from the international manufacturer Nestle due to tough negotiations regarding supply terms.[1] In this way, difficult bar-

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[1] https://www.reuters.com/article/nestle-retailers-edeka/german-supermarket-edeka-expands-nestle-boycott-lebensmittel-zeitung-idUSL2N1RJ0AS , retrieved 2020, June 08.

gaining are evident even between large firms, and threats on breaking the commercial relationship - totally or partially - to get better deals seem to be part of these negotiations.

The analysis of the bargaining environment in such situations is difficult, since typically negotiations and results of contract remain business secrets with only some famous special events - such as the described boycott- becoming public. In order to analyze bargaining relationships, the empirical literature has used structural econometric models, which overcome the typical data restrictions, by imposing structure on the available facts; being the most used models for this purpose the so called Nash-in-Nash Solutions (e.g. Crawford et al. (2018), Ho and Lee (2017), Bonnet and Bouamra-Mechemache (2015), Grennan (2013), Crawford and Yurukoglu (2012), Draganska et al. (2010)). Models that have been applied mostly for uneven bargaining power, and assuming certainty regarding the bargaining environment. These models have been assuming that all bargaining taking place in the market are independent from each other, meaning that the negotiation of one product would not have an impact on the negotiation of other, under the so called *passive belief* assumption. This kind of assumption may suit well in markets in single-product commercial relationships; but may be too restrictive for multi-product ones; in which the same pair of players bargain different products (or portfolio of products) separately, and where not reaching an agreement in a negotiation may have implications toward the other products bargained within the same commercial relationship. Implicitly assuming, in this way, the no use of threats for strategic reasons; and therefore, smooth bilateral negotiations. Assumption that may not necessarily hold in all cases, as seen in the EDEKA-Nestle boycott that is stated above.

On the other hand, new proposals have been made to analyze such situations, Klein and Rebolledo (2020) introduced the intra-relationship uncertainty in bargaining environments, and applied their estimation approach by analyzing a bargaining situation in which an upcoming break-off of negotiations was likely, due to a possible producers strike (dairy milk farmer strike), they analyzed the bargainers' incentives to reach an agreement to prevent the strike, and with it the commercial relationship disruption, being able to predict ex-ante the break-up of the commercial relationships. However, their analysis considered uneven bargaining power distributions, that may not be the case when analyzing negotiations between large firms, and in which the bargaining power distribution analysis may not be as important as the anaylsis on threat credibility.

In this paper, we apply their approach including the simplifying assumption of equally distributed bargaining power, but allowing the analysis of strategic incentives of bargainers to use threats of breaking the commercial relationship to get better deals from negotiation.

We are also comparing results of this approach with the usually applied Nash-in-Nash without uncertainty which also assumes uneven distributed bargaining power, we see that in cases where bargaining partners of equal bargaining power can improve or deteriorate their outcome with the credibility of threats to stop the overall negotiations, we see substantial differences to the model without uncertainty. The findings clearly show that it is of enormous importance which assumptions justify which setting since a wrong choice may lead to substantial errors in the prediction of margins.

This paper distributes as follows, section (2) first provides the model, in section (3) the data used is described and section (4) discusses the results. Finally section (5) concludes.

2 Model

The standard model of a Nash-in-Nash Solution, assuming that all parties have complete information regarding their agreements' and disagreements' payoffs has been characterized typically in the literature (e.g. Crawford et al. (2018), Ho and Lee (2017), Bonnet and Bouamra-Mechemache (2015), Grennan (2013), Crawford and Yurukoglu (2012), Draganska et al. (2010))[2] as follows:

$$\underset{w_j}{\text{Max}} \left(\pi_j^m - d_j^m\right)^{\lambda_j^m} \left(\pi_j^r - d_j^r\right)^{\lambda_j^r} \tag{1}$$

where, in a retailer-manufacturer commercial relationship would be translate as, the retailer r and the manufacturer m bargain over the wholesale price w_j of product j. In this maximization the insides profits (π_j^m and π_j^r) and the outside profits (d_j^m d_j^r) of this transaction are weighted by the players' bargaining power λ_j^i (being $i = r, m$ and $\sum_i \lambda_j^i = 1$). In this framework is assumed that all bargaining taking place in the market are independent from each other and, therefore, there is no uncertainty regarding the outside options.

Klein and Rebolledo (2020) proposed an estimation approach in which the potential interdependency of negotiations was allowed, in particular the negotiations of different prodcuts between the same pair of bargainers; setting that makes possible to analyze conflicting multi-product bilateral relationships, in which bargainers could face uncertainty regarding their disagreement outcome. In this way, their proposal included uncertainty in the disagreement outcome, as follows:

[2] We follow the general case description presented by Klein and Rebolledo (2020).

$$\underset{w_j}{\text{Max}} \left(\pi_j^m - E(d_j^m)\right)^{\lambda_j^m} \left(\pi_j^r - E(d_j^r)\right)^{\lambda_j^r}$$

in which w_j, λ_j^i, π_j^i represent the same as before, and $E(d_j^i)$ denotes the expected profit of bargainer i from no reaching agreement, where $E(d_j^i) = \zeta d_j^i + (1-\zeta) d_{Jmr}^i$, being d_j^i bargainer's i disagreement outcome when the failed negotiation over product j does not affect the others negotiations within the same bilateral relationship; on the other hand, d_{Jmr}^i is his profit when a disagreement over product j translates in the end of the commercial relationship between r and m, i.e. no product is exchanged between these two agents, and ζ is the belief of bargainer i on facing a disagreement profit d_j^i, where $\zeta \in [0,1]$.

Through this setting, Klein and Rebolledo (2020) developed an estimation approach that allows not only to compute the margin distribution among bargainers but also their beliefs on possible bargaining scenarios they expect to face if negotiations are not successful. Given the transitory nature of the uncertainty in the analyzed case, Klein and Rebolledo (2020), were able to implement and confirm an incentive condition proposed by Chun and Thomson (1990), which concluded that in uneven bargaining power relationships the incentives to reach an agreement under uncertainty conditions may not meet and bargainers would prefer to wait until the uncertainty disappears in order to then reach an agreement.

However, Chun and Thomson (1990) also concluded that the (symmetric) Nash bargaining solution, i.e. the outcome from the following bargaining:

$$\underset{w_j}{\text{Max}} \left(\pi_j^m - E(d_j^m)\right) \left(\pi_j^r - E(d_j^r)\right) \tag{2}$$

would always fulfilled the incentive condition required to reach an agreement in a situation of temporal disagreement-payoff uncertainty, meaning that bargainers with even bargaining power would always reach an agreement in spite of the uncertainty in the negotiation. Therefore, conflicting bilateral relationships between two even-bargaining-power agents are able to reach a solution.

In this way, the fact that usually conflicts in bilateral relationships are not observable, would not mean that they do not exist and that bargainers do not doubt the strategic incentives of their counterparty; but rather that due to their evenly distributed bargaining power, they are able to reach an agreement, even though they may not completely trust in each other.

In this way, the present paper aims to compare the suitability of both bargaining frameworks the uneven-bargaining power relationship with certain disagreement outcomes and the even-bargaining power relationship with uncertain disagreement outcomes, in concentrated markets.

In following subsections we provide the two different bargaining models. First, the usually applied one with uneven bargaining power and certain disagreement profits and then the model with even bargaining power and uncertain disagreement profits, which is a case of the proposed by us in Klein and Rebolledo (2020); a case in which both bargainers hold equal bargaining power.

Both models have in common that they are solved by backward induction; being needed first the consumer side results (demand estimations), then the analysis of the competition among retailers and their price optimization process (retailers margin). Afterward, the bargaining over the wholesale price are analyzed through both approaches to be compared, and get the margin distribution through both settings.

2.1 Retailers margin

As mentioned, the model is solved by backward induction, being needed before solving the bargaining situation, the results from the competition among retailers, which are assumed to compete in a Bertrand-Nash manner. With this purpose, retailers set prices to maximize their profits, being the retailer profit function: $\pi^r = \sum_{j \in J^r} \left[p_j - w_j - c_j^r \right] s_j(p)M$, in which π^r represents the retailer profit resulted from selling all products j that are available in his shelves, being J^r the set of products available at retailer r; and p_j, w_j, and c_j^r represent the price, wholesale price and retailing marginal cost of product j, while $s_j(p)$ is the market share of this product and M represents the market size. Notice that this maximization process is performed by each retailer; in this way, and defining the retailer margin from selling product j $(p_j - w_j - c_j^r)$ as γ_j, and being $\boldsymbol{\gamma}$ the vector of retailer margins; introducing Δ the matrix of the marginal effects of the price on the market shares, where the general element of it is $\Delta[j,k] = \frac{\partial s_k(p)}{\partial p_j}$, which is the change on the share of product k when the price of product j changes; as well as defining as $s(p)$ the vector of market shares, being T^r the retailer ownership matrix, which general element $T^r(k,j) = 1$ if both k and j are sold through retailer r, and zero otherwise; then the retailer margin can be express in matrix notation as follows:

$$\boldsymbol{\gamma} = -\left(T^r * \Delta\right)^{\dagger} \boldsymbol{s(p)} \tag{3}$$

in which $(T^r * \Delta)^{\dagger}$ is the Moore-Penrose inverse of matrix $(T^r * \Delta)$.

2.2 Uneven bargaining power with certain disagreement outcomes

Consider a bilateral negotiation between a manufacturer m and retailer r regarding the wholesale price w_j of product j, being j an available alternative in the market. It an uneven bargaining power distribution among players and that they consider their gains (π_j^r and π_j^m) and opportunity costs (d_j^r and d_j^m) from the negotiation while bargaining. Assume further that bargainers hold *passive beliefs* regarding all other negotiation taking place in the market, i.e. neither the current negotiation nor the others affect each other. In this way, the solution from the negotiation described is the one resulted from the maximization process presented in (1); from which we have the following equation:

$$(\pi_j^m - d_j^m)\frac{\partial \pi_j^r}{\partial w_j} = -\frac{(1-\lambda_j)}{\lambda_j}(\pi_j^r - d_j^r)\frac{\partial \pi_j^m}{\partial w_j} \tag{4}$$

for which, the agreement and disagreement payoffs, as summarized in Klein and Rebolledo (2020), are the following:

Table 1: Agreement and Disagreement Profits

	Agreement	Disagreement
Manufacturer	$\pi_j^m = \Gamma_j s_j(p)M + \sum_{\substack{k\in J^m \\ k\neq j}} \Gamma_k s_k(p)M$	$d_j^m = \sum_{\substack{k\in J^m \\ k\neq j}} \Gamma_k s_k^{-j}(p)M$
Retailer	$\pi_j^r = \gamma_j s_j(p)M + \sum_{\substack{k\in J^r \\ k\neq j}} \gamma_k s_k(p)M$	$d_j^r = \sum_{\substack{k\in J^r \\ k\neq j}} \gamma_k s_k^{-j}(p)M$

where Γ_j represents the manufacturer m margin from selling alternative j, in which $\Gamma_j = w_j - c_j^m$ being c_j^m the manufacturer's marginal cost of producing j. Similarly, γ_j denotes the retailer's margin form product j, where $\gamma_j = p_j - w_j - c_j^r$, representing p_j the consumers' price of product j and c_j^r the retailer marginal cost from selling that alternative. Product j's market share is represented by $s_j(p)$, and represented the market share of product k when product j is not longer available in the market by $s_k^{-j}(p)$. And being J^m the set of alternatives produce by manufacturer m and J^r the to being in the set of alternatives available in retailer r, where the total set of alternatives available in the market is represented by J (being $J = \sum_r J^r = \sum_m J^m$). In this way, and considering simultaneous negotiations in the market, the manufacturer margin can be computed through the system of equations resulted from equation (4), which can be represented in matrix notation as follows:

$$\mathbf{\Gamma} = (T^m * D^j)^\dagger \left(\tilde{\boldsymbol{\lambda}} * \left((T^r * D^j)\boldsymbol{\gamma}\right)\right) \tag{5}$$

in which, T^r and $\boldsymbol{\gamma}$ represent the same as before; while $\mathbf{\Gamma}$ is the vector of manufacturer margins, T^m is the manufacturer ownership matrix, eing its general element $T^m[j,k] = 1$ if both alternatives j and k are produced by m and zero otherwise; D^j is a matrix of dimension J general element is $D^j[j,k] = s_j(p)$ if $j = k$, and $D^j[j,k] = -\Delta s_k^{-j} = -(s_k^{-j}(p) - s_k(p))$ otherwise. Finally, $\tilde{\boldsymbol{\lambda}}_{\boldsymbol{i}}$ is the vector of the bargaining power ratio being its general element $\tilde{\boldsymbol{\lambda}}[i,1] = \frac{1-\lambda_i}{\lambda_i}$.

Following Klein and Rebolledo (2020), $\mathbf{\Gamma}$ can be expressed as $\mathbf{\Gamma} = C\tilde{\boldsymbol{\lambda}}$, where C is an square matrix of dimension J which general element is $C[i,k] = (T^m * D^j)^\dagger[i,k]b_k$ and b_i is the general element of the vector $b_i = (T^r * D^j)\boldsymbol{\gamma}[i,1]$.[3]

These equations are now used according to Draganska et al (2010) to estimate the unobserved bargaining power parameter. Applying the corresponding reformulations (Klein and Rebolledo, 2020), we use the assumption of $\boldsymbol{c^r} + \boldsymbol{c^m} = IP\boldsymbol{\kappa} + \boldsymbol{\eta}$; which is,the distribution of the total marginal cost (retail and manufacturer) that are explained by input costs included in the matrix IP, and its effect being gathered in $\boldsymbol{\kappa}$ and an error term $\boldsymbol{\eta}$. Considering that the total marginal costs is also $\boldsymbol{c^r} + \boldsymbol{c^m} = \boldsymbol{p} - \boldsymbol{\gamma} - \mathbf{\Gamma}$, then equation (5) can be expressed as follows:

$$\boldsymbol{p} - \boldsymbol{\gamma} = C\tilde{\boldsymbol{\lambda}} + IP\boldsymbol{\kappa} + \boldsymbol{\eta} \tag{6}$$

Specification from which, the bargaining power distribution is estimated through a non-linear least square.

2.3 Even bargaining power with uncertain disagreement outcomes

Now consider, that manufacturer m and retailer r bargain over the wholesale price of product j in equal conditions, i.e. both have the same bargaining power; however, there is no complete information regarding the intentions of the counterparty, in particular in regards to their actions if disagreement occurs; therefore, both parties bargain without certainty on the scenario they would face if they do not reach an agreement, being the possible scenarios: 1) disagreement over product

[3] See Klein and Rebolledo (2020) Appendix to more details on matrix C.

j have no effect over the other products negotiations, i.e. disagreement payoff d^i_j, where $i = m, r$, 2) not reaching an agreement over product j would translate in the end of the commercial relationship between r and m, i.e. none product will be exchanged between these two agents, then the disagreement payoff is $d^i_{J^{mr}}$, where $i = m, r$ and J^{mr} are the set of products usually exchanged between m and r. In this way, the Nash product to be maximize, to get the results from this negotiation is the one presented in (2).

This expression differs to the one of the usual bargaining model applied (presented in section 2.2) in two regards. First, the bargaining power distribution is not assumed to be uneven and, second, there is no certainty on the outside option of players, thus, bargainers negotiate considering an expected value of it.

Notice that while the setting proposed in Klein and Rebolledo (2020) also considered uncertainty on the disagreement payoffs, both approaches differ in the assumption made regarding the distribution of bargaining power, considering in the current work an even distribution among bargainers; which is a simplifying assumption that may be an advantage in the analysis of markets in which the level of concentration is high enough, thus, this would not constitute a restrictive assumption, and where the analysis of bargaining power distribution may not be as relevant as studying agents credibility or their expectations and its effect on the margin distribution.

The retailer expected disagreement payoff is represented by $E(d^r_j)$, where $E(d^r_j) = \theta d^r_j + (1 - \theta) d^r_{J^{mr}}$, in which θ is the retailer's belief on the first scenario, and consequently $(1 - \theta)$ the belief on the second one, being $\theta \in [0, 1]$. Similarly, the manufacturer expected disagreement profit is given by $E(d^m_j) = \delta d^m_j + (1 - \delta) d^m_{J^{mr}}$, in which δ is the manufacturer's belief on the first scenario ($\delta \in [0, 1]$). Finally, d^r_j and d^m_j are the same as in Table 1; while $d^m_{J^{mr}} = \sum_{\substack{k \in J^m \\ k \notin J^{mr}}} \Gamma_k s_k^{-J^{mr}}(p) M$ and $d^r_{J^{mr}} = \sum_{\substack{k \in J^r \\ k \notin J^{mr}}} \gamma_k s_k^{-J^{mr}}(p) M$, where $s_k^{-J^{mr}}(p)$ is the share of product k when the set of products J^{mr} is not longer available in the market. In this way, by maximizing expression 2 the following is derived:

$$\pi^m_j - E(d^m_j) = \pi^r_j - E(d^r_j) \tag{7}$$

Given that the symmetric Nash bargaining solution is a case of the asymmetric one, the case in which both bargainers have the same bargaining power and then $\frac{1-\lambda_j}{\lambda_j} = 1$ for all j; then, by following Klein and Rebolledo (2020) and taking into account this consideration on the ratio of bargaining power, we have[4]:

$$\Gamma_j s_j - \sum_{\substack{k\in J^m\\ k\neq j}} \Gamma_k \Delta s_k^{-j} - \tilde{\delta}_j \left(\sum_{\substack{k\in J^m\\ k\notin J^{mr}}} \Gamma_k s_k^{-J^{mr}} - \sum_{\substack{k\in J^m\\ k\neq j}} \Gamma_k s_k^{-j} \right) =$$

$$\left[\gamma_j s_j - \sum_{\substack{k\in J^r\\ k\neq j}} \gamma_k \Delta s_k^{-j} - \tilde{\theta}_j \left(\sum_{\substack{k\in J^r\\ k\notin J^{mr}}} \gamma_k s_k^{-J^{mr}} - \sum_{\substack{k\in J^r\\ k\neq j}} \gamma_k s_k^{-j} \right) \right]$$

being then, according to Klein and Rebolledo (2020), the matrix notation of the previous expression:

$$(T^m * D^j)\boldsymbol{\Gamma} - \tilde{\boldsymbol{\delta}} * \left[(T^m * (S^{J^{mr}} - S^j))\boldsymbol{\Gamma} \right] = (T^r * D^j)\boldsymbol{\gamma} - \tilde{\boldsymbol{\theta}} * ((T^r * (S^{J^{mr}} - S^j))\boldsymbol{\gamma}) \qquad (8)$$

in which $\tilde{\boldsymbol{\delta}}$ represents the vector of manufacturer beliefs on the break of the whole commercial relationship if disagreement occurs, i.e. $(1-\delta)$; similarly, $\tilde{\boldsymbol{\theta}}$ is the vector of retailer beliefs on facing the same scenario if no agreement is reached. S^j is an square matrix of dimension J, which general element $S^j[k,j] = 0$ if $j = k$ and $S^j[k,j] = s_k^{-j}(p)$ otherwise. Likewise, $S^{J^{mr}}$ is a matrix of the same dimension which general element $S^{J^{mr}}[k,j] = 0$ if both k and j belong to the same J^{mr} and $S^{J^{mr}}[k,j] = s_k^{-J^{mr}}(p)$ otherwise.

As in section 2.2, it is assumed the total marginal costs are explained by the input prices and an error term, and therefore the manufacturer margin ($\boldsymbol{\Gamma}$) can be expressed as $\boldsymbol{\Gamma} = \boldsymbol{p} - \boldsymbol{\gamma} - (IP\boldsymbol{\kappa} + \boldsymbol{\eta})$; thus, (8) can be expressed as[5]:

$$\boldsymbol{p} - \boldsymbol{\gamma} - \left(T^m * D^j\right)^{\dagger} \left[\left(T^r * D^j\right)\boldsymbol{\gamma} \right] = IP\boldsymbol{\kappa} + E\tilde{\boldsymbol{\delta}} + H\tilde{\boldsymbol{\theta}} + \sum_{z=1}^{Z} F_z \tilde{\boldsymbol{\delta}} \kappa_z + [G + I]\boldsymbol{\eta} \qquad (9)$$

where matrices E, H, F_z and G are of dimension J, in which the general element of $E[i,j] = (T^m * D^j)^{\dagger}[i,j] \left(\sum_{k=1}^{J} ts_{jk}^m (p_k - \gamma_k^r) \right)$, with $ts_{jk}^m = (T^m * (S^{J^{mr}} - S^j))[j,k]$; while the general element of matrix H is $H[i,j] = -(T^m * D^j)^{\dagger}[i,j] d_j$, where d_j is defined the element in position j of vector $\left[(T^r * (S^{J^{mr}} - S^j))\boldsymbol{\gamma} \right]$. The general element of matrix F_z is $F_z[i,j] = -(T^m * D^j)^{\dagger}[i,j] \left(\sum_{k=1}^{J} ts_{jk}^m IP[k,z] \right)$. Regarding G its general element $G[i,j] = -\sum_{k=1}^{J} (T^m * D^j)^{\dagger}[j,k] \tilde{\delta}_k ts_{kj}^m$ while I is an identity matrix. Finally, specification (9) is estimated via a non-linear least square.

[4]See Klein and Rebolledo (2020) for more details on this result.

[5]For more details on the following matrices E, F_z, G and H, see the Appendix in Klein and Rebolledo (2020).

3 Data and Demand model

We use data for the German biscuits grocery retail market provided by the GfK Panel Services SE, which is a representative consumer panel collected through the scanning of the purchases done by a representative sample of households in year 2011. This market has several important features since it is constituted, as in other sweets market, by strong brands (besides a significant share of private labels), all of them being available in different varieties (subbrands); and this variety of subbrands belonging to the same manufacturer can be exploited in the analysis of uncertainty regarding the consequences of a disagreement in the negotiation of each kind of subproduct.

We use a random sample of 100,000 purchases (observations). It was assumed that consumers make not distinction among outlets belonging to the same retail firm; however, they do distinguish among subproducts of the same brand (subbrands). In this way, it is considered that a consumer's choice alternative is the result from combining of a retailer and a subbrand. Private labels were grouped as a single brand, and given their wide variety, they were not separated by categories. To the set of products available to consumers there is added a consumer outside option with an utility equal to zero to which alternatives with smaller market shares were grouped. In this way, the choice set was constituted by 13 subbrands, belonging to 5 distinctive brands, a group of private labels, 9 different retailers, and a outside option; which resulted in 55 different alternatives (including the outside option). In Table (2) can be found some descriptives statistics on the choice set at a brand level and, as can be seen, there is a substantial price and market share variation, with private labels capturing the vast amount of market shares.[6]

[6]Due to confidentiality agreement with the GfK Panel Services SE, the brand names are not displayed.

Table 2: Data

	Market Share		*Price*	
Brand	Mean	SD	Mean	SD
B1	0.0083	0.0136	0.9396	0.2967
B2	0.0052	0.0044	0.4187	0.1097
B3	0.0056	0.0042	0.6963	0.1172
B4	0.0089	0.0096	0.6725	0.1560
B5	0.0089	0.0097	0.3176	0.0635
PL	0.4820	0.4536	0.3754	0.0407
Total	0.4041	0.4504	0.4055	0.1257

In the next sections, and by considering the dataset in this section described and applying the demand model presented in the section 3.1, it is estimated the German consumers' biscuits demand in year 2011, from it marginal effects are derived, and afterward it is estimated the margin distribution among players by using the two different bargaining models described in section 2.

3.1 Demand

The demand is defined in a standard way and estimated via a random-coefficient logit, as for instance described by Revelt and Train (1998) or Train (2003), using a typical consumer (i) utility function from the consumption of an particular product (j) at a specific point in time (t).

$$U_{ijt} = \beta_{FE} X^{FE} + \beta_{FC} X_{jt}^{FC} + \alpha_i p_{jt} + \varepsilon_{ijt} \tag{10}$$

The utility function considers different product characteristics (X_{FE}), such as retailer and manufacturer fixed effects, further characteristics included (X_{FC}) were size effects, the share of waffels and cookies; the price p_{jt} was also considered, which effect is assumed to be heterogeneous across consumers (random coefficient); and finally an error term ε_{ijt}.

To control for potential endogeneity from the supply side, we use a control function approach according to Petrin and Train (2010). In this way, we first estimate the effect of cost shifters from the supply side (instruments) on the price, and then include the residuals from this regression in the estimation of the utility; where the probability of consumer i buying alternative j on time t conditional to α_i is represented by:

$$L_{ijt}(\alpha_i) = \frac{exp(x_j^{'}\beta_{FE}X^{FE} + \beta_{FC}X_{jt}^{FC} + \alpha_i p_{jt} + \varepsilon_{ijt})}{1 + \sum_{k=1}^{J} exp(\beta_{FE}X^{FE} + \beta_{FC}X_{jt}^{FC} + \alpha_i p_{jt} + \varepsilon_{ijt})}$$

which allows to derive the market share of product j in time t through:

$$s_{jt} = \int \frac{exp(x_j^{'}\boldsymbol{\beta} + \alpha_i p_{jt} + \rho\hat{v}_{jt})}{1 + \sum_{k=1}^{J} exp(x_k^{'}\boldsymbol{\beta} + \alpha_i p_{kt} + \rho\hat{v}_{kt})} dF_w$$

Afterwards, marginal effects are computed using the procedure proposed by Cameron and Trivedi (2010, p. 353).

4 Results

Table (3) provides the estimations from the control function (price estimation) and the results from the demand through random coefficient logit. In regards to the instruments of the price regression, i.e. a labor market costs provided by the German federal statistics bureau as well as a Hausman style instrument capturing the price of other firms in that month, were both significant. The F-test for weak instruments provides a value of 11.67 suggesting that the instruments are not weak. Regarding the demand estimation, as observed the price coefficient is negative and significant and the standard deviation are small. Thus, these results provides consistent estimates of marginal effects that are then used in the further supply side models as an input.

Table 3: Estimation Results

Price Regression			*Random Coefficient Logit*		
Variable	Coefficient	SE	Variable	Coefficient	SE
Labor Costs	0.0033***	0.0007	Price	-3.4990***	0.2142
Hausman Instr. (Price)	-1.6983***	0.4462	SD (Price)†	-0.4191*	0.2536
Share Biscuits	-0.4220***	0.0646	Control Function	-3.4149***	0.2231
Share Cookies	-0.9598***	0.1108	Size	-0.0030***	0.0003
			Share Biscuits	-3.9868***	0.2239
			Share Cookies	-10.1481***	0.3717
Subbrand FE	x		Subbrand FE	x	
Retailer FE	x		Retailer FE	x	
R^2	0.9401		Log Likelihood	-213 460.08	
F-Value Instruments	11.67				

*Price regression includes Size, Promotion and a trend control. ***, **, * denote a level of significance of 1%, 5% and 10% respectively. †The sign of the estimated standard deviation should be interpreted as being positive.*

Table (4) comprises the main results of the supply model; Retailers margins were computed following the specification presented in section 2.1; while the results on manufacturers margin were computed through the models presented in sections 2.2 and 2.3, in both cases considering as input costs the monthly labor costs.

First, we show the retail margins ($\boldsymbol{\gamma}$), which in average present small variation across brands. Second, we have the manufacturer margin ($\boldsymbol{\Gamma^{nu}}$) and retailer bargaining power ($\boldsymbol{\lambda}$) computed through the usual specification (assuming no uncertainty and uneven bargaining power) according to these results in average the bargaining power is in favor of retailers, and consequently in the margin distribution the retailers have a larger piece of the pie ($\boldsymbol{\gamma} > \boldsymbol{\Gamma^{nu}}$). By comparing the retailer margins ($\boldsymbol{\gamma}$) and the manufacturer margin calculated through the uncertainty model assuming even bargaining power ($\boldsymbol{\Gamma^{u}}$), it can be observed that in average the retailer margin is higher than the manufacturer margin ($\boldsymbol{\gamma}>\boldsymbol{\Gamma^{u}}$), relating these results with the players beliefs, we can see that retailers beliefs on facing a no retaliation scenario ($\boldsymbol{\theta}$) is higher than the beliefs from manufacturers on the same scenario ($\boldsymbol{\delta}<\boldsymbol{\theta}$), which may be interpreted as a subestimation of counter party's threats by retailers compare to manufacturers, and this seems to be consistent for all brands.

Comparing the estimation of both manufacturer margins, it can be observed that on average the results from the model considering uncertainty and evenly distributed bargaining power are higher than the ones resulted from the usually applied model, which considers no uncertainty and assumes uneven bargaining power, i.e. $\boldsymbol{\Gamma^u}>\boldsymbol{\Gamma^{nu}}$. Even though, it is difficult to disentangle the effect of each assumption (no uncertainty vs. certainty and uneven vs. even distribution of bargaining power), some hints can we get from the results of brands B3 and B5, in which the effect of the assumption on the uncertainty is not longer present (given that both players expect facing no retaliation if no agreement is reached), and we can see that even on those cases $\boldsymbol{\Gamma^u}>\boldsymbol{\Gamma^{nu}}$, which may suggest that the assumption on uneven bargaining power may give an advantage to retailers; however, this should be further in detail analyzed.

As mentioned before, both models may be applied to different situations; and the assumptions of each of them may help to estimate/analyze a particular variable (either bargaining power distribution or uncertainty of bargainers -credibility of threats), but it should be taken into account that it may exist a trade off from applying either kind of assumptions.

Table 4: Results Supply Side

Brand	$\boldsymbol{\gamma}$		$\boldsymbol{\Gamma^{nu}}$		$\boldsymbol{\lambda}$		$\boldsymbol{\Gamma^{u}}$		$\boldsymbol{\delta}$		$\boldsymbol{\theta}$	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
B1	0.2906	0.0817	0.0907	0.0358	0.3304	0.1211	0.1299	0.1699	0.4528	0.3697	0.8118	0 .3464
B2	0.3032	0.0130	0.2391	0.0530	0 .7895	0.1880	0.2592	0.0910	0.8954	0.2734	0.9950	0.0165
B3	0.3043	0.0018	0.1264	0.0144	0.4259	0.0510	0.2968	0.0019	1	0	1	0
B4	0.2918	0.0782	0.1274	0.0454	0.4479	0.1132	0.2503	0.1869	0.6127	0.3935	0.9316	0.1193
B5	0.2620	0.1099	0.2273	0.0928	0.8961	0.0956	0.2626	0.1073	1.0000	0.0000	0.9896	0.0247
PL	0.3096	0.0248	0.2554	0.0428	0.8368	0.1549	0.3077	0.0242	1	0	1	0
Total	0.2939	0.0668	0.1835	0.0830	0.6378	0.2551	0.2524	0.1355	0.8126	0.3368	0.9565	0.1510

5 Conclusion

In the present study, it was applied a simplified version of the model presented by Klein and Rebolledo (2020), assuming players hold evenly distributed bargaining power and keeping the assumption on uncertain disagreement profits. We compared the estimations between this model and the ones from a traditional asymmetric bargaining power model which assumes certainty on the disagreement payoffs. As it was oberved, both models provide different estimations, in which the intuition behind the results from the model proposed were more consistent in all cases than the ones from the traditional model. The results also hinted that the effect of the assumption regarding the distribution of bargaining power may subestimate manufacturers margin; however, this should be further analyzed. In addition, the results from the model presented also highlight the importance of credibility at negotiations, how beliefs and credibility on players threats may play a role on the distribution of rent.

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