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Retailing in the Presence of Store
Brands (With an Application to the
German Coffee Cartel)**

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Abstract

Store brands are a frequent phenomenon in today's retailing landscape. When wholesale prices for national brands are affected by a cartel, retailers' may still be able to procure store brands competitively, either as they are procured from different sources and under different formats or as retailers are vertically integrated. While this suggests to ignore store brands when calculating retailer (or even consumer) damages, we show that, at least from an economist's perspective, this is wrong. The first part of this article provides the economic foundations for how we should expect retailers to optimally adjust their store brand prices when facing higher wholesale prices on national brands. We identify two opposing effects, a "demand diversion effect" and a "margin effect", which could, in principle, lead to both higher or lower store brand prices when there is a cartel of brand manufacturers. While the integration of store brands into damage calculation is thus a priori ambiguous from a consumers' perspective, we show that the presence of store brand unambiguously mitigates retailers' damages. We provide calculations for the German coffee cartel.

JEL Classification: D43, K21, K42

Keywords: Cartel damages, umbrella claims, Store brands, damage mitigation

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ABSTRACT

Store brands are a frequent phenomenon in today's retailing landscape. When wholesale prices for national brands are affected by a cartel, retailers' may still be able to procure store brands competitively, either as they are procured from different sources and under different formats or as retailers are vertically integrated. While this suggests to ignore store brands when calculating retailer (or even consumer) damages, we show that, at least from an economist's perspective, this is wrong. The first part of this article provides the economic foundations for how we should expect retailers to optimally adjust their store brand prices when facing higher wholesale prices on national brands. We identify two opposing effects, a "demand diversion effect" and a "margin effect", which could, in principle, lead to both higher or lower store brand prices when there is a cartel of brand manufacturers. While the integration of store brands into damage calculation is thus a priori ambiguous from a consumers' perspective, we show that the presence of store brand unambiguously mitigates retailers' damages. We provide calculations for the German coffee cartel.

KEYWORDS

Cartel damages; umbrella claims; store brands; damage mitigation

* This paper builds on more formal, joint work with Marco Kotschedoff, who was then assistant at the Chair. None of the authors was or is involved in proceedings relating to the German coffee cartel. Corresponding e-mail: inderst@finance.uni-frankfurt.de

I. INTRODUCTION

Private enforcement cases to claim cartel damages have been steadily on the rise in Europe in recent years. Apart from increased public enforcement, this is also due to the efforts of the European Commission to enable such private enforcement. At least since *Courage v. Crehan*¹ and *Manfredi*², it is generally accepted that any affected party can claim compensation for harm suffered from an infringement of EU competition rules.³ As manufacturers frequently sell through retailers, many follow-on cases involve retailers claiming damages from brand manufacturers. In fact, we subsequently illustrate our analysis with the German coffee cartel. In the market for coffee, but also elsewhere, store brands have become ubiquitous, at least in grocery retailing. The procurement of store brands may often not be directly affected due to the nature of production and supply of these products. For instance, in the case of coffee the respective roasting factories are even owned by some retailers (vertical integration). Our key argument in this paper is that, at least from an economist's perspective, it would be wrong, however, to dismiss store brands from the analysis of cartel damages.

Conceptually, as we explore below, an overcharge on wholesale prices for branded goods can lead to both lower and higher retail prices for store brands. This is the result of two conflicting effects, a "demand diversion effect" and a "margin effect". In the case of the empirically analyzed German coffee cartel, our results indicate that retail prices for store brands increased. From consumers' perspective we thus identify a possible umbrella effect also on store brands, even though the manufacturer cartel should not have resulted in higher costs of the supply of store brands to retailers. If this was practically feasible, consumers should thus obtain compensation also for higher prices of store brands, in case such higher prices materialize. We note here that in Europe it is by now accepted that the right to claim compensation for harm also extends to indirect damages, resulting from the passing-on of overcharges, as well as so-called "umbrella effects".⁴

Our main point in this paper, however, relates to retailers' damages. Irrespective of whether a retailer optimally increases or decreases retail prices for store brands, the presence of store brands should mitigate damages. To our knowledge, such mitigation has not yet been brought forward as a defense by cartelists. While this may be due to legal obstacles, such an omission creates a wedge between compensation and actually suffered damages. Based on our data for the German coffee market, we delineate the potential for such damage mitigation by retailers.

The rest of this article is organized as follows. In Section II we isolate the potential effects of an increase in brand manufacturers' wholesale prices on store brands. Section III presents the case of the German coffee cartel and a simple estimate of the effect of the cartel on the various retail prices for cartelists' brands as well as store brands, using a

¹ See Case C-453/99, *Courage Ltd. v Crehan*, 2001 E.C.R. I-6297.

² See joined Cases C-295/04 to C-298/04, *Manfredi*, 2006 E.C.R. I-6619.

³ Claiming such damages includes both cases from breaches of articles 101 and 102 of the Treaty on the Functioning of the European Union (TFEU), the focus of this article lies on cartel damages.

⁴ The treatment of both passing-on claims as well as umbrella claims is notably different in the United States. In Europe, following a respective request by Austria's highest court, the European Court of Justice ruled in 2014 that damages due to potential umbrella effects cannot be categorically denied (Case C-557/12, *Kone AG, Otis GmbH, Schindler Aufzüge und Fahrtreppen GmbH, Schindler Liegenschaftsverwaltung GmbH, & ThyssenKrupp Aufzüge GmbH v. ÖBB-Infrastruktur AG*, 2014 ECLI:EU:C:2014:1317).

standard backcasting model. There, we also derive (lower) bounds on the potential mitigation of retailers' damages. Section IV concludes.

II. ISOLATING THE TWO EFFECTS OF A NATIONAL BRAND OVERCHARGE ON STORE BRAND PRICES

The effects that we now isolate have been analyzed more thoroughly in the theoretical and empirical literature in marketing science. There, retailers' joint optimization problem of choosing the prices of national and store brands falls into the area of "category management." This literature has also analyzed how higher wholesale prices for one product in a given category affect all retail prices in that category, a so-called "cross-cost pass-through."⁵ This literature does not focus on store brands, however. The large literature on store brands in industrial economics has, however, largely ignored such effects, focussing instead more generally on how store brands affect the distribution of bargaining power between manufacturers and retailers.⁶

In what follows, we isolate two effects that higher (cartel-induced) wholesale prices for national brands have on a retailer's choice of store brand prices. For this we introduce some notation mainly to bridge the additional derivations in the appendix, which are subsequently used to derive a lower boundary on damage mitigation. We first consider how a retailer optimally chooses the price of a store brand, before subsequently turning to an effects analysis. For this we refer to the retail price of a single national brand as p_{NB} and to that of a single store brand as p_{SB} . The respective quantities are denoted by q_{NB} and q_{SB} , respectively, which depend on both prices as long as the national and store brand are indeed in the same category and thus to some degrees substitutes. Finally, the national brand's wholesale price is denoted by w_{NB} and the cost of procuring the store brand is given by c_{SB} . From standard (so-called first-order) principles the following captures a retailer's marginal change in profits when he increases the store brand price p_{SB} . There are two distinct effects (albeit they should not be confused with the subsequently isolated two effects of a change in the wholesale price w_{NB}).⁷ A change in p_{SB} has an immediate effect on the retailer's profits realized with the store brand. Only this effect would be present when the retailer did not offer national brands. In this case, the optimal choice of the store brand price would be such that the benefits from a (further) increase, in terms of a higher margin, just outweigh the loss in volume. The second effect captures the impact on the profits realized with the national brand. As

⁵ See Sridhar Moorthy, A General Theory of Pass-through in Channels with Category Management and Retail Competition, 24 *MARKETING SCIENCE* 110 (2005).

⁶ There is, of course, a broad literature in economics and notably in marketing that analyzes store brands, both theoretically and empirically. Various studies have pointed to the benefits of store brands to enhance retailers' bargaining position vis-à-vis national brands. (See e.g., David E. Mills, *Why Retailers Sell Private Labels*, 4 *JOURNAL OF ECONOMICS & MANAGEMENT STRATEGY* 509 (1995); Philippe Bontems, et al., *Strategic Effects of Private Labels*, 26 *EUROPEAN REVIEW OF AGRICULTURAL ECONOMICS* 147 (1999); Fiona S. Morton & Florian Zettelmeyer, *The Strategic Positioning of Store Brands in Retailer-Manufacturer Negotiations*, 24 *REVIEW OF INDUSTRIAL ORGANIZATION* 161 (2004); Claire Chamboll & Sofia B. Villas-Boas, *Buyer Power Through the Differentiation of Suppliers*, 43 *INTERNATIONAL JOURNAL OF INDUSTRIAL ORGANIZATION* 56 (2015)). The strategic role of store brands vis-à-vis national brands has been empirically investigated in, for instance, Jagmohan S. Raju, et al., *The Introduction and Performance of Store Brands*, 41 *MANAGEMENT SCIENCE* 957 (1995); Pradeep K. Chintagunta, et al., *Investigating the Effects of Store-Brand Introduction on Retailer Demand and Pricing Behavior*, 48 *MANAGEMENT SCIENCE* 1242 (2002).

⁷ Formally, when $\frac{\partial q_{SB}}{\partial p_{SB}}$ and $\frac{\partial q_{NB}}{\partial p_{SB}}$ capture the marginal changes in the respective demand following a change in the store brand price, the marginal change in profit is $\left[q_{SB} + (p_{SB} - c_{SB}) \frac{\partial q_{SB}}{\partial p_{SB}} \right] + (p_{NB} - w_{NB}) \frac{\partial q_{NB}}{\partial p_{SB}}$. In the main text, we discuss the two terms in turn.

the store brand price increases, some of the lost volume is diverted to the national brand. To what extent this contributes to the retailer's profits depends, of course, on the respective margin earned with the national brand (and on the respective diversion). This observation is important for the following discussion of how the retailer optimally responds to a (cartel-induced) increase in the national brand's wholesale price.

When the wholesale price of the national brand w_{NB} increases, there are again two effects at work. One effect induces the retailer to respond with a lower store brand price and one effect points in the opposite direction. We presume here that, *ceteris paribus*, an increase in the wholesale price w_{NB} reduces the retailer's margin on this product, even when he passes on some of the price increase to consumers. Formally, the difference $p_{NB} - w_{NB}$ decreases. This makes selling the national brand less profitable following a cartel-induced increase in the respective wholesale price. The retailer thus benefits less when consumers buy the national brand, which creates an incentive to reduce the store price p_{SB} , thereby diverting demand to the store brand. We call this the "margin effect". There is now, however, also an opposite effect, which we term "demand diversion effect". As the retailer passes on at least some of the overcharge of the national brand and thereby increases the retail price, this diverts demand to the store brand. *Ceteris paribus*, the higher demand for the store brand creates incentives to raise the store brand price, which, as already noted, amounts to a standard "umbrella effect": As demand increases it becomes relatively more profitable to earn a higher margin on the increased quantity, making it relatively more profitable to increase the respective price. We have thus two opposing effects that a cartel-induced increase in the wholesale price of national brands has on the retailer's store brand price. How these two effects play out even in the simple case of a monopolistic retailer, is generally ambiguous.⁸

In addition, with retailer competition, a given retailer's change in demand both for his store brands and national brands depends on the reactions of all other retailers. In the extreme case where a retailer only sells store brands and is thus not directly affected by the margin effect, only the demand diversion effect remains, albeit the increase in demand arises from price increases by other retailers. For such a retailer only the "standard" umbrella effect is at work, leading to a rise in the price of his store brands. If a retailer sells both store brands and national brands, which is the case for all but one retailer in the subsequently analyzed case of the German coffee market, both effects are present. Our empirical findings suggest that in the German coffee market the "demand diversion effect" still dominates.

These observations have various practical implications. For one, due to the ambiguous effect it can not be learnt from a change in store brand prices alone whether the national brand cartel had an effect on them. To the extent that national brands and store brands are substitutes, however, an interdependency of the respective prices should be expected. Second, from consumers' perspective total damage may be mitigated or increased in the presence of store brands – or, likewise, a focus on national brands alone may either under- or overestimate the damage inflicted on consumers. In particular, those consumers who buy store brands both under the cartel scenario and under the counterfactual scenario are thus not necessarily harmed, given the theoretically ambiguous effect, albeit for the analyzed case of the German coffee market this seems to be the case. Importantly, however, even if the price of store brands were to decrease, as the "margin effect" dominated, this would not imply that all consumers who purchase

⁸ Recently, new results for the related question of the cross-product cost pass-through of a multiproduct monopolist were provided by Mark Armstrong & John Vickers, *Multiproduct Pricing Made Simple*, 126 JOURNAL OF POLITICAL ECONOMY 1444 (2018). They derive conditions for when under quantity competition the resulting net effect is in fact zero.

store brands in the cartel scenario benefit. While store brands are cheaper than they would be in the counterfactual scenario, those consumers may still be harmed if their preferred choice in the counterfactual scenario consisted of national brands, whose prices increased under the cartel.

The last and for our purpose most important observation relates to retailers' damages. Irrespective of whether retailers' equilibrium response to higher wholesale prices for national brands is an increase or a decrease of the prices of their respective store brands, the presence of store brands allows retailers to mitigate the harm inflicted by the cartel. This will now be worked out in detail, both conceptually and empirically. For the empirical analysis we first provide the background.

III. DAMAGES AND DAMAGE MITIGATE FROM STORE BRANDS IN THE CASE OF THE COFFEE CARTEL IN GERMANY

We explore the detection of a cartel among manufacturers of branded ground coffee in Germany in July 2008.⁹ From the published records we know that the cartel had been operating since at least 2000, i.e., notably before the subsequently chosen period from which our analysis starts (January 2004). The German antitrust authority found all four major brand manufacturers guilty of conspiring to raise prices.¹⁰ Our analysis focuses on the grocery retail market, which is also the main sales channel for ground coffee. Ground coffee constitutes around 50% of total consumption, of which again more than 95% is accounted for by the sales of 500g packages, on which our subsequent analysis will focus.¹¹

All considered retailers have store brands, with store brands accounting for around 25% of the German market. The German grocery retail market is also highly concentrated, with five leading retail groups, which are also the ones that we subsequently consider, accounting for around 75% of the total market. We take this, as well as detailed information on the market for coffee and notably also the provision of store brands, from an independent sector inquiry that the German antitrust authority conducted recently.¹² Learnings from the sector inquiry are particularly important in the following way. While typically little is known about the manufacturing of store brands, we learn from the sector inquiry that in Germany the manufacturing of store brands is almost exclusively undertaken by specialized manufacturers, that is, notably not the cartelists. In fact, in its competitive assessment of the industry the report notes that only one larger manufacturer is known to sometimes participate in the competitive procurement process for store

⁹ The antitrust authority was informed by a whistleblower and undertook its "dawn raid" in July 2008. (See Press Release, Bundeskartellamt, Bundeskartellamt Imposes Fines on Coffee Roasters (December 21, 2009), https://www.bundeskartellamt.de/SharedDocs/Meldung/EN/Pressemitteilungen/2009/21_12_2009_Kaffeer%C3%B6ster.html?nn=3591568).

¹⁰ Two of these manufacturers have two national brands each, which we subsequently account for separately. The fact that some manufacturers therefore operate multiple brands does not affect our (reduced form) analysis.

¹¹ Market shares (in terms of standardized cup equivalents) are based on own calculations over the considered sample period. Instant coffee represents the second largest category, accounting for 38% of consumption. We do not include instant coffee for two reasons. First, it is unclear to us to which extent the cartel also extended to instant coffee, where notably also other firms (such as Nestlé) represent important players in the German market. Second, industry reports suggest that ground and instant coffee indeed belong to separate markets (Cf. Euromonitor International Ltd, Coffee in Germany (2015)).

¹² See Bundeskartellamt, Sektoruntersuchung Lebensmitteleinzelhandel (2014), http://www.bundeskartellamt.de/Sektoruntersuchung_LEH.pdf%3F__blob%3DpublicationFile%26v%3D7. We acknowledge, however, that the information that we learn from this report may potentially not always be accurate for all years of interest, that is from 2004 to 2012.

brands, while retailers are also known to possess own coffee-roasting plants.¹³ On those occasions where retailers procure coffee for their store brands, they can exert considerable bargaining power in the competitive process. Conceptually, the nature of the procurement and manufacturing of store brands suggests therefore that there are neither direct nor indirect (umbrella) effects through which wholesale prices for ground coffee sold as store brands were increased because of the infringement.¹⁴

For our empirical analysis we use homescan panel data, spanning from January 2002 to December 2012.¹⁵ As we explain later, we aggregate such retail prices on a quarterly basis. As noted above, we consider sales through the five leading retail groups and, next to their store brands, from the five large manufacturers of national coffee brands. We split the sample into two time periods. The years 2009 to 2012, which constitute the final period, are considered to be competitive and are subsequently used to fit a “backcasting model” in order to calculate counterfactual prices for the first period, the years 2002 to 2008. We provide details for the respective econometric specification in a short appendix.¹⁶ The backcasting model is then applied calculate counterfactual prices. Products always refer to 500g packages of ground coffee, where we distinguish between different brands and also whether the product is regular or mild. We calculate a percentage overcharge relative to the counterfactual price.

Figure 1 illustrates the estimated overcharge with one national brand and a store brand at a given retailer. For anonymity purposes, we do not give further details on the retailer or the specific coffee brand. Note that, for completeness, the estimated price is also reported for the competition period. The figure also includes world market prices for the two main coffee beans.

¹³ The sector inquiry focused on the relationship between retailers and manufacturers, more generally, but it considered five different “focus categories” that were explored in detail, of which coffee constituted one.

¹⁴ That said, subsequent results such as the quantification of overcharges for consumers or aggregate consumer harm, across both national and store brands, are unaffected by whether such an additional (umbrella) channel was at work or not.

¹⁵ Throughout the considered period the data provider increased the number of panel households to more than 13,000.

¹⁶ We do not use a so-called “dummy variable” method, as notably the extent to which changes in the prices of coffee beans were passed on to retailers may be directly affected by the cartel. Also, hikes in the prices of coffee beans may have been used as triggers for wholesale price increases vis-à-vis retailers. By estimating the respective pass-on only with data from the comparator period and applying these coefficients to backcast counterfactual prices, we circumvent these issues. We acknowledge, however, the use of a (fully) “interacted dummy variable” model, where the dummy variable for the infringement period is interacted with key covariates, here the price of coffee beans. See Roman Inderst & Christopher Milde, *A Practical Review of Methods to Estimate Overcharges Using Linear Regression*, <https://ssrn.com/abstract=3136923> (2018) for a practical overview of these different approaches, building notably on the contributions of Justin McCrary & Daniel L. Rubinfeld, *Measuring Benchmark Damages in Antitrust Litigation*, 3 JOURNAL OF ECONOMETRIC METHODS 63 (2014); David S. Salkever, *The Use of Dummy Variables to Compute Predictions, Prediction Errors, and Confidence Intervals*, 4 JOURNAL OF ECONOMETRICS 393 (1976).

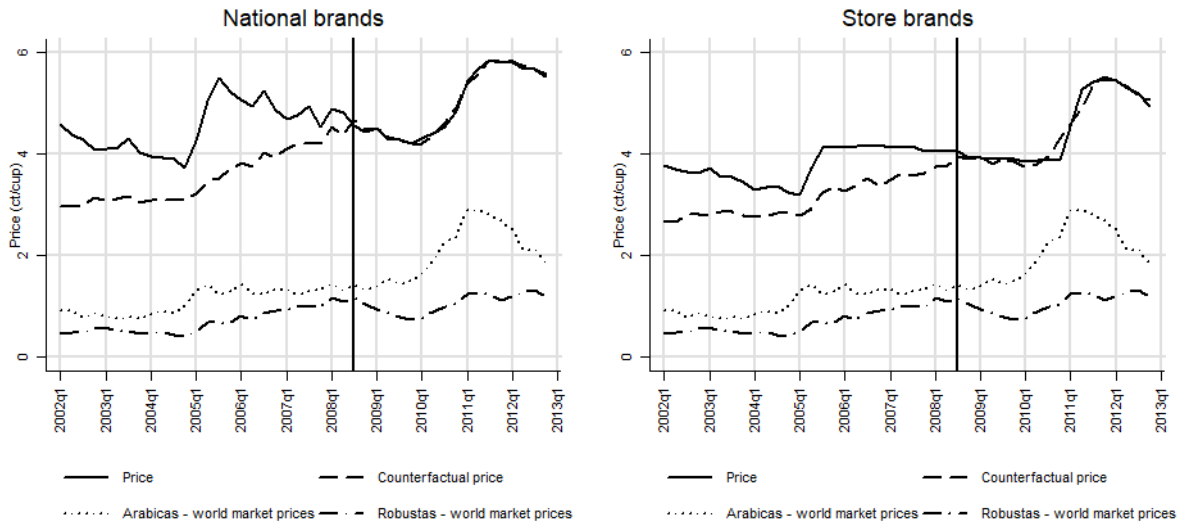


Figure 1. Observed and estimated (counterfactual prices), next to bean prices as key price determinant

We observe that the counterfactual price series are both below the actual price series in the cartel period, i.e., the years before 2009, indicating that the manufacturer cartel indeed resulted in higher retail prices for the national brand and the store brand. Notably, the positive overcharge on the considered store brand deserves some discussion. While we found that the price effect on store brands is theoretically ambiguous, for the considered store brand it is positive. In fact, when we aggregate the overcharge for store brands, the (Euro volume weighted) average is 20.3%.¹⁷ We omit a statement of overcharges for national brands as this is not at the focus of this article. We note, however, that they differ between brands, but are typically somewhat larger than the percentage overcharge of the store brand.¹⁸

We use these estimates to first calculate consumer damages, which is a straightforward exercise, once counterfactual retail prices are established. Note first that we presume, as it is typically the case, that consumers can only claim damages for monetary losses, i.e., not forgone utility. Aggregating over all products and the whole cartel period, we obtain the following results:

Table 1. Consumer overpayment in Million EUR for the cartel period from 2002 to 2008.

Total Overpayment	National Brand Overpayment	Store Brand Overpayment
10,928.6	7,278.2	3,650.4

Thus, the overpayment for store brand purchases accounts for around 33 % of total overpayment. This percentage share is affected by both the market share of store brands, which is considerable in Germany, and the comparison between the nominal overcharge of national and store brands. While percentage overcharges are somewhat comparable, albeit somewhat higher on average for national brands, retail prices are considerably larger for national

¹⁷ The pricing of store brands is almost uniform across retailers in this product category and the overcharge is therefore almost identical.

¹⁸ Note that for the calculation of the percentage overcharge, we divide by the counterfactual price. The actual and counterfactual prices are considerably lower for the store brands.

brands. In the case of the German coffee cartel, our calculations suggest that consumers thus suffered considerable additional loss from overpaying for store brands, for which, according to the presented calculations, prices were increased as an indirect consequence of the brand manufacturer cartel.

We now turn to retailers. In the Appendix we provide a formal decomposition of a retailer’s damages. It is obvious from there that we cannot estimate such damages without additional information. This applies also for a calculation of the damage mitigation from store brands, as we would need, in particular, information about the costs of procuring store brands. We can, however, calculate a lower boundary of the mitigation effect. This is derived in the Appendix and ultimately amounts to the following simple calculation. For store brands we take the difference between the (in our case higher) actual price and the counterfactual price and multiply this by the actual volume. This simply reflects the additional revenue obtained from higher store-brand prices, holding the volume constant. That such a bound may be very conservative can already be seen from the observation that it would be negative if store prices decreased as the discussed “margin effect” dominated.

We conclude by reporting the calculated lower bounds of retailers’ damage mitigation, where we aggregate across three different retail formats: full line supermarkets, soft discounters and hard discounters. We note that the calculated figure for hard discounters may, for some retailers, reflect even a net benefit from the brand manufacturers’ cartel, as hard discounters overwhelmingly sell store brands. Instead, for soft discounters or, in particular, full line supermarkets, direct damages from national brands are much higher. As these retailers have mitigated such damages with the sales of store brands, including at adjusted (here higher) prices, from an economic perspective this would have to be deducted.

Table 2. Lower bound for damage mitigation (full line supermarkets and soft discounters) and benefits from the cartel (hard discounters) in Million Euro

Retailer format	
Full line supermarkets	355.4
Hard discounters	2,483.0
Soft discounters	812.1

IV. CONCLUDING REMARKS

At least in Europe, in private enforcement cases attention has recently shifted to potential damages from “umbrella effects” that arise when firms that are not parties to the infringement adjust their strategies. This article provides a conceptual and empirical analysis of such umbrella effects in the case of store brands, which, to our knowledge, has been largely overlooked in the literature. Our empirical results from the German coffee cartel suggest that even though the procurement of such store brands was most likely not directly affected by the infringement, still the prices of store brands increased significantly in the shadow of the cartel, which considerably increased consumer harm. On the other hand, retailers’ response to the cartelized wholesale price increase of national brands allowed them to mitigate damages.

Though the empirical findings point to a positive (umbrella) effect also for the price of store brands, we also showed that conceptually the price of store brands may both increase or decrease as an equilibrium response to higher wholesale prices for national brands. This is due to two countervailing effects: a “demand diversion effect,” which pushes up store brand prices, and a “margin effect,” which may make it optimal for retailers to lower the price of store brands. Importantly, even when retailers react to the infringement by decreasing instead of increasing the price of store brands, the resulting potentially large increase in store brands’ market share should still lead to a reduction of overall lost profits, at least for retailers who sell (cartelized) national brands to a large extent (while retailers who sell predominantly or only store brands may gain a competitive advantage and even profit from the brand manufacturer cartel). From an economic perspective, to calculate actually suffered damages from the infringement, such compensating profits on the sale of store brands should be accounted for when calculating total damages in court. Whether courts are willing to afford cartelists such a defense also seems to be a still untested question.

APPENDIX I. DETAILS FOR THE OVERCHARGE ESTIMATION

In the following, we first specify the (backcasting) regression model. We run the following regression for prices of products j at time t :

$$p_{jt} = \gamma_j + \sum_{b=1}^B \lambda_b \Omega_t + \sum_{r=1}^R \phi_r \chi_t + X_j \delta + \epsilon_{jt},$$

where γ_j is a product specific constant, Ω_t is a matrix of cost shifters interacted with brand indicator variables (world market coffee bean prices), χ_t is a matrix of cost shifters interacted with retailer dummies (average retail labour gross salaries in Germany), and X_j denotes observable product characteristics.

The world market price for raw coffee beans indicated by Ω is the main driver for changes in coffee retail prices since 1.19kg of raw coffee beans are required to produce 1kg of roasted ground coffee.¹⁹ We interact brand dummy variables with the world market prices for Arabica and Robusta coffee beans.²⁰ We include up to two lags of world market prices for raw coffee beans Ω .²¹ Furthermore, we control for the share of the different taste varieties (i.e. mild, organic or decaf) and also include market and product fixed effects which capture any unobserved time-invariant market and product features that influence prices. As ground coffee is a rather mature product and this type of regression is a pure prediction exercise, we expect that our backcasted prices are a good approximation of the counterfactual prices. Given the estimated coefficients from our regression, we can use data from the cartel period to backcast the counterfactual prices.

APPENDIX II: DERIVING FORMAL BOUNDS FOR RETAILER DAMAGE MITIGATION

Again, for ease of exposition only we consider the case of a retailer that stocks a single national and a single store brand. Using the previous notation, total profits are then

$$\pi = q_{SB}(p_{SB} - c_{SB}) + q_{NB}(p_{NB} - w_{NB}).$$

Likewise, with the respective counterfactual prices and quantities, counterfactual profits are

$$\hat{\pi} = \hat{q}_{SB}(\hat{p}_{SB} - c_{SB}) + \hat{q}_{NB}(\hat{p}_{NB} - \hat{w}_{NB}),$$

and ultimately the resulting damage is $\Delta\pi = \pi - \hat{\pi}$. We first strip out the effects related to the national brand. Here, the standard decomposition is as follows:

$$\Delta\pi_{NB} = q_{NB}(w_{NB} - \hat{w}_{NB}) - q_{NB}(p_{NB} - \hat{p}_{NB}) + (\hat{q}_{NB} - q_{NB})(\hat{p}_{NB} - \hat{w}_{NB}),$$

where the first term captures the overcharge suffered on the actual quantity, the second term the mitigation from pass-on and the third term the lost-volume effect. Typically, out of practical considerations, only the first two terms are

¹⁹ See Leon Bettendorf & Frank Verboven, *Incomplete Transmission of Coffee Bean Prices: Evidence from the Netherlands*, 27 EUROPEAN REVIEW OF AGRICULTURAL ECONOMICS 1 (2000).

²⁰ See Daily Coffee Prices, http://www.ico.org/coffee_prices.asp?section=Statistics (last visited February 05, 2019).

²¹ See Emi Nakamura & Dawit Zerom, *Accounting for Incomplete Pass-Through*, 77 THE REVIEW OF ECONOMIC STUDIES 1192 (2010). Adding further lags of the bean world market price did not improve the predictive power of the regression.

considered in actual damage cases, less so the lost-volume effect. Collecting the terms of $\Delta\pi$ that relate to the store brands, we have the difference

$$\Delta\pi_{SB} = q_{SB}(p_{SB} - c_{SB}) - \hat{q}_{SB}(\hat{p}_{SB} - c_{SB}).$$

Absent information about the retailer's costs of procuring the store brand, c_{SB} , we cannot quantify this expression. We can however form a lower bound as follows. For this we rearrange the terms relating to the store brand as follows:

$$\Delta\pi_{SB} = q_{SB}(p_{SB} - \hat{p}_{SB}) + (q_{SB} - \hat{q}_{SB})(\hat{p}_{SB} - c_{SB}).$$

Now the first term, i.e., the additional margin from the actual sales of the store brand, forms a potentially very conservative lower bound on the retailer's damage mitigation. In fact, recall that we identified two effects, the "demand diversion effect" and the "margin effect". When the latter effect is stronger the retailer may even lower its price of the store brand as a reaction to the cartelized wholesale price. Then, the first term would be negative, even though there was still damage mitigation from store brands