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Using Retail Scanner Data for Upstream Merger Analysis: Counterfactual Experiments in the Retail Coffee Market



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# USING RETAIL DATA FOR UPSTREAM MERGER ANALYSIS

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**Abstract**

The typical situation faced by antitrust authorities is to analyze a proposed manufacturer merger using scanner data at retail-level. I start with a benchmark model of manufacturers' and retailers' sequential pricing behavior. Then I perform counterfactual experiments to explore the relationship between downstream retailer pricing models and the resulting estimates of upstream mergers, in the absence of wholesale prices. Looking at scanner data for the ground coffee category sold at several retail chains in Germany I find that not considering retail pricing explicitly when analyzing the potential consequences of an upstream merger, results in simulated changes in welfare that are significantly different given the underlying model of retail pricing behavior. These findings are relevant for competition policy, and authorities should consider incorporating the role of retailers in upstream merger analyzes, especially in the presence of increasingly consolidated retail food markets.

JEL Classifications: C13, L13, L41. Keywords: Merger Analysis, Vertical relationships, multiple manufacturers and retailers.

## I. INTRODUCTION

One of the current discussions by antitrust authorities is to consider including vertical relationships between manufacturers and retailers when analyzing proposed mergers between manufacturers. This topic is referred as one of the

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current economic issues of the Federal Trade Commission (FTC). *(...)Estimates from scanner data provide, at best, reliable estimates of demand at retail. But the purpose (...) is to determine whether a merger of manufacturers is likely to be anticompetitive (...)* (Scheffman and Coleman, 2002). This paper presents a simple framework to do so and assesses merger welfare effects in a market where both upstream and downstream firms make pricing decisions. As a first step, this requires the researcher's estimation of the underlying model of manufacturers' and retailers' pricing behavior, and of a model of vertical relationships between manufacturers and retailers. The second step is to use this vertical pricing model for merger analysis to assess welfare effects of a merger between upstream manufacturers.

I focus on a national retail market for ground coffee in Germany, where a group of the leading manufacturers were allowed to merge by the German antitrust authority (the Bundeskartellamt) in the late nineties. Performing this analysis in a non-integrated food market vertical chain is of particular importance given the empirical evidence that a process of horizontal consolidation is taking place both at the food processing level (manufacturers) and at the retailer level (Sexton 2000). Understanding the implications for market power and for welfare resulting from this process of consolidation is of growing importance in these markets. In this analysis, I use retail level scanner data on quantities and prices for the top selling ground coffee products sold at a variety of large retail chains in Germany.

The research plan is as follows. First I estimate a model of consumer demand for ground coffee. Demand is specified as a random coefficient discrete choice model for differentiated products where a product is defined as a coffee brand sold at a certain retail chain. Second, given the estimates of the demand model, I estimate the implied price-cost margins for the retail chains and for the post merger manufacturer equilibrium. This step is done without observing data on wholesale prices, in a sequential pricing game based on a structural model of non-integrated vertically related markets as in Manuszak (2001), Mortimer (2004), Goldberg and Verboven (2005), Villas-Boas and Zhao (2005), Villas-Boas and Hellerstein (2006) and Villas-Boas (2007a). Following this literature stream, I assume that manufacturers compete as Nash-Bertrand in wholesale prices and that the manufacturers that have merged maximize joint profits. Given the wholesale prices, retail chains decide retail prices in a Nash-Bertrand fashion. Given the estimated margins for all manufacturers and for all retail chains, I then recover marginal costs by subtracting the estimated margins from the observed retail prices. The third step consists of simulating the Nash equilibrium that was in place before the firms merged. This is performed by finding the implied pre-merger Nash equilibrium prices given upstream and downstream Bertrand Nash-competition and vertical Stackelberg linear pricing model. In this exercise, I assume that there were no cost savings resulting from the mergers and also that the product choice set before and after the merger of the involved manufacturers remained the same. Next, I am able to compute the resulting change in consumer surplus and changes in profits for manufacturers and for retailers. The final step is to perform simulations for estimated welfare changes under alternative models of retail competition: (i) the previous literature's assumption that retailers add no retail margins (and therefore are not modeled); (ii) and, at the other extreme, that retailers behave collusively and add a retail margin resulting from downstream collusion. The goal is to compare the estimated welfare effects assuming linear pricing with these two counterfactuals varying the degree of ability of retailers to mark-up over the wholesale prices.

The previous and recent literature considers effects on prices and quantities sold resulting from mergers among horizontally competing firms (as in Baker and Bresnahan 1985, Berry and Pakes 1993, Werden and Froeb 1994, Nevo 2000, and Dubé 2005). The objective in those analyses is to simulate the welfare effects of a potential merger between two or more manufacturers, relying on estimates for a demand model and a model of firm pre-merger competitive behavior. The present paper follows this methodology but its contribution is to incorporate a model of non-integrated vertical interactions into the merger analysis. In this model, manufacturing firms who merge sell through retailers, who in turn decide the retail prices that consumers have to pay. The goal is to assess the welfare effects of these mergers on consumer surplus, on manufacturer surplus, and on retailer surplus, without observing wholesale prices (following Villas-Boas 2007a).

Not considering retail pricing decisions is an assumption that is reasonable for vertically integrated industries, but it is a simplifying assumption for most markets, because most merging manufacturers do not sell directly to consumers. If the simulation is based on the implicit assumption of passive or perfectly competitive retail firms, then it does not have to directly analyze the retail pricing behavior of retail firms (see, for example, Sexton 2000). Another example is a recent paper by Allain and Souam (2006), which analyzes the incentives to merge of retailers in relation to the incentives to merge of manufacturers. However, Manuszak (2001)argues that the assumption of vertical integration is not reasonable, and that one should consider a non-integrated vertical supply chain in his simulation of the downstream retail price level effects of upstream mergers of refineries in the Hawaiian gasoline market.

I follow Manuszak (2000)'s approach for a grocery retail market, where the assumption of vertical integration, or of no retail strategic pricing, may not reasonable given industry evidence. There are two studies that combine the same retail scanner data with additional data sources to empirically examine the determinants of retail and manufacturer margins in the German coffee market (Draganska and Klapper (2007) and Draganska, Klapper and Villas-Boas (2007)). The focus of the present paper is different from the previous two, in that it empirically assesses mergers within the wholesale (manufacturing) coffee market in the context of non-integrated vertical relationships between manufacturers and retailers. The main contribution of this paper is to illustrate that the importance of the choice of a manufacturer-retailer model underlying the framework for merger assessments.

From analyzing the effects of the consolidation that occured between manufacturers of ground coffee sold at the major four retail chains in Germany, there are two main findings. First, not considering retail pricing explicitly results in simulated changes in welfare that are significantly different from those when I assume that retail pricing behavior departs from Nash Bertrand, and include that behavior in the simulation. Second, by performing what if counterfactual scenarios, I find that welfare conclusions are significantly affected by the retail pricing behavior considered, and consequently the merger policy recommendations are affected as well.

The next section sets up the problem by describing the market and the available data. Section three describes the demand model and the solution for the supply model for imperfectly competing manufacturers selling through imperfectly competing retailers. The fourth section discusses the estimation method and counterfactual procedures. Section five presents and discusses the results and section six concludes by also discussing implications of the analysis and avenues for future research extensions.

## II. THE SET-UP: THE MARKET AND THE AVAILABLE DATA

The empirical focus is on the coffee market in Germany, where there are presently a small number of manufacturers producing coffee and selling to a small number of large retail chains. This market consists of an interesting and empirically attractive set-up to study imperfectly competitive retailers and the effects of merging manufacturers. The relatively small number of major firms in this industry is also attractive from a modeling and empirical perspective. In fact, there are only seven manufacturers producing coffee and selling it to consumers via a small set of national retailers. At the retail level, there are four major retail chains that have several retail stores throughout Germany. The retail chains are called Edeka, Markant, Metro, and Rewe. Aldi is the largest German discounter (similar to Walmart) but does not make data available to researchers. However, Aldi sales represent less than 5 percent of the coffee market, for the years in the data, while the retailers included in the data set capture over 95 percent of sales in the market. Thus the data used, are representative of the German coffee market.

The coffee brands included in the analysis, are sold to consumers primarily through the above retail chains. A smaller amount of coffee is sold through vertically integrated coffee shops. At the manufacturers level, there are seven major national brands in the coffee market. These are Jacobs, Onko, Melitta, Idee, Dallmayr, Tchibo, and Eduscho. These brands capture more than 95% of the market, while the rest consists of private label brands and a few minor brands. Jacobs and Onko are produced by Kraft. Before they merged in the 1990s and became part of Kraft, they were produced by two separate manufacturers, Onko and Jacobs Suchard AG.[1] Another merger that took place in mid-1997 was between Tchibo and Eduscho, which are now brands of the same main firm, Tchibo.[2]

The empirical analysis is based on a weekly data set on retail prices, aggregate market shares and product characteristics for seven coffee products produced by five manufacturers sold at four retail chains. Note that there are seven brands at the manufacturer level that are sold through the four different retailers and thus creating a choice set equal to twenty-eight products at the retail-consumer level. The price, advertising and market share data used in the empirical analysis were collected by MADAKOM, Germany, from a national sample of retail outlets belonging to the four major retailers Edeka, Markant, Metro, and Rewe, during the years 2000 and 2001. These data contain weekly information on the sales, prices, and promotional activity for all brands in the ground coffee category. I focus on the 7 major national brands of modal package size of 500 grams: the largest being Jacobs with 28% market share, Onko (20%), Melitta (16%), Idee (12%), Dallmayr (12%), Tchibo (9%), and Eduscho (3 %). Private label brands (1.71% market share) and a few minor brands (combined share of 2.57%) were dropped from the analysis.

Table 1 describes the data summary statistics broken up for each of the four retail chains, for each of the seven brands in the data. For the retail chains considered, the data obtained to perform this analysis were already aggregated across the different stores for each chain. Combined market shares for the products sold in Metro represent over forty-six percent of the market. Markant comes next with twenty-nine percent, then Edeka with fourteen percent, and finally Rewe with eleven percent. Since Aldi, the discounter, does not provide scanner data, estimates of Aldi's market share were obtained and are used to compute the outside option not modeled.

Looking at brand presence per retail chain, Jacobs is the market leader, followed by Melitta and Tchibo. However, Tchibo is the top-selling brand at Rewe. In terms of descriptive statistics for prices, Markant seems to be offering the lowest overall prices. Melitta, Jacobs, Onko, and Eduscho are somewhat lower-priced at all retailers, whereas Idee, Dallmayr and Tchibo occupy the upper end of the market. Price data are expressed in Deutsch Marks per 500 grams. Most of the quantity time series variation may be attributed to temporary price discounts. This is particularly true for the leading brands in the market, Jacobs, Tchibo and Melitta.

[1] http://www.fundinguniverse.com/company-histories/Kraft-Jacobs-Suchard-AG-Company-History.html.

[2] http://www.allbusiness.com/manufacturing/food-manufacturing-food-coffee-tea/605147-1.html.

**Table 1**. Summary Statistics for the 28 Products in the Sample

| | Prices | std p | Shares | Promotion | Advertising |
|---|---|---|---|---|---|
| Retailer Edeka | | | | | |
| Jacobs | 6.815 | 0.325 | 30.359 | 1.277 | 2.335 |
| Onko | 5.980 | 0.564 | 8.547 | 1.057 | 0.224 |
| Melitta | 6.241 | 0.320 | 12.706 | 1.018 | 1.776 |
| Idee | 8.008 | 0.638 | 4.989 | 0.726 | 0.302 |
| Dallmayr | 7.314 | 0.421 | 15.820 | 1.166 | 1.618 |
| Tchibo | 7.893 | 0.422 | 17.951 | 0.661 | 1.640 |
| Eduscho | 6.960 | 0.499 | 9.628 | 0.932 | 1.465 |
| Retailer Markant | | | | | |
| Jacobs | 6.537 | 0.523 | 30.619 | 1.024 | 2.335 |
| Onko | 5.978 | 0.541 | 7.306 | 1.033 | 0.224 |
| Melitta | 5.965 | 0.440 | 19.581 | 1.290 | 1.776 |
| Idee | 7.779 | 0.697 | 3.709 | 0.783 | 0.302 |
| Dallmayr | 7.304 | 0.491 | 12.248 | 0.939 | 1.618 |
| Tchibo | 7.826 | 0.446 | 15.845 | 0.684 | 1.640 |
| Eduscho | 6.916 | 0.553 | 10.692 | 0.904 | 1.465 |
| Retailer Metro | | | | | |
| Jacobs | 7.093 | 0.724 | 27.485 | 0.921 | 2.335 |
| Onko | 6.557 | 0.808 | 10.172 | 0.577 | 0.224 |
| Melitta | 6.669 | 0.808 | 23.375 | 0.857 | 1.776 |
| Idee | 8.093 | 0.930 | 3.735 | 0.536 | 0.302 |
| Dallmayr | 7.818 | 0.666 | 11.091 | 0.710 | 1.618 |
| Tchibo | 7.738 | 0.512 | 11.841 | 0.694 | 1.640 |
| Eduscho | 6.958 | 0.603 | 12.301 | 0.910 | 1.465 |
| Retailer Rewe | | | | | |
| Jacobs | 7.039 | 0.537 | 23.350 | 0.688 | 2.335 |
| Onko | 6.296 | 0.397 | 7.157 | 0.578 | 0.224 |
| Melitta | 6.565 | 0.392 | 15.892 | 0.863 | 1.776 |
| Idee | 8.279 | 0.480 | 2.812 | 0.410 | 0.302 |
| Dallmayr | 8.109 | 0.817 | 7.806 | 0.448 | 1.618 |
| Tchibo | 7.912 | 0.444 | 28.434 | 1.025 | 1.640 |
| Eduscho | 6.919 | 0.528 | 14.549 | 1.134 | 1.465 |
| By Retailers | | | | | |
| Edeka | 7.017 | 0.721 | 13.528 | 0.866 | 9.360 |
| Markant | 6.769 | 0.829 | 29.072 | 0.991 | 9.360 |
| Metro | 7.117 | 0.864 | 46.697 | 0.805 | 9.360 |
| Rewe | 7.260 | 0.829 | 10.703 | 0.842 | 9.360 |

The mean of the variables in the data is reported. Prices are in Deutsch Marks per 500 grams, Quantity in units sold of 500 grams, and Advertising in Million Euros. Source: MAKADOM, Germany.

In terms of promotions data, the data set contains a dummy variable for the presence of store-front advertisements, display and feature advertising; this variable varies by brand and by retailer. Auxiliary data on total advertising expenditures by brand (but not by brand by retailer) varies by year.

The quantity data consist of quantities sold for each brand of coffee at the different retailers. A unit in this data set corresponds to 500 grams of coffee, the modal package size of the products sold. To calculate the market share of each brand allowing for no purchase option (also called outside good option), one needs a measure of the size of the potential market. Market size per key account is calculated based on individual consumer panel data obtained from GfK , which records panelists' shopping trips. Given that the panel is representative, for each chain, the number of shopping trips in a given week is defined as the total market potential. I then use this measure of market size to calculate the share of the outside good and the brand shares. To account for Aldi, I adjust the weekly market size, i.e., the magnitude of the outside good, to account for the percentage of consumers who made their coffee purchases there (3% in 2000 and 4.5% in 2001).

The consolidations that took place in this market were twofold: the merger between the manufacturers Jacobs and Onko, and the merger between the manufacturers Tchibo and Eduscho. These two mergers occurred before the start of our data set, and therefore this paper has only post-merger market data and no pre-merger data. Furthermore, I do not observe wholesale price data, which is the price charged by the manufacturers to the retail chains. What I observe are retail level price, quantity and promotional post-merger data. The goal is to assess the changes in welfare, in producer and consumer surplus, that resulted from these two mergers. If retailers have a constant mark-up or no mark-up, I can use standard merger analysis techniques to compute the welfare changes. The remainder of this paper addresses when this simplifying approach may be more or less problematic in the context of simulations given an estimated demand and supply model.

## III. THE MODEL

This section sets up the model of demand and supply. The economic-econometric model is a standard discrete-choice demand formulation (McFadden 1984; Berry, Levinsohn and Pakes 1995) and a Stackelberg linear pricing model between multiple Nash-Bertrand competing manufacturers and Nash-Bertrand competing retail chains. This section derives first expressions for the total sum of retail and manufacturer price-cost margins as functions of demand substitution patterns for the supply model specified. Then it presents the alternative supply scenarios of passive retailers and of collusive downstream retailers and derives the resulting wholesale and retail margins again as functions of demand substitution patterns (for more technical details, see Villas-Boas 2007a and Villas-Boas and Hellerstein 2006).

### A. Demand

We assume that consumers choose among $N$ different products indexed by $j$ that consist of a variety of brands sold at different retail chains denoted by $k$, or decide to make no purchase in the category. Note that, if a certain brand is sold at two different retail chains, it results in two products at the consumer choice level, since brand $A$ at chain 1 is different from the same brand sold at chain 2. The indirect utility $U_{ijt}$ of consumer $i$ from purchasing product $j = 1, 2, \ldots, N$, in time period $t = 1, 2, \ldots, T$ is given by:

$$U_{ijt} = \alpha_j - \beta_i p_{jt} + \gamma X_{jt} + \xi_{jt} + \varepsilon_{ijt}, \tag{1}$$

where $\alpha_j$ is a product-retailer fixed effect capturing the intrinsic preference for product $j$ (where a product is defined as a brand sold at a particular retailer). The shelf price of product $j$ at time $t$ is denoted by $p_{jt}$. We include retailer promotions, manufacturer advertising and a time trend in $X_{jt}$. The term $\xi_{jt}$ accounts for factors such as shelf space, and positioning of the product, among other factors that affect consumer utility; these are observed by consumers and firms but are not observed by the researcher. $\varepsilon_{ijt}$ is an i.i.d. type I extreme value distributed error term capturing consumer idiosyncratic preferences.

To allow for category expansion or contraction, we include an outside good (no-purchase option), indexed by $j = 0$, whose utility is given by:

$$U_{i0kt} = \varepsilon_{i0kt}. \tag{2}$$

The price coefficient $\beta_i$ is assumed to vary across consumers according to $\beta_i = \beta + \sigma_p v_i,\ v_i \sim N(0, 1)$, where $\sigma_p$ is a parameter to be estimated. As in Nevo (2000), we rewrite the utility of consumer $i$ for product $j$ as:

$$U_{ijt} = \delta_{jt}(p_{jt}, X_{jt}, \xi_{jt}; \alpha, \beta, \gamma) + \mu_{ijt}(p_{jt}, v_i; \sigma_p) + \varepsilon_{ijt}, \tag{3}$$

where $\delta_{jt}$ is the mean utility, while $\mu_{ijt}$ is the deviation from the mean utility that allows for consumer heterogeneity in price response.

Let the distribution of $\mu_{ijt}$ across consumers be denoted as $F(\mu)$. The aggregate share $S_{jt}$ of product $j$ at time $t$ across all consumers is obtained by integrating the consumer level probabilities:

$$S_{jt} = \int \frac{\exp(\delta_{jt} + \mu_{ijt})}{1 + \sum_{n=1}^{N} \exp(\delta_{nt} + \mu_{int})} dF(\mu). \tag{4}$$

This aggregate demand system not only accounts for consumer heterogeneity, but also provides more flexible aggregate substitution patterns than the homogeneous logit model.

### B. Linear Pricing Supply Model

On the supply side, let us assume a manufacturer Stackelberg model in which $M$ manufacturers set wholesale prices $p^w$ first, in a Nash-Bertrand manufacturer-level game, and then $R$ retailers (chains) follow, setting retail prices $p$ in a Nash-Bertrand fashion.[3] Let each retail chain $r$ marginal costs for product $j$ be given by $c_j^r$, and let manufacturers' marginal cost be given by $c_j^w$. We also assume that the manufacturers who have merged behave as if they are the same manufacturer by maximizing joint profits over the set of products both produce.

Assume each retail chain $r$ maximizes his profit function defined by

$$\pi_r = \sum_{j \epsilon S_r} \left[ p_j - p_j^w - c_j^r \right] s_j(p) \quad \text{for} \quad r = 1, ...R, \tag{5}$$

where $S_r$ is the set of products sold by retail chain $r$,and $s_j$ is defined, given a potential market, as the market share of product $j$. The first-order conditions, assuming a pure-strategy Nash equilibrium in retail prices, are:

$$s_j + \sum_{m \epsilon S_r} T_r(m,j) \left[ p_m - p_m^w - c_m^r \right] \frac{\partial s_m}{\partial p_j} = 0 \quad \text{for} \quad j = 1, ...N \tag{6}$$

where matrix $T_r$ has the general element $T_r(i,j) = 1$, if a retail chain sells both products $i$ and $j$ and equal to zero otherwise. Switching to matrix notation, let us define $[A*B]$ as the element-by-element multiplication of two matrices of the same dimensions $A$ and $B$. Let $\Delta_r$ be a matrix with general element $\Delta_r(i,j) = \frac{\partial s_j}{\partial p_i}$, containing retail chain level demand substitution patterns with respect to changes in the retail prices of all products. Solving (6) for the price-cost margins for all products in vector notation gives the price-cost margins $m_r$ for all the products in the retail chains under Nash-Bertrand pricing:

$$\underbrace{p - p^w - c^r}_{m^r} = -[T_r * \Delta_r]^{-1} s(p), \tag{7}$$

which is a system of $N$ implicit functions that expresses the $N$ retail prices as functions of the wholesale prices. If retail chains behave as Nash-Bertrand players then equation (7) describes their supply relation.

Manufacturers choose wholesale prices $p^w$ to maximize their profits given by

$$\pi_w = \sum_{j \epsilon S_w} \left[ p_j^w - c_j^w \right] \, s_j(p(p^w)), \tag{8}$$

[3] The several stores in the same chain have price correlation very close to one and they do appear to perform chain-level retail pricing.

where $S_{wt}$ is the set of products sold by manufacturer $w$ during week $t$ and $c^w_{jt}$ is the marginal cost of the manufacturer that produces product $j$, and knowing that retail chains behave according to (7).[4] Solving for the first-order conditions from the manufacturers' profit-maximization problem, assuming again a pure-strategy Nash equilibrium in wholesale prices and using matrix notation, yields:

$$\underbrace{(p^w - c^w)}_{m^w} = -[T_w * \Delta_w]^{-1} s(p), \tag{9}$$

where $T_w$ is a matrix with general element $T_w(i,j) = 1$, if the manufacturer sells both products $i$ and $j$, and equal to zero otherwise; $\Delta_w$ is a matrix with general element $\Delta_w(i,j) = \frac{\partial s_j}{\partial p^w_i}$ containing changes in demand for all products when wholesale prices change subject to retail mark-up pricing behavior assumed in (7); and $*$ represents the element-by-element multiplication of both matrices.[5]

Under the above model, given the demand parameters $\theta = [\ \alpha\ \beta\ \sigma\ ]$, the implied price-cost margins for all $N$ products can be calculated as $m^r(\theta)$ for the retailers and $m^w(\theta)$ for the manufacturers.[6]

### C. Passive Retailers Model

Under this assumption, given retail and manufacturer marginal costs, and using the same notation as above, retailers are passive and therefore retail mark-ups are just covering their retail costs,

$$p - p^w = c^r. \tag{10}$$

Manufacturers margins are then given by

$$\underbrace{p^w - c^w}_{m^w} = -[T_w * \Delta_r]^{-1} s(p) \tag{11}$$

where $T_w$ is the manufacturer matrix of product ownership, with elements equal two one when the manufacturer sells both products in row and column, as previously defined.

[4]Note that in this market manufacturers may, if they choose to, set different wholesale prices for the same brand sold to different retailers. In another study, Villas-Boas (2007b) considers the welfare effects from imposing uniform wholesale pricing restrictions in this market.

[5]See Villas-Boas (2007a) and Villas-Boas and Hellerstein (2006) for the derivation of $\Delta_w$.

[6]If the profit maximizing retail mark-up, $m^r(\theta)$ is non varying with quantity, then the linear pricing model is indistinguishable from a model where retailers charge a constant retail mark-up $m^r_{constant}$, if $m^r_{constant} = m^r(\theta)$. For special cases of demand models where $\frac{\partial m^r(\theta)}{\partial q} = 0$ this may be true. For general demand models this is not the case.

### D. Model of Linear Pricing with Collusive Retailers

Under the assumption that there is downstream collusion, retailers' margins are given by

$$\underbrace{p - p^w - c^r}_{m^r} = -\Delta_r^{-1} s(p), \tag{12}$$

given that retailers are choosing retail prices to jointly maximize profits. Manufacturers margins are given by (9), but now $\Delta_w$ is a matrix containing changes in demand for all products when wholesale prices change, subject to retail mark-up pricing behavior assumed in (12).

## IV. ESTIMATION AND MERGER SIMULATIONS

With the data sample discussed in section 2, we estimate demand and use the estimates to compute price-cost margins for retailers and manufacturers. Given demand and assuming the model of sequential Bertrand-Nash linear pricing as a starting point, I simulate the resulting equilibrium from imposing pre-merger pricing practices, and derive expressions to compute estimates of welfare, consumer surplus and producer surplus changes. This allows me to compute welfare changes, in the context of imperfectly competitive retailers, in order to gain insights into the role of downstream retail market power in horizontal upstream merger analysis.

### A. Demand Estimation

When estimating demand, the goal is to derive parameter estimates that produce product market shares close to the observed ones. This procedure is non-linear in the demand parameters, and prices enter as endogenous variables. The key step is to construct a demand side equation that is linear in the parameters associated with the endogenous variables so that instrumental variables estimation can be directly applied. This follows from equating the estimated product market shares[7] to the observed shares and solving for the mean utility across all consumers, defined as

$$\delta_{jt}(\alpha, \beta, \gamma) = \alpha - \beta p_{jt} + x_{jt}\gamma + \xi_{jt}. \tag{13}$$

For the mixed Logit model, solving for the mean utility (as in Berry 1994) has to be done numerically (see Berry, Levinsohn and Pakes 1995). Finally, once this inversion has been made, one obtains equation (13) which is linear

[7] For the random coefficient model, the product market share in equation (4) is approximated by the Logit smoothed accept-reject simulator.

in the parameter associated with price. If we let $\theta$ be the demand side parameters to be estimated, then $\theta = (\theta_L, \sigma_p)$, where $\theta_L$ are the linear parameters $(\alpha, \beta, \gamma)$ and $\sigma_p$ is the non-linear parameter. In the mixed Logit model, $\theta$ is obtained by feasible Simulated Method of Moments (SMOM) following Nevo's (2000) estimation algorithm.[8]

### B. Instruments and Identification of Demand

The first step is having consistently estimated demand parameters. In the demand model, consumers choose between different coffee products over time, where a product is perceived as a bundle of attributes, among which one is price. Since prices are not randomly assigned, I use coffee input price changes over time that are significant and exogenous to unobserved changes in product characteristics as instruments for prices. These cost instruments separate cross-coffee-brand variation in prices due to exogenous factors from endogenous variation in prices from unobserved product characteristics changes. Instrumental variables in the estimation of demand are required because retailers consider all product characteristics when setting retail prices, not only the ones that are observed. That is, retailers consider both observed characteristics, $x_{jt}$, and unobserved characteristics, $\xi_{jt}$. Retailers also account for any changes in their products' characteristics and valuations. A product fixed effect is included to capture observed and unobserved product characteristics/valuations that are constant over time. Furthermore, a time trend captures trending unobserved determinants of demand. The econometric error that remains in $\xi_{jt}$ will therefore only include the (not-trending) changes in unobserved product characteristics such as unobserved promotions and changes in shelf display and/or changes in unobserved consumer preferences. This implies that the prices in (13) are correlated with changes in unobserved product characteristics affecting demand. Hence, to obtain a precise estimate of the price coefficients, instruments are used. We use, as instruments for prices, direct components of marginal cost, namely manufacturer input prices, interacted with product-specific fixed effects as in Villas-Boas (2007a). The price decision takes into account exogenous cost-side variables, such as input prices. It is reasonable to assume that the prices of inputs are uncorrelated with changes in unobserved product characteristics, $\xi_{jt}$. For example, changes in shelf display are most likely not correlated with raw coffee prices. The intuition for interacting input prices with product dummies is to allow raw coffee average price to enter the production function of each product differently, maybe because products use different blends or purchase raw coffee from different regions in the world. The identifying assumption

[8] The aim is to concentrate the SMOM objective function such that it will be only a function of the non-linear parameters. By expressing the optimal vector of linear parameters as a function of the non-linear parameters and then substituting back into the objective function, it can be optimized with respect to the non-linear parameters alone.

is that changes in unobserved product characteristics $\xi_{jt}$, such as changes in shelf display, are most likely not correlated with changes in raw coffee average prices. The raw coffee cost measure used in the analysis is the trade-volume weighted average of the five most traded contracts at the New York Stock Exchange, where these dollar prices were adjusted for the exchange rate and for a tax in the amount of 2.169 Deutsch Marks per 500 grams of coffee. The production and roasting of coffee is quite simple; all input factors are used in fixed proportions (the main input being coffee beans, given that each of the others individually represents less than five per cent of costs) and economies of scale in production are limited (see Bettendorf and Verboven, 2000).

### C. Simulation of Pre-Merger Nash Equilibrium

Given demand and assuming the model of no uniform pricing as a starting point, where retail and manufacturer mark-ups are given by (7) and (9), respectively, we recover the marginal costs under such model by

$$\underbrace{c^w + c^r}_{\hat{c}} \;=\; p \;-\Big[\; -[T_r * \Delta_r]^{-1}q(p) - [T_w * \Delta_w]^{-1}q(p)\Big]. \qquad (14)$$

Note that we recover the sum or retail and manufacturer marginal costs in (14) without the need to observe wholesale prices, once we have estimated demand. Then we simulate the equilibrium ($N$ by 1) vector of retail prices under pre-merger wholesale pricing practices and assuming that retailers follow in a Nash Bertrand pricing game, as the prices that solve

$$p^* = \hat{c} - (T_r * \Delta_r)^{-1}\, q(p^*) - [\;(T_w^{\text{Pre-Merger}} * \Delta_w)]^{-1}[s(p^*)], \qquad (15)$$

again without the need to observe wholesale prices.[9]

We assess the changes in the welfare components (consumers', manufacturers' and retailers' surplus) resulting from the changes of the simulated counterfactual equilibrium prices $p^*$ of the pre-merger wholesale game from the observed equilibrium prices $p$ after the merger occurred. Given the demand model utility maximization, expected consumer $i$'s surplus (Small and Rosen 1981) is defined as $E\left[CS_i\right] = \frac{1}{|\beta_i|}E\left[max_j(u_{ij}(p)\forall j)\right]$, where $\beta_i$ denotes the marginal utility of income in (1) that is assumed to remain constant for each household. Given the extreme value distributional assumptions and linear utility formulation, the change in consumer surplus for individual $i$ is computed as

$$\Delta E\left[CS_i\right] = \frac{1}{|\beta_i|}\left[ln\left(\sum_{j=1}^{N} e^{\alpha_j + x_j\gamma_i - \beta_i p_j^*}\right) - ln\left(\sum_{j=1}^{N} e^{\alpha_j + x_j\gamma_i - \beta_i p_j}\right)\right]. \qquad (16)$$

[9]Common to related papers, one limitation of this paper is that it does not consider the possibility of potential efficiency gains due to joint production and distribution of the merging manufacturers, as well as changes in products made available to consumers pre- and post-merger.

This measure of consumer valuation is computed using the estimated demand model parameters and the simulated counterfactual retail equilibrium prices. Total change in consumer surplus is obtained adding this over the individuals. The change in the sum (given that we do not observe wholesale prices) of manufacturers' and retailers' producer surplus is given by

$$\Delta E\left[PS\right] = \left[\sum_{j=1}^{N}\left(\pi_j^r\left(p\right) + \pi_j^w\left(p\right)\right) - \sum_{j=1}^{N}\left(\pi_j^r\left(p^*\right) + \pi_j^w\left(p^*\right)\right)\right]. \tag{17}$$

where we assume that manufacturer and retailer marginal costs remain unchanged as do the set of products sold. The change in total welfare is the sum of total change in consumer surplus, manufacturers' producer surplus and retailers' producer surplus.

The final simulations start from the benchmark recovered costs and consider the effects of the same upstream merger analysis as before, but now assuming that retailers are (i) passive or (ii) collusive in the counterfactuals. In doing so, I am able to assess the role of retail pricing behavior on the welfare estimates for these two extreme retail behavior cases.

## V. RESULTS

### A. Demand and Elasticities

The demand model estimates are presented in Table 2. The first set of columns presents the OLS estimates without instrumenting for price; the second set of columns presents the Logit model estimates where I have instrumented for prices. In the last set of columns, consumer heterogeneity is considered by allowing the coefficient on price to vary across consumers as a function of unobserved consumer characteristics, and the Generalized Method of Moments estimates of the random coefficient specification are presented, where the individual choice probabilities are given by (4).

The first stage R-squared and F-Statistic are high, suggesting that the instruments used are important in order to consistently estimate demand parameters. Also, comparing the first two set of columns corresponding to no instrumentation (OLS) with the other columns to the right: when price is instrumented for, one notices that the estimates of the other variables affecting utility are robust to instrumentation, and the price parameter does increase slightly in absolute value. On average price, has a significant and negative impact on utility and, moreover, when comparing the Logit with the random coefficient specification, it appears that unobservable characteristics in the population seem to affect the price coefficient significantly. Promotion and advertising coefficients are significant and positive, and thus are estimated demand expanding factors. There is a significant and negative time trend

**Table 2**. Demand Results

| Parameter | *LogitOLS*(1) Est. | Std | *LogitIV*(2) Est. | Std | *GMM*(3) Est. | Std |
|---|---|---|---|---|---|---|
| Price | −0.678 | (0.016) | −0.753 | (0.035) | −0.772 | (0.065) |
| Constant | −2.137 | (0.137) | −1.534 | (0.284) | −1.619 | (0.411) |
| Promotion | 0.482 | (0.015) | 0.435 | (0.025) | 0.466 | (0.033) |
| Trend | −0.002 | (0.000) | −0.002 | (0.000) | −0.002 | (0.000) |
| Advertising | 0.032 | (0.008) | 0.032 | (0.008) | 0.027 | (0.007) |
| Onko in Edeka | −1.849 | (0.052) | −1.922 | (0.061) | −1.897 | (0.064) |
| Melitta in Edeka | −1.172 | (0.049) | −1.227 | (0.054) | −1.202 | (0.051) |
| Idee in Edeka | −0.678 | (0.052) | −0.615 | (0.058) | −0.663 | (0.055) |
| Dallmayr in Edeka | −0.373 | (0.048) | −0.340 | (0.050) | −0.362 | (0.047) |
| Tchibo in Edeka | 0.612 | (0.049) | 0.664 | (0.053) | 0.632 | (0.048) |
| Eduscho in Edeka | −0.858 | (0.047) | −0.863 | (0.048) | −0.862 | (0.038) |
| Jacobs in Markant | 0.620 | (0.047) | 0.587 | (0.050) | 0.604 | (0.047) |
| Onko in Markant | −1.266 | (0.052) | −1.340 | (0.061) | −1.315 | (0.065) |
| Melitta in Markant | −0.351 | (0.049) | −0.414 | (0.056) | −0.388 | (0.058) |
| Idee in Markant | −0.454 | (0.051) | −0.405 | (0.055) | −0.444 | (0.058) |
| Dallmayr in Markant | 0.260 | (0.047) | 0.280 | (0.048) | 0.266 | (0.043) |
| Tchibo in Markant | 1.184 | (0.049) | 1.232 | (0.053) | 1.202 | (0.046) |
| Eduscho in Markant | −0.034 | (0.048) | −0.044 | (0.048) | −0.041 | (0.037) |
| Jacobs in Metro | 1.086 | (0.047) | 1.090 | (0.047) | 1.085 | (0.051) |
| Onko in Metro | −0.931 | (0.052) | −0.984 | (0.056) | −0.966 | (0.089) |
| Melitta in Metro | 0.301 | (0.048) | 0.270 | (0.050) | 0.283 | (0.064) |
| Idee in Metro | 0.001 | (0.052) | 0.061 | (0.058) | 0.015 | (0.056) |
| Dallmayr in Metro | 0.442 | (0.049) | 0.491 | (0.053) | 0.459 | (0.069) |
| Tchibo in Metro | 1.289 | (0.048) | 1.331 | (0.051) | 1.305 | (0.045) |
| Eduscho in Metro | 0.554 | (0.047) | 0.547 | (0.048) | 0.549 | (0.040) |
| Jacobs in Rewe | −0.122 | (0.047) | −0.134 | (0.048) | −0.125 | (0.044) |
| Onko in Rewe | −1.845 | (0.053) | −1.917 | (0.061) | −1.887 | (0.075) |
| Melitta in Rewe | −0.960 | (0.048) | −0.998 | (0.051) | −0.980 | (0.052) |
| Idee in Rewe | −1.161 | (0.052) | −1.093 | (0.060) | −1.142 | (0.062) |
| Dallmayr in Rewe | −0.720 | (0.050) | −0.663 | (0.055) | −0.700 | (0.057) |
| Tchibo in Rewe | 0.666 | (0.050) | 0.736 | (0.058) | 0.692 | (0.057) |
| Eduscho in Rewe | −0.833 | (0.047) | −0.832 | (0.048) | −0.836 | (0.043) |
| Std. Deviation Price ($\Upsilon$) | | | | | 0.098 | (0.035) |
| First Stage | | | | | | |
| F(28,2766) (p-value) | | | 50.78 | (0.000) | 50.78 | (0.000) |
| R Squared | | | 0.842 | | 0.842 | |

OLS (in columns (1)), Logit (in columns (2) and Random Coefficients for price (in columns (3)) GMM estimates. White standard errors are in parenthesis. Source: Author's calculations.

effect, which is in line with the evidence in the market that the overall attractiveness of the category has been diminishing over time in the German coffee market.[10]

**Table 3**. Elasticities

Given Mixed Logit Demand Estimates in Column (3) of Table 2

| | Own Price El | | Cross Price El | |
|---|---|---|---|---|
| | mean | std | mean | std/mean |
| By manufacturers | | | | |
| Jacobs | −6.01 | 0.17 | 0.07 | 0.21 |
| Onko | −5.59 | 0.19 | 0.01 | 0.21 |
| Melitta | −5.69 | 0.22 | 0.03 | 0.21 |
| Idee | −6.81 | 0.13 | 0.01 | 0.22 |
| Dallmayr | −6.54 | 0.25 | 0.03 | 0.22 |
| Tchibo | −6.66 | 0.06 | 0.06 | 0.22 |
| Eduscho | −6.09 | 0.02 | 0.03 | 0.21 |

| | Own Price El | Cross Price Elasticities | | |
|---|---|---|---|---|
| | mean | mean Overall | Same Store | NotSame Store |
| By Retailers | | | | |
| Edeka | −6.15 | 0.02 | 0.02 | 0.02 |
| Markant | −6.04 | 0.03 | 0.04 | 0.03 |
| Metro | −6.28 | 0.05 | 0.05 | 0.04 |
| Rewe | −6.33 | 0.01 | 0.02 | 0.01 |

Source: Author's calculations.

The random coefficient demand model in column (3) implies own-price elasticities ranging from -5.6 (with a standard deviation of 0.2) for Onko to -6.8 (s.d. of 0.1) for Idee. These estimates are consistent with other studies in the ground coffee category such as Krishnamurthi and Raj (1991). Mean cross-price elasticities are, on average, 0.02 with a standard deviation of 0.02, and the point estimates vary significantly, ranging from 0.003 to 0.11. The complete table of elasticities is too large to report here. Instead, Table 3 reports summary statistics for estimated own- and cross-price elasticities. The purpose of this table is to show that the estimated substitution patterns are not driven by the restrictive Logit patterns. The random coefficient model used here addresses the issue of having substitution patterns that are functional form driven, which is a major concern for merger analysis (see McFadden, 1981; Werden and Froeb, 1994; Berry, Levinsohn, and Pakes, 1995; and Nevo, 2000). The main concern has to do with the restrictive pattern of cross-price elasticities resulting from the logit specification. Cross-price elasticities are forced to be "equal," that is, the percent changes

[10]Industry evidence from Germany shows that yearly consumption, measured as kilograms per capita per year, has fallen from 7.4 by ten percent in the twelve year period 1990-2002.

in all brands' market shares are exactly the same for a change in a certain price of a brand. In contrast, these limitations do not appear to be present when the random coefficient model is estimated and used. This is illustrated by Table 3, where there are considerable differences in cross price elasticities. In fact, the standard deviation in cross-price elasticities relative to the average cross price elasticities for each price change of each brand is about twenty percent, and thus not zero. One conclusion to be drawn is that it is important to be aware to what extent using a poor demand model may affect the merger analysis.[11]

### B. Benchmark Supply Model Results

The demand estimates from the random coefficient specification are used to compute the implied estimated substitution patterns, which in turn are combined with the model of retail and manufacturer behavior to estimate the retail and wholesale margins. In Table 4, the summary statistics for the estimated margins are presented under the benchmark model. Subtracting the estimated margins from retail prices, I also recover the sum of retail and manufacturer marginal costs of all products for both models; summary statistics for those are provided in the bottom of the table. The average estimated recovered cost of 4.3 Deutsch Marks per unit is very plausible, according to industry research, and also within the ball-park when comparing with the average raw coffee price after adjusting for the expected loss in volume when produced (given the t-statistic of 0.7 and p-value of 0.5). This paper does not wish to claim, based on the existing data, that this is the correct model for this industry. Rather, the idea is to use this model as a benchmark to show that the relationships among retailers and manufacturers matter for merger assessments.[12]

### C. Merger Analysis

The changes in retail prices that resulted from the upstream mergers are obtained as the difference between observed retail prices and simulated pre-merger Nash equilibrium prices. With these simulated prices, I am able to

[11] I also estimated specifications with random coefficients on brand dummies following a more flexible demand model. I do not have data on product characteristics for different coffee brands (to be able to specify heterogeneity along observed product attributes as in Berry Levinsohn and Pakes, 1995). I allow heterogeneity along unobserved (constant) product characteristics captured by the brand dummies. While the estimated random parameters were not statistically significant for the alternatives investigated, it is worth noting that the price mean and standard errors estimates were very robust across the alternative demand random coefficient specifications.

[12] Other models have not been estimated, such as two-part tariff structures, and better costs estimates should be used when confronting the different models formally.

**Table 4**. Price-Cost Margins and Recovered Costs for Benchmark Linear Pricing Model

| | Linear Pricing Model | | |
|---|---|---|---|
| | mean | std | % of Price |
| Manufacturer Margins | | | |
| Jacobs | 1.411 | (0.078) | 20.7% |
| Onko | 1.399 | (0.074) | 22.9% |
| Melitta | 1.383 | (0.067) | 22.0% |
| Idee | 1.397 | (0.077) | 17.5% |
| Dallmayr | 1.397 | (0.076) | 18.5% |
| Tchibo | 1.422 | (0.088) | 18.2% |
| Eduscho | 1.405 | (0.077) | 20.4% |
| Retailer Margins | | | |
| Markant | 1.415 | (0.087) | 20.4% |
| Edeka | 1.429 | (0.092) | 21.1% |
| Metro | 1.445 | (0.096) | 20.2% |
| Rewe | 1.417 | (0.088) | 19.7% |
| Total Margins | 2.829 | (0.167) | 40.4% |
| Recovered Costs | 4.299 | (0.921) | p-value |
| t-statistic(recovered costs=raw Coffee Estimate) | 0.705 | | 0.5 |

PCM=$(p-c)/p$ where $p$ is price and $c$ is marginal cost and all data are expressed in Deutsch Marks per 500 grams. Recovered Costs=$p - PCM$ where $p$ is retail price and $PCM$ are the estimated margins, also in Deutsch Marks per 500 grams. Std: Standard deviation. Source: Author's calculations.

estimate the resulting pre-merger manufacturers' and pre-merger retailers' margins using the above price-cost margin equations with pre-merger $T$ matrices. On that manner, I also compute the manufacturers' and retailers' pre-merger profits, using the profit functions in equations (8) and (5), respectively.

**Table 5**. Estimated Changes in Retail Prices and Quantities due to Upstream Mergers

| | Price | | Quantity | | |
|---|---|---|---|---|---|
| | Change | std | Change | std | % Change |
| Random Coefficient on Price | | | | | |
| Overall | 0.045 | 0.006 | −5.05 | 0.91 | −3.73 |
| By Retailer | | | | | |
| Edeka | 0.044 | 0.012 | −2.20 | 0.91 | −2.71 |
| Markant | 0.046 | 0.012 | −7.19 | 1.91 | −3.83 |
| Metro | 0.048 | 0.013 | −9.00 | 2.79 | −3.99 |
| Rewe | 0.044 | 0.012 | −1.81 | 0.75 | −2.71 |
| By Manufacturer | | | | | |
| Jacobs | 0.043 | 0.016 | −10.48 | 4.30 | −3.94 |
| Onko | 0.061 | 0.015 | −3.54 | 1.10 | −6.37 |
| Melitta | 0.034 | 0.014 | −4.44 | 2.34 | −2.64 |
| Idee | 0.037 | 0.018 | −1.54 | 0.81 | −2.94 |
| Dallmayr | 0.035 | 0.018 | −4.49 | 1.39 | −4.51 |
| Tchibo | 0.050 | 0.017 | −6.99 | 2.51 | −3.47 |
| Eduscho | 0.057 | 0.016 | −3.87 | 1.95 | −2.76 |

Prices are expressed in Deutsch Marks per 500 grams; Changes are computed as Data that are Observed Post Merger Minus Simulated Pre Merger Data. Average change is computed for each brand over the time period and std reports standard errors of the changes. Source: Author's calculations.

Table 5 presents the average changes in prices and also the implied average changes and percent changes in quantities as a result of the upstream mergers. All these computations are based on the demand estimates previously described. The simulated price increases are economically small but significant, and the quantity sold for all brands decreases on average.[13]

While the previous table reports results on equilibrium prices and quantities, the implied changes in welfare are of importance for merger analysis. Table 6 presents changes in producer profits and consumer surplus and overall changes in welfare resulting from the mergers. It also presents a breakdown of the resulting changes in profits for manufacturers and for retailers separately, without the need to observe wholesale prices. Total change in Consumer Surplus is obtained by averaging the computed compensated variation for each individual draw and them multiplying by the market size. Changes in profits

[13]The analysis starts with the observed post merger data and compares those to simulated pre-merger equilibrium data. Since the pre-merger situation actually occurred, one important check would be to compare actual with simulated pre-merger prices and quantities. Unfortunately, however, I could not obtain pre-merger data.

are computed as the variable profits in the post merger minus the variable profits in the pre merger situation.

According to the surplus estimates, the mergers between Jacobs and Onko, and between Tchibo and Eduscho, lead to a significant overall decrease in welfare. This is mostly due to a significant decrease in retailer surplus, while manufacturer surplus changes are not significant. Another contributor to a drop in welfare is a significant decrease in consumer surplus due to the upstream mergers. In summary, the recommendation would be to challenge the mergers, given that welfare would significantly decrease (point estimate of -421 and p-value of 0.01).

**Table 6**. Estimated Changes in Surplus due to Upstream Mergers.

| Change in Producer Surplus | Mean Estimate | std | Percent Revenues |
|---|---|---|---|
| Retailers | | | |
| Edeka | −26.10 | 14.16 | 0.57 |
| Markant | −83.43 | 42.65 | 0.82 |
| Metro | −107.02 | 54.39 | 0.90 |
| Rewe | −21.40 | 10.19 | 0.56 |
| Manufacturers | | | |
| Jacobs | −60.72 | 36.22 | 0.74 |
| Onko | −13.56 | 7.57 | 0.96 |
| Melitta | −27.55 | 20.25 | 0.66 |
| Idee | −9.64 | 6.33 | 0.52 |
| Dallmayr | −27.03 | 12.13 | 0.79 |
| Tchibo | −33.89 | 27.92 | 0.47 |
| Eduscho | −13.70 | 17.74 | 0.33 |
| Change in Producer Surplus | −224.98 | 120.76 | 1.08 |
| Change in Consumer Surplus | −196.26 | 106.55 | 0.95 |
| Change Welfare | −421.24 | 161.04 | 2.03 |

All data are expressed in Deutsch Marks per week; Average change was computed for each brand over the time period. std: Standard deviation. Source: Author's calculations.

## D. Merger Simulations without Considering Retailers

This subsection replicates merger analysis that does not consider retail pricing. The ultimate goal is to compare the resulting welfare estimates to the welfare changes from the previous subsection, where retail pricing is explicitly modeled and included in the upstream merger calculations. First, I estimate the margins from manufacturers pricing model without any retailers, and am able to recover post merger underlying implied costs. Given these costs, I then simulate pre merger Nash equilibrium prices, compute the resulting welfare estimates, and compare whether those are different from the welfare estimates obtained when explicitly considering retail pricing. This analysis is presented in Table 7.

Not considering retailers at all leads to significantly different changes in quantity and prices. In particular, estimated changes in prices and quantities are smaller than those estimated when considering retailers; the null hypothesis that the estimated changes are similar is rejected at the five percent level for prices and quantity changes.

Estimated average surplus changes are overall smaller in magnitude when compared to those in Table 6. However, the differences are not statistically significant at the one percent level. When comparing the estimated producer surplus changes by manufacturer (in the bottom of Table 7) with the changes in Table 6, we conclude that the estimated changes in producer surplus are mostly not significant. Moreover, the changes in producer surplus are not significantly different at the one percent level from those estimated when explicitly considering retailers' Nash-Bertrand pricing. One exception is manufacturer Onko, where the estimated drop in manufacturer surplus is smaller than the average drop estimated in Table 6; this difference is significant at the ten percent level. In terms of overall changes in manufacturers' and consumer surplus, we cannot reject at the one percent significance level that they are equal to the estimated changes in Table 6. However, estimated point estimates for retailer's surplus are negative and significant, leading to an overall estimated average change in total welfare that is larger in absolute value when we include retailers' pricing in the analysis. One implication is that one would infer smaller welfare changes, and, in this case, smaller losses, if one does not include the retailers in the welfare computations. In the case studied in this paper, the mergers were authorized by the Bundeskartellamt on the assumption that the German coffee market was highly competitive among the largest manufacturers (roasters) and therefore there was no threat of decreased competition.[14] Although each of the two post-merger entities would have each roughly thirty percent of the market, there was equally high substitutability of the merging roaster's products to the other coffee manufacturers not involved in the mergers.[15] Although the welfare point estimates in Table 7 are negative, they are not significantly different from zero at the one percent level. Thus, if one were to use the estimates in Table 7 for assessing the mergers, the policy conclusion would be to approve the mergers. In contrast, including the retailers' pricing leads to larger point estimates surplus losses (in absolute value). Thus a simulation including retailer pricing, as shown in Table 6, would lead to the opposite policy recommendation: the Bundeskartellamt would challenge the mergers.

[14]Tea & Coffee Trade Journal, January 1997.

[15]In fact, according to the demand estimates in this paper, the estimated cross price elasticities are not statistically different when looking among non merging and among merging manufacturers. For example, the point estimate for the cross price elasticity between Eduscho and Tchibo is 0.027 and between Eduscho Melitta is 0.025.

### E. Sensitivity of Welfare Estimates to Retail Counterfactual

From comparing the results of the two previous subsections, I conclude that considering retail pricing behavior in the upstream merger welfare calculations does affect welfare estimates for the supply model used in this analysis. In order to investigate how different retail pricing behavior models may affect welfare estimates, the final analysis uses a counterfactual what-if simulation to assess the sensitivity of welfare calculations to departures from the retail Nash Bertrand pricing model previously considered. More precisely, what welfare effects would be missed in an upstream merger analysis if the retail sector were collusive but the merger analysis did not consider retail strategic behavior?

**Table 7**. Merger Analysis Without Retailers in the Model.

| | Price | | Quantity | |
|---|---|---|---|---|
| | Change | Diff. Table 4 p-value | Change | Diff. Table 5 p-value |
| Overall | 0.03 | 0.01 | −2.67 | 0.03 |

| Change in Prod. Surplus | Mean | std | % Revenues | Diff. Table 6 p-value |
|---|---|---|---|---|
| Jacobs | −29.87 | 21.11 | 0.14 | 0.45 |
| Onko | −6.99 | 3.92 | 0.03 | 0.08 |
| Melitta | −15.13 | 11.56 | 0.07 | 0.46 |
| Idee | −4.56 | 3.37 | 0.02 | 0.14 |
| Dallmayr | −14.03 | 6.84 | 0.07 | 0.32 |
| Tchibo | −18.19 | 16.55 | 0.09 | 0.44 |
| Eduscho | −6.92 | 9.25 | 0.03 | 0.18 |
| | | | | |
| Change in Prod. Surplus | −95.70 | 64.05 | 0.46 | 0.23 |
| Change in Cons. Surplus | −103.31 | 63.28 | 0.50 | 0.30 |
| Change Welfare | −199.02 | 90.04 | 0.96 | 0.12 |

All data are expressed in Deutsch Marks per week; Prices are expressed in Deutsch Marks per 500 grams. Average change was computed for each brand over the time period; Diff. Table X p-value: reports the p-value for the differences in the average changes estimated between the present table and Table X; std: Standard deviation; Source: Author's calculations.

Table 8 presents the welfare computations from this what-if exercise. I start here with the pre-merger prices computed above, and simulate what would be the resulting equilibrium prices if the upstream merger had occurred in the presence of collusive retailers. Table 8 reports the resulting changes in prices, quantities, and average estimated changes in consumer, producer,

**Table 8**. Varying Downstream Model and Upstream Merger Analysis.

Collusive Retailers

| | Price | | Quantity | | |
|---|---|---|---|---|---|
| | Change | Diff. Table 5 p-value | Change | Diff. Table 5 p-value | |
| Overall | 0.06 | 0.06 | −2.72 | 0.06 | |
| Change in | Mean | std | % Revenues | Diff. Table 6 p-value | Diff. Table 7 p-value |
| Prod. Surplus | 236.58 | 62.03 | 1.14 | 0.00 | 0.00 |
| Cons. Surplus | −98.44 | 98.68 | −0.47 | 0.26 | 0.49 |
| Welfare | 138.14 | 116.56 | 0.67 | 0.00 | 0.02 |

All data are expressed in Deutsch Marks per week, prices are expressed in Deutsch Marks per 500 grams; Diff. Table X p-value: reports the p-value for the differences in the average changes estimated between the present table and Table X; std: Standard deviation; Source: Author's calculations.

and total surplus of the same upstream merger analysis as before, but now assuming that retailers are collusive in the counterfactual scenario. The goal is twofold: to compare the estimates with those obtained using the benchmark model of Nash Bertrand retail pricing (Tables 5 and 6) and to compare the estimates with the ones obtained when ignoring completely retail behavior, as in Table 7. The p-values from these comparisons are in the two far right columns (labeled, Diff. Table 5 and Diff. Table 6, respectively) of Table 8.

I find significant effects from the departure from Nash-Bertrand retail pricing behavior on the producer surplus and overall welfare estimates. First, departures from Nash Bertrand scenarios at the retail level have no estimated differential effects on consumer surplus estimates. As before, and as a result of the merger, retail prices increase and thus this hurts consumer surplus. The estimated change in consumer surplus is negative, although not statistically significant, as in all scenarios considered. The estimates in terms of changes in producer surplus resulting from the merger are now positive and significant, both for the manufacturers and for the retailers. Downstream collusion pricing maximizes profits relative to Bertrand Nash downstream pricing. Due to the merger, upstream pricing decisions are also more coordinated than before the merger. In this case, prices for the merging firms increase as do prices for the non-merging firms. Final retail prices are set to maximize downstream profits rather than in a simultaneous Bertrand Nash fashion. If one were to include retailers in the welfare calculations, in the case where they behave very collusively, the merger recommendation would be to not challenge the merger, given that it does not negatively affect welfare estimates.

In summary, the inclusion of retail strategic behavior in upstream merger analysis does impact welfare estimates, and the impact is significantly different for different levels of downstream market power. According to our what-if merger counterfactuals, the less downstream competition (the greater the departure from Bertrand Nash), the more positive the effect on welfare due to an increase in producer surplus. The more competitive downstream, the changes in producer and consumer surplus are of the same sign and negative, according to the counterfactual estimates in the paper. Antitrust policy should thus incorporate the strategic role of retailers in the analysis of upstream mergers, especially in situations where retailers may have significant market power.

## VI. CONCLUSIONS AND IMPLICATIONS

This paper develops a useful way for antitrust authorities to incorporate relationships among manufacturers and retailers in assessing upstream merger proposals. The conventional practice has used retail level scanner data and a Bertrand manufacturer oligopoly model as a benchmark for predicting the consequences of a horizontal merger at the manufacturer level. The fact that vertical linkages among manufacturers and retailers relate to horizontal interactions and vice versa has been long recognized in the food distribution channel (Handy and Padberg, 1971). Considering downstream behavior when studying upstream merger proposals is a concern of antitrust authorities (Froeb, Hasken and Pappalardo, 2004). Building on recent advances in vertical pricing modeling and estimation, this paper presents a first attempt and a simple framework to do so. This model will help antitrust authorities make decisions when analyzing proposed upstream mergers since they typically only have access to downstream market level data. For example, this is the typical situation in the grocery retail industry, where mergers are proposed upstream but scanner data are more readily accessible at the retail level.

For the market analyzed, this paper finds that overall welfare predictions and policy implications resulting from merger analysis, if researchers' were to ignore retail pricing models, would be different from those obtained when incorporating retail behavior in the analysis formally. There are important implications of the results for competition authorities, in the context of the market at hand. Furthermore, given the counterfactual what-if simulation, one can derive implications for antitrust beyond this market. For the upstream merger cases analyzed here, the estimated consequences in terms of welfare would be different and would lead to a different merger challenge recommendation depending on whether the researcher explicitly considered retail behavior. In either approach to merger analysis, the merger reduces welfare: Ignoring the retailer would lead to negative but not significant welfare losses; including retail pricing would increase the welfare losses to a significant level and result in a recommendation to challenge the mergers. Thus, different merger decisions might be reached if antitrust authorities do not incorporate retail decisions in the formal analysis.

Moreover, counterfactual simulations show that, if retail behavior departs from Nash Bertrand pricing, the resulting welfare estimates from upstream merger analysis ignoring retail behavior would further understate welfare effects. Although estimated effects in consumer surplus were not significantly affected by the counterfactual experiment (consumers have a negative point estimate loss in either scenarios in which retail pricing is considered), the changes in welfare and in producer surplus suggest that regulators should consider retail strategic role and departure from Nash pricing. Considering that the role of retailers as strategic players has been discussed recently as increasingly important when analyzing markets, this paper argues that one should also incorporate retailers' strategic role in upstream merger analysis, especially the more market power retailers have.

One extension of the present paper is to consider the implications of the firms using non-linear pricing for this analysis, along the lines of the current research by Rey and Vergé (2004), Bonnet et al. (2004), and Bonnet and Dubois (2006). Another application and extension of the present paper using this same structural modeling of vertical relationships is to consider theoretically and empirically the effects of non-horizontal mergers. While related literature studies vertical mergers (see Chen 2001), mergers when there is both upstream and downstream buyer concentration (Hendriks and McAffee 2006), and the effects of vertical integration on downstream prices (Hastings 2004), on upstream pricing (Hastings and Gilbert 2005), and on the possibility of upstream collusion (Nocke and White 2003), there are many reasons to study vertical issues. This is particularly of interest in the retail food sector where downstream consolidation may increasingly lead to strategic role of retailers and to buyer power issues. According to a report produced to the European Commission, a leading German branded manufacturer in the grocery retail sector estimates that over seventy five percent of its sales went to the top five customers, which were the four leading retail chains in this study and Aldi.[16] The inherent consequences for buyer power, quality and provision of variety, foreclosure, and many other issues involving the vertical marketing channel (for a thorough survey see Cotterill 2006) are important research avenues.

[16] http://ec.europa.eu/comm/competition/publications/studies/bpifrs/.

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