International Retail Buying Groups:
A Force for the Good? The case of AgeCore/EDEKA

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International retail buying alliances have been subject to controversy over the past few years. Brand owners argue that these buying groups are created predominantly to increase retailer profits, and thus merely add costs to the supply chain. Retailers insist that alliances are a necessary strategy to restore the negotiating balance between national retail chains and big multinational brand owners. This study investigates whether German market leader EDEKA's membership of international retail buying alliance AgeCore has led to lower consumer prices as a result of improved buying conditions, comparing shopper prices based on scanner data for a data set of over 6 million observations, composed of 138,000 stock-keeping units (SKUs) from 20 food categories based on monthly observations over a 6-year period. More specifically, SKUs within the scope of AgeCore negotiations are compared with non-AgeCore SKUs, following the Counterfactual Impact Evaluation (CIE) methodology often used by scientists at the Joint Research Centre of the European Commission. The aim is to find out if average monthly consumer prices of SKUs in the buying group (the treatment group) would be cheaper than comparable SKUs which were not part of the buying group negotiations (the control group), ceteris paribus. Three different models are used to estimate the effect of AgeCore on consumer prices offered to EDEKA shoppers. A base model using two types of variables – a range of time variables and buying group membership – indicates that the average monthly consumer price of SKUs in the buying group are 21% cheaper than similar products outside the buying group, ceteris paribus. This is a likely over-estimation of the effect of the buying group, as EDEKA would always need to be price competitive on best-selling items, whether they are within AgeCore or not. An enhanced model, introducing rescaled annual sales value per SKU as an additional variable, reduces the estimated impact of AgeCore to -12%. A third, advanced model, introduces product category as an additional explanatory variable, as the unit price of SKUs varies considerably between product categories. This methodology reveals that average monthly prices for SKUs in a specific product category belonging to AgeCore tend to be lower than the average monthly price of similar SKUs in that product category that are outside AgeCore. The effect varies from -36% in the frozen food category to -6% for snacks, for example. In some categories, average consumer prices for SKUs within AgeCore are higher than those outside AgeCore. This is, for example, the case for beverages, both alcoholic and non-alcoholic (in the latter case, the treatment and control groups are too dissimilar). Only three product categories show no statistically significant effect of being in the AgeCore set: bakery, plant-based dairy and delicatessen. Regardless of potential improvements to the methodology, the analysis shows unambiguously that EDEKA's membership of AgeCore has resulted in approximately, on average, 12% lower prices of AgeCore SKUs as compared to similar non-AgeCore SKUs for their shoppers. Admittedly, the effect of the international buying group on EDEKA consumer prices varies considerably across product categories. The results of the study are consistent with other studies on the impact of retail buying groups, and thus contribute to a growing body of evidence illustrating that retail buying groups do lead to a significant reduction in consumer prices.
Keywords: International Retail Buying Groups; Consumer Prices; Counterfactual Impact Evaluation

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ABSTRACT

International retail buying alliances have been subject to controversy over the past few years. Brand owners argue that these buying groups are created predominantly to increase retailer profits, and thus merely add costs to the supply chain. Retailers insist that alliances are a necessary strategy to restore the negotiating balance between national retail chains and big multinational brand owners.

This study investigates whether German market leader EDEKA's membership of international retail buying alliance AgeCore has led to lower consumer prices as a result of improved buying conditions, comparing shopper prices based on scanner data for a data set of over 6 million observations, composed of 138,000 stock-keeping units (SKUs) from 20 food categories based on monthly observations over a 6-year period. More specifically, SKUs within the scope of AgeCore negotiations are compared with non-AgeCore SKUs, following the Counterfactual Impact Evaluation (CIE) methodology often used by scientists at the Joint Research Centre of the European Commission. The aim is to find out if average monthly consumer prices of SKUs in the buying group (the treatment group) would be cheaper than comparable SKUs which were not part of the buying group negotiations (the control group), ceteris paribus.

Three different models are used to estimate the effect of AgeCore on consumer prices offered to EDEKA shoppers. A base model using two types of variables – a range of time variables and buying group membership – indicates that the average monthly consumer price of SKUs in the buying group are 21% cheaper than similar products outside the buying group, ceteris paribus.

This is a likely over-estimation of the effect of the buying group, as EDEKA would always need to be price competitive on best-selling items, whether they are within AgeCore or not. An enhanced model, introducing rescaled annual sales value per SKU as an additional variable, reduces the estimated impact of AgeCore to -12%.

A third, advanced model, introduces product category as an additional explanatory variable, as the unit price of SKUs varies considerably between product categories. This methodology reveals that average monthly prices for SKUs in a specific product category belonging to AgeCore tend to be lower than the average monthly price of similar SKUs in that product category that are outside AgeCore. The effect varies from -36% in the frozen food category to -6% for snacks, for example.

In some categories, average consumer prices for SKUs within AgeCore are higher than those outside AgeCore. This is, for example, the case for beverages, both alcoholic and non-alcoholic (in the latter case, the treatment and control groups are too dissimilar). Only three product categories show no statistically significant effect of being in the AgeCore set: bakery, plant-based dairy and delicatessen.

Regardless of potential improvements to the methodology, the analysis shows unambiguously that EDEKA's membership of AgeCore has resulted in approximately, on average, 12% lower prices of AgeCore SKUs as compared to similar non-AgeCore SKUs for their shoppers. Admittedly, the effect of the international buying group on EDEKA consumer prices varies considerably across product categories. The results of the study are consistent with other studies on the impact of retail buying groups, and thus contribute to a growing body of evidence illustrating that retail buying groups do lead to a significant reduction in consumer prices.

INTRODUCTION

There has been quite some controversy, spanning many years but lately becoming more insistent, about the possible negative side-effects of buying groups formed by major food retailers in Europe. On one side, some large brand-owners argue that international retail buying groups merely add transaction costs to the supply chain and are created predominantly to increase the profits of member retailers.

According to critics, buying groups upset the balance of power in the food supply chain, causing (brand) manufacturers to suffer from heavy bargaining pressure. The survival of smaller suppliers in particular, who often contribute the most to innovation and variety in the product range, would be threatened (Allain et al., 2019).

On the other side, retailer members of these alliances argue that they are necessary to their survival in price competitive retail markets dominated by international retailers who are in a superior position to negotiate with international brand-owners. After all, these brand owners not only have a global footprint but also own 'must-have' brands, which puts them in a powerful position.

A recent extensive study by the European Commission's Joint Research Centre (JRC) confirms that retail alliances are able to increase competitiveness in a competitive, consolidating and internationalizing market, whereby at least some of the benefits are likely passed on to consumers, even if the report warns there is the possibility of increased retail consolidation and of potential anti-competitive practices (Colen, Bouamra, Daskalova and Nes, 2020).

The purpose of this study is to generate empirical evidence on the real-world effect of an international buying group on their member retailers and on their shoppers. More specifically, this analysis investigates the effect on consumer prices for EDEKA shoppers due to the latter's membership of the international retail buying alliance, AgeCore. Clearly, a key motivation for retailers to join an international buying group is to reduce their net buying prices. The empirical question addressed by this research is whether these reduced buying prices trickle down to EDEKA's shoppers and, if so, in what proportion do the shoppers benefit from the improved buying prices of retailers.

EDEKA is a group of 3.500 independent retailers and the largest grocery retailer chain in Germany, running a number of retail formats, including a hard discount chain, Netto Marken-Discount. EDEKA runs two different types of organisations: stores owned and operated by independent retailers as well as

integrated stores. Unlike many retail organisations such as Walmart, Aldi, Lidl, or Carrefour, EDEKA is geographically limited to Germany.

Until its departure in 2021, EDEKA was the largest member of buying group AgeCore, which linked six independent retailers from around the EU: Colruyt in Belgium, Coop in Switzerland, Conad in Italy, Intermarché in France, and Eroski in Spain. AgeCore, as such, does not modify the competitive retail scene in any of these countries as AgeCore, by principle, only has one member per country and this member has virtually no sales outside its home country. This way AgeCore is a very different phenomenon from the usual horizontal merger/acquisitions that do rejig national retail landscapes.

RATIONALE FOR BUYING GROUPS

The creation of buying groups to negotiate jointly with suppliers is a widespread phenomenon across many industries and situations. Examples include purchasing organizations that negotiate tariffs with medical device manufacturers on behalf of hospitals (e.g. McKesson, US); independent drugstores who unite to negotiate wholesale contracts with drug manufacturers (e.g., Numark, U.K. or Giphar, France); jewellery retailers (e.g. Continental Buying Group, US); Hardware (e.g. Progroup, US); auto parts (e.g. After Market Auto Parts Alliance, US); advertisers in the online ads industry who delegate their bidding campaigns to specialized agencies to negotiate advertisement space on search engines and social networks (Decarolis, Goldmanis and Penta, 2017); and buyer groups formed by grocery retailers to negotiate trading terms with their suppliers (e.g. Geyskens, Gielens and Wuyts, 2015).

The economic theory underpinning the development of such retail buying groups goes back to Stigler and Galbraith.

Galbraith (1952, 1954) coined the concept of *countervailing buyer power* as a description of the observed phenomenon whereby, in the equilibrium, large suppliers 'call forth' large buyers. When suppliers grow and concentrate within a market, they obtain *market power*, and this was indeed a general trend in US industry in those years. Galbraith saw countervailing power as a necessary force to offset this increased market power resulting from concentration, which, unchecked, would have impoverished businesses in other parts of the value chain. Galbraith gave the example of a nationwide grocery chain extracting

lower wholesale prices from individual food producers, and of concentrated car manufacturers extracting ever lower prices from individual steel producers.

In the same manner, the market power of the owners of the most universal brands, as well as the market power of large international retailers, were an increasing force that pressured predominantly national retailers to create a 'counter-force' of international retail buying groups (Chen, 2003; Inderst and Wey, 2011). Galbraith considered this type of countervailing power as being generally a benefit for consumers, as the members of large international retail buying groups could obtain better trading terms and pass on the resulting benefits to final consumers.

A unique, and somewhat unexpected, development in grocery retailing in the last 20 years, has been the retreat of several large grocery retailers from their international expansion: Walmart, Tesco, Carrefour, Ahold, EDEKA have all reduced the number of countries in which they operate (Corstjens and Lal, 2012). Simultaneously, the industry has seen increasing efforts by grocery retailers to build and expand their international buying alliances. Smaller grocery retailers have echoed this move, joining buying groups in an attempt to improve their competitive position (Dobson 2011; O'Shaughnessy 2014). A prominent example in the United States is Topco, which represents more than 50 member-owners across the country (including Harris Teeter, Save Mart, Wegmans, and Weiss), more than $120 billion in aggregated sales, and thousands of stores. In Europe, buying groups such as Coopernic, AgeCore, AMS, EMD and recently Epic Partners are examples of international alliances in the retail market that, between them, represent many of the largest national European retailers.

Nobel prize winner Stigler's contribution to our understanding of why buying groups exist, and seem to be thriving, while international expansion of retailers seems to be regressing, goes back to Adam Smith. Smith's well-known concept of the *advantage of the division of labor and specialization* was first presented in "The Wealth of Nations" in 1776, and raised the question of what the optimal size of a company should be – should one vast pin-factory service the whole world?

The answer to this question is determined by efficiency and, more precisely, by the average cost curve of a firm and the size for which these average costs are minimized. Clearly, the firm should be large enough to benefit from the full range of economies of scale, but should avoid expanding beyond a size where diseconomies set in.

Stigler observed that a company may fulfil a number of critical functions (such as R&D and innovation, recruitment, accountancy, buying, production, commercialization, and distribution) and each of these functions will have its own average cost curve (see figure 1). It is unlikely that all the firm's activities would have their lowest average cost occurring at the same size (or volume of sales). For example, in the pharmaceutical industry, smaller laboratories and start-ups discover a disproportionate number of new pharmaceutical compounds. Large pharma companies react by buying-up or licensing-in the innovative compounds (or buy the small company) and then apply their resources and scale to the resource-intensive processes of development, production and commercialization, functions that are beyond the scope of a small firm.

Applying these insights to the retail industry, the buying function benefits from large scale, whereas the store operating function is most efficient when it is close to local shoppers and able to motivate its workforce to provide good customer-service. Small to medium size operations are often more successful in these challenges than large-scale store operators. Retailers operating both company-owned stores and individually operated stores (e.g., by independent retailers) recognize that the private initiative and the ability to adjust to local markets often make the latter more efficient and more profitable.
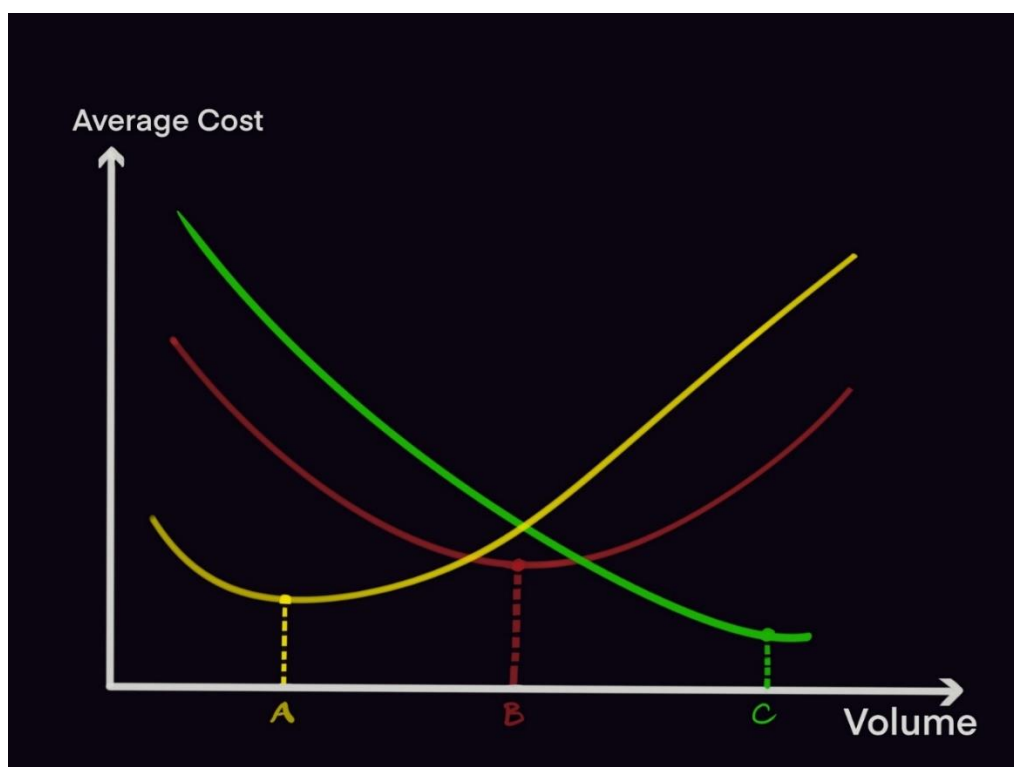

Figure 1: Average cost curves for different company functions. Yellow might be for R&D, Red for store operations, and Green for buying.

In this context, retail buying groups are a logical evolution because they achieve two objectives simultaneously: optimizing scale for buying (Galbraith's countervailing power and lower average cost), while preserving the smaller firm size for efficiently delivering their core activity - localness and closeness to their shoppers (Smith's economies and specialization).

This explains the sound economic reasons for the existence of international retail buying groups. At first glance, these groups may generate better trading terms for buyers resulting in cost savings which can then be passed on to final consumers without, in a national market, generating any potential market power effects as opposed to horizontal mergers between retailers.

As Carstensen points out, for a number of years the competition concerns about buyer alliances have been analysed with a presumption of legality by antitrust agencies (Carstensen, 2010). However, research on possible anti-competitive side-effects of retail buying groups and recent investigations conducted by competition authorities, especially in Europe, have noticed risks of adverse effects such as potential collusive behaviour between retailers due to exchanges of information, and have argued for further control of such practices (Inderst and Shaffer, 2007; Dana, 2012; Chen and Li, 2013; Norman, Roesch and Schultz, 2015; Colen, Bouamra, Daskalova and Nes, 2020).

SCOPE OF THE STUDY

The objective of this AgeCore/EDEKA study is to investigate whether international retail buying groups might benefit consumers by contributing to lower consumer prices and thereby increasing consumer surplus.

The study is an empirical analysis, based on a real-world dataset of over 6 million observations of average monthly consumer prices over many categories and SKUs (stock-keeping units) at EDEKA. The study investigates the effect of the international buying group on the prices paid by EDEKA's shoppers. Although this is not a theoretical paper, it is necessary to address two questions of theoretical nature before setting out the empirical part of the paper: the first about the setting and the second about the objective of the study.

First, why did EDEKA, the largest grocery retailer in Germany, feel a need to join an international retail buying group to be price competitive in their home

market? This is a legitimate question. Although EDEKA is the biggest grocery retailer in Germany, with a market share of grocery retail of about 23% (Euromonitor), it has virtually no sales outside Germany, yet it competes in the German market with other large retailers, including Aldi, Lidl, Rewe and Metro, which have extensive international sales and/or are part of international retail buying groups. Therefore, joining an international retail buying group makes good sense for EDEKA from a price competitive point of view.

Secondly, the bargaining relation between an international brand manufacturer and a retailer has been dominated by the supplier side for decades, clearly illustrated by the far superior profitability of brand manufacturers over retailers. International brand manufacturers are in a better bargaining position because of their presence in many international markets and because of the strength of many of their branded products, enjoying a 'must have' status and acting as traffic generators in and to stores. The retailer is obliged to offer these branded must-have products in its stores because otherwise, consumers would revert to rival retailers, which do offer those branded goods. In other words, the outside option even of a large retailer like EDEKA in Germany when dealing with the likes of Nestlé or Unilever is not as strong as one might think at first glance. (Inderst and Montez, 2019; Wey, 2019)

Furthermore, being price competitive for a retailer means, first and foremost, offering prices comparable to its competitors, with the lowest prices for the biggest selling products. It is precisely these best-selling products that are dealt with by international retail buying groups. The retailer will use the lower buying prices for these products made possible via the international buying group, to ensure it does not lose shoppers. The relative prices of 'must have/traffic-building' products are often used by consumers to infer a retailer's overall price image, a key driver of store choice for shoppers. Considering the arguments above, it is a reasonable hypothesis that a retailer like EDEKA will pass on, at least in part, lower buying prices obtained via AgeCore, to its shoppers. A hypothesis that must be empirically tested, which is what this study is all about.

In the following section the methodology applied in this study is explained. The three models used in the analysis are introduced: the base model, the enhanced model, and the advanced model. For each of the models the estimated effects of being a member of AgeCore on EDEKA average monthly consumer prices are explained and interpreted. This section is then followed by a stress testing exercise to ensure the robustness of the results. The results from the advanced model are further scrutinized by checking the matching conditions between

SKUs in the buying group and those that are not in the buying group. In the final section the key learnings from the analysis are summarized and avenues for future research are identified.

METHODOLOGY AND DATA

We have set up an extensive statistical analysis comparing EDEKA consumer prices of SKUs that are within the AgeCore buying partnership with EDEKA consumer prices of similar SKUs that are outside of AgeCore's scope. AgeCore, by its very nature as an international buying group, only deals with SKUs that are present in the product ranges of all of their 6 members and therefore in all 6 countries. These AgeCore SKUs cover about 10% of the observations in the analysis but represent about 30% of the EDEKA sales covered by our analysis. The AgeCore SKUs tend to be ubiquitous, popular brands with correspondingly high sales. This does not mean that all the non-AgeCore SKUs (representing the other 70% of sales) are minor brands. Some large, ubiquitous brands like Ferrero and Lindt refuse to interact with the international buying group. Also, there are numerous large, well-known brands in EDEKA's stores that are not present in all six of the AgeCore countries (and may only be present in Germany), which are therefore excluded from AgeCore's remit.

This empirical study applies a version of the Counterfactual Impact Evaluation (CIE) methodology, a methodology championed by scientists of the JRC in the European Union. On its official website, the European Union Science Hub describes CIE as follows:

> *In its simplest form, counterfactual impact evaluation is a method of comparing the outcomes of interest of those having benefitted from a policy or programme (the "treated group") with those of a group similar in all respects to the treatment group (the "comparison/control group"), the only difference being that the comparison/control group has not been exposed to the policy or programme. The comparison group provides information on "what would have happened to the members subject to the intervention had they not been exposed to it", the counterfactual case.*

This method is based on the study of causal effects in the hard sciences. For example, to measure the effect of a new drug, some patients are administered the drug and, simultaneously, another group, similar in all aspects to the treatment group, is administered a placebo. There is then a high likelihood that any difference in the outcomes between the two groups can be attributed to the new drug.

In this study, average monthly consumer prices of AgeCore SKUs are contrasted with the average monthly prices of similar non-AgeCore SKUs; AgeCore SKUs are the treatment group and non-AgeCore SKUs are the control group. Counterfactual analysis enables the attribution of cause and effect between interventions and outcomes. Since the equivalence of the two sets of SKUs cannot be rigorously established, the method falls short of the scientific ideal of the CIE approach. In practice, in many applications of the CIE methodology, strict equivalence of treatment and control group is not fully satisfied, and the study results must be considered within the context of this methodological shortfall.

The chocolate product category illustrates the approximate similarity between treatment and control groups. The share of sales of the AgeCore SKUs in the chocolate category is close to the average across all product categories, at 26%. The average price differential over the 6-year period between the AgeCore SKUs and the non-AgeCore SKUs is close to zero and the average price differential between the chocolate treatment and the chocolate control group is less than 10%. Furthermore figure 2 illustrates that the two groups are composed of different yet comparable ubiquitous brands.

Figure 2: comparable SKUs inside and outside of the buying group

The scope of the analysis is kept as wide and detailed as possible, using scanner data from EDEKA. Sales from EDEKA's hard discount chain, Netto, are not included, because its assortment consists mainly of private label for which the international retail buying group is less relevant. Also excluded from our

analysis are all private label products, promotions, and product categories outside the standard food grocery universe.
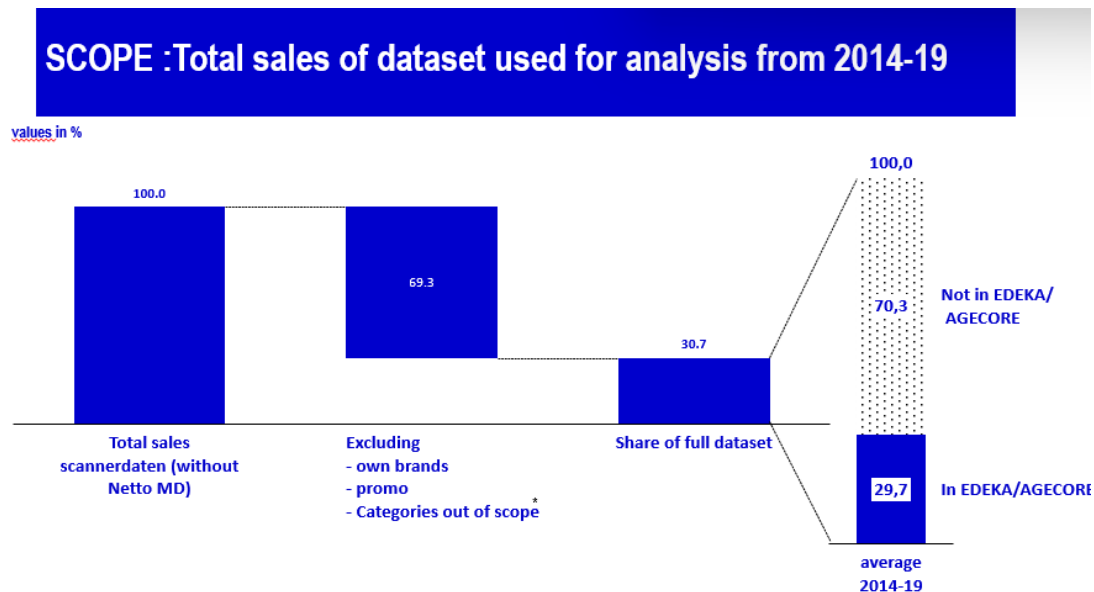

Figure 3: Scope of the analysis: share of EDEKA sales included in the analysis

The primary variable of interest in the analysis is the average monthly consumer price for an SKU available for shoppers in EDEKA stores in Germany during that month. For each of the approximately 6 million observations, data was available for a number of additional variables which were hypothesized to contribute to explaining the variance in the average monthly consumer prices of the SKUs. The period 2014-2019 was selected to the neglect of the most recent years 2020 and 2021 to avoid unwanted perturbations in consumer behaviour and store operations during the Covid pandemic.

This data set contains around 138,000 SKUs from about 20 different food product categories. No EDEKA store carries 138,000 SKUs at any one point in time but over time the SKUs composition of the EDEKA assortment varies due to seasonality and many other exogeneous factors like new SKUs introduced, some SKUs dropped etc.

The power of a counterfactual impact evaluation approach depends on the similarity of the treatment and the control groups and thus it is instructive to compare the two sets on key characteristics. In terms of the EDEKA assortment typology, the correlation coefficient between the AgeCore and the non-AgeCore SKUs is 58% for the share of sales across product categories (see figures 4 and 5), meaning there is an acceptable – but not perfect – relationship between the sales shares of the product categories in the buying group and the sales shares of

the product categories that are not in the buying group. In this sense, alcoholic beverages are an outlier, representing more than twice the share of sales in the non-AgeCore group than in the AgeCore group. This is caused by the plethora of important (local) German brands of beer, spirits etc.
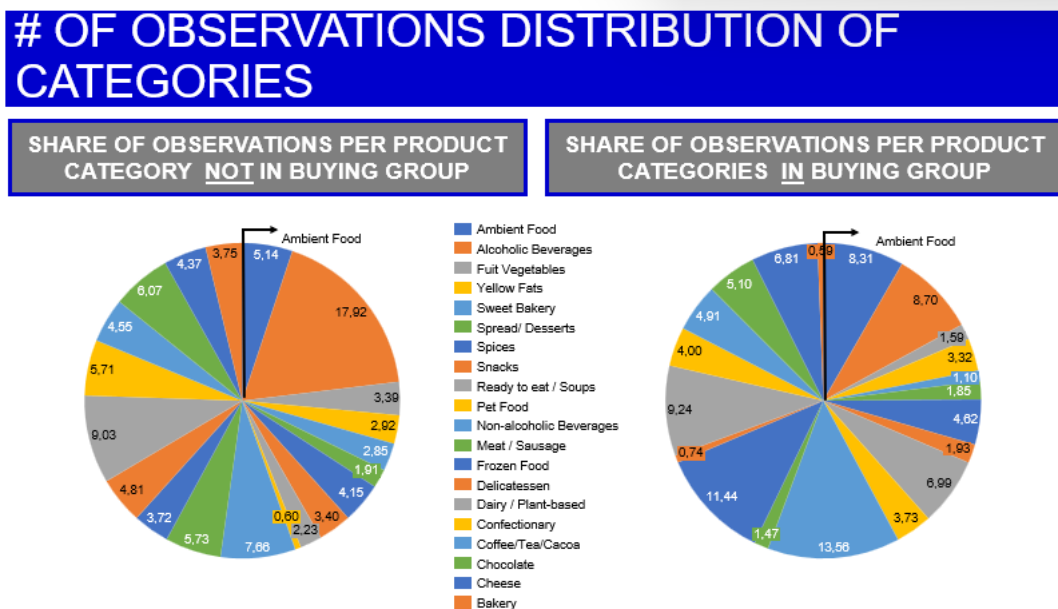

Figure 4: comparison of the distribution of the share of observations across categories for the 'in buying group' and 'not in buying group' SKUs.
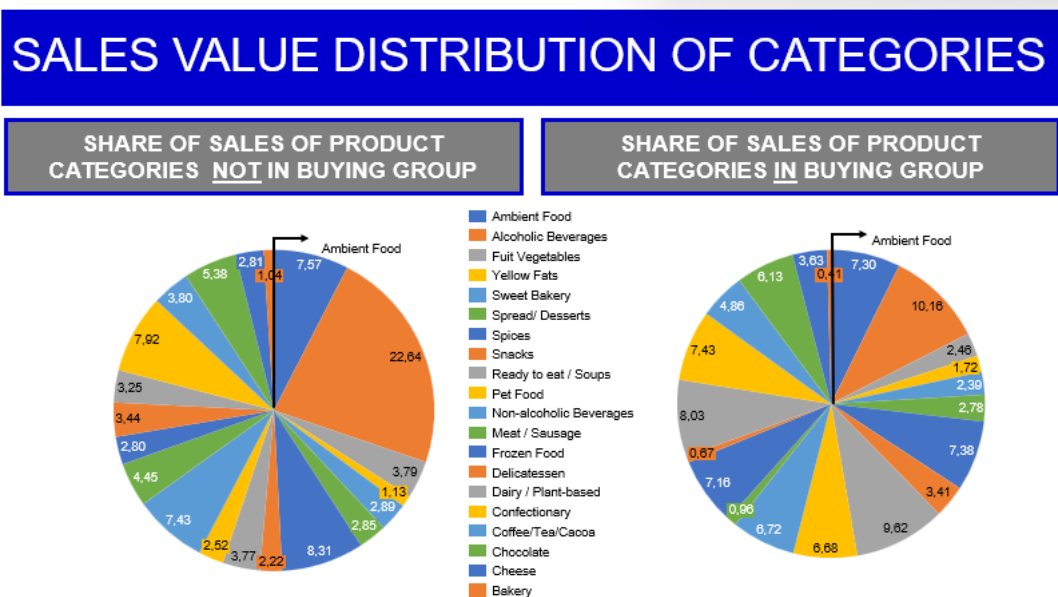
Figure 5: comparison of the sales value distribution across categories for the AgeCore and non-AgeCore SKUs.

A similar study to the one reported here investigated the effect on consumer prices of the buying alliance linking Metro (German retailer) and Auchan (French retailer) in the French market (Frontier Economics, 2019). That study applied a similar methodology to a similar extensive assortment of food products. The results of the Metro-Auchan study showed that consumer prices were 5% to 7% cheaper during the 2 years after the buying group was established as compared to the 2 years before the buying group was created (2013-2015) (Frontier Economics, 2020).

Although the AgeCore/EDEKA and the Metro/Auchan studies have a similar objective, the execution and the research settings of the studies are substantially different. Metro and Auchan are relatively small retailers compared to EDEKA, and AgeCore was, at the time of the study, the largest European retail buying group. Both studies cover a very large set of SKUs, product categories and observations. An advantage of the Metro-Auchan study is the fact that a before-after analysis was possible because their buying group was created in 2016 and data were collected 2 years before and 2 years after that event. The situation is different for this study because EDEKA was a member of an international buying group long before it joined AgeCore. Therefore, we do not compare before-after effects but 'in-buying group' versus 'not-in-buying group' effects. Specific differences between the two studies are summarized in the table.

EDEKA / AGECORE STUDY VS. METRO / AUCHAN STUDY

EDEKA AGECORE	Auchan METRO
FRANCE, GERMANY, ITALY SWITZERLAND, BELGIUM & SPAIN	FRANCE
AGENOR - AGECORE	BEFORE-AFTER
IN BUYING GROUP- NOT IN BUYING GROUP	IN BUYING GROUP- NOT IN BUYING GROUP
OLS REGRESSION	FIXED EFFECT REGRESSION
2014-2019	2013-2018
138,000 DIFFERENT SKUs	165,000 DIFFERENT SKUs
6,100,000 OBSERVATIONS	3,500,000 OBSERVATIONS

Figure 6: Comparison of Metro-Auchan and the AgeCore-EDEKA studies

THREE MODELS

A sequence of three different models is used to estimate the effect of the buying group AgeCore on the prices offered to EDEKA shoppers: the base model, followed by the enhanced model and ending with the advanced model. The conclusions of the study are based on the results of the third model but following the successive steps through the two simpler models demonstrates the specific contributions of the various variables introduced to explain the phenomenon in question. After the application of the three models, some stress testing on the models' results is used to check their consistency and robustness.

All three models are special cases of the following general linear regression model:

$$Y_{it} = \alpha + \beta_1 X_{1,it} + \cdots + \beta_k X_{k,it} + u_{it}$$

There are three different elements in the models used: variables (Y_{it}, $X_{1,it}$), coefficients (alpha, beta etc.) and the error term (u_{it}).

Y_{it} is the dependent variable: average monthly consumer price of SKU i in month t (say 33cl can of Coke Zero (i) in February 2015 (t)).

$X_{1,it}$ $X_{2,it}$ etc. are the variables which explain the variance in the average monthly consumer price of SKU i in period t. There are k such variables.

The values of the variables are the known quantities (the EDEKA data set), and statistics tools (OLS: Ordinary Least Squares method) are used to estimate the coefficients.

To simplify the interpretation of the estimated coefficients, natural logs of the dependent variable were used: ln (Y_{it}).

After this logarithmic transformation of the dependent variable, each estimated coefficient can be interpreted as the % change in the monthly average consumer price associated with the marginal increase in the X variable corresponding to the coefficient.

The Base Model

The base model is specified to explain the variance in average monthly consumer prices across all SKUs using two explanatory variables: time and buying group membership. Clearly, many more factors impact average monthly consumer prices, but the base model only considers two: time effects (inflation, seasonality, etc.) and AgeCore membership or non-membership within all SKUs. Thus, prices were modelled on a set of dummy variables related to time, and a dummy variable for AgeCore membership or non-membership in the corresponding time period. The base model is simplistic, but it provides a point of reference.

$$\ln(p(it)) = \alpha + \beta \,(\text{time dummies }(t)) + \gamma \,(\text{AgeCore }(it)) + u(it)$$

The estimation results of the base model (see figure 7), run on the 6 million observations, indicate that the average monthly consumer price of SKUs in the buying group are 21% cheaper than comparable SKUs which were not part of the buying group, ceteris paribus. The 3 stars by the coefficient indicate there is a very high confidence level that this result of a 21% price reduction is significantly different from zero. The low corrected R-squared value for the basic model shows that the predictive power of the base model is particularly low (under 1%). As the purpose of this model was only to indicate whether belonging to the buying group impacts on the consumer price of any SKU, the model's predictive power is less relevant, and our next models should improve this. The base model estimates many time-related coefficients which are not reported here as they are of little interest for the purpose of this analysis.

The Enhanced Model

As pointed out in the methodology section of the paper, the validity of the application of a counterfactual impact evaluation approach rests fundamentally on the similarity of the treatment and the control groups.

Pricing strategy is a key issue for retailers, and it is not necessarily optimal for a retailer to be equally price competitive across all brands and SKUs. Shoppers are more likely to be aware of the prices of popular, frequently purchased, or high-ticket SKUs and furthermore, they will use the relative prices of these items to assess the overall price image of a retailer. The prices of such SKUs therefore have a disproportionate effect on determining store preference

(Briesch, 2013). Conversely, for smaller brands or SKUs that are bought less frequently, consumers may be less aware of the relative prices across competing retailers or simply less price sensitive. Retailers react by trying to be more price competitive on the most price-salient SKUs.

The treatment group, i.e., SKUs within the buying group, are correlated with the more salient items for which competitive market forces dictate that retailers must be most price competitive. So, even if those AgeCore SKUs were not in AgeCore, the retailer would generally have to be particularly price competitive within this set. It is thus necessary to correct for this bias in the model, to avoid overestimating the effect of the buying group on consumer prices. A categorisation of the annual sales value for each SKU in one of three categories (low, medium, high) is thus introduced as a variable in the enhanced model to capture the 'price-salience' factor. This is an important improvement to the basic model as it allows the enhanced model to disentangle the effect of being a high-sales-value SKU from the effect of being a SKU included in the buying group, and so answers a major shortcoming in the base model that led to a likely over-estimation of the effect of the buying group on consumer prices.

$\ln(p_{(it)}) = \alpha + \beta$ (time dummies (t)) $+ \gamma$ (AgeCore (it)) $+ \omega$ (annual sales level dummies(it)) $+ u_{(it)}$

As hypothesized, adding the sales-value variable substantially reduces the estimated impact of the buying group on prices of AgeCore SKUs at EDEKA; it went from -21% to -12% (see figure 7). In other words, EDEKA is generally more price competitive on high-sales-value SKUs than on medium and small SKUs, whether they are within AgeCore or not, though being within AgeCore increases this level of price competitivity further.

The Advanced Model

The unit price of SKUs varies significantly between product categories. Thus, it is hypothesised that introducing product category as an additional explanatory variable could improve the power of the model to explain the variation in consumer prices.

$\ln(p_{(it)}) = \alpha + \beta$ (time dummies (t)) $+ \omega$ (annual sales level dummies(it)) $+ \delta_{(k)}$ (product category k) $+ \gamma_{(k)}$ (product category k * AgeCore (it)) $+ u_{(it)}$

EDEKA's assortment typology for food products is used to operationalize the product category variable. Not only does the new variable enhance the model results, but the effect of the buying group on average monthly consumer prices of SKUs is found to vary significantly across product categories. From the 'enhanced model' the average reduction was -12%, but this average hides considerable differences between product categories.

RESULTS

	Model 1 # Obser. = 6,244,207, R-Squared=.007	Model 2 # Obser. = 6,244,175, R-Squared=.021	Model 3 # Obser. = 6,106,468; R-Square=.339
EDEKA/AGECORE	-.21***	-.12ˣˣˣ	
SALES MEDIUM		+.06ˣˣˣ	0
SALES LARGE		-.28ˣˣˣ	-.20ˣˣˣ
ALCO BEVERAGES			1.00ˣˣˣ
AMBIENT FOOD			-0.09ˣˣˣ
BAKERY			0.02
CHEESE			-0.1ˣˣˣ
CHOCOLATE			-0.2ˣˣˣ
COFFEE,TEA,CACAO			0.15ˣˣˣ
CONFECTIONARY			-0.24ˣˣˣ
DAIRY,PLANT BASED			0
DELICATESSEN			-0.02
DRY FRUIT & VEG			-0.09ˣˣˣ
FROZEN FOOD			-0.32ˣˣˣ
MEAT/SAUSAGES			0.02ˣˣˣ
NON-ALCOH BEV			0.20ˣˣˣ
PET FOOD			-0.35ˣˣˣ
RTE/ SOUPS			-0.38ˣˣˣ
SNACKS			-0.06ˣˣˣ
SPICES			-0.14ˣˣˣ
SPREAD / DESERTS			-0.17ˣˣˣ
SWEET BAKERY			0.12ˣˣˣ
YELLOW FATS			-0.07ˣˣˣ

Figure 7: Estimation results for the three models: base, enhanced and advanced

In figure 7, for the product category 'confectionary', the AgeCore effect is reported as -0.24 meaning, after accounting for time effects, the sales level effect of SKUs, and the general product category effect, the confectionary SKUs within the AgeCore remit are on average 24% cheaper than similar SKUs in the confectionary category which are outside the remit of AgeCore, ceteris paribus. In the ambient food category prices are 9% lower due to the effect of AgeCore. [In figure 7 only the interaction coefficients (product category + AgeCore) are reported, as the coefficients relating to each individual product category are of less interest.]

The results from the advanced model provide 5 insights:

1) Even when the product categories variables are added, the effect of the high sales value variable on consumer prices remains strong and negative, i.e., retailers are more price competitive for SKUs with high sales levels, as compared to SKUs with medium and small sales levels.

   Re-running the analysis for the advanced model omitting the 'sales-value' variable gives the anticipated result of making the buying group effect significantly stronger, because, as before, some of the high-sales effect is then (erroneously) attributed to the buying group.

SENSITIVITY ANALYSIS: EXCLUDING SALES DUMMY VARIABLES

	ADVANCED MODEL # Obser. = 6,106,468; R-Square=.339	ADVANCED MODEL WITHOUT SALES DUMMIES # Obser. = 6,106,500, R-Squared=.333
EDEKA/AGECORE		
SALES MEDIUM	0	
SALES LARGE	-.20***	
ALCO BEVERAGES	1.00xxx	0.96xxx
AMBIENT FOOD	-0.09xxx	-0.18xxx
BAKERY	0.02xxx	-0.05xxx
CHEESE	-0.10xxx	-0.17xxx
CHOCOLATE	-0.21xxx	-0.27xxx
COFFEE,TEA,CACAO	0.15xxx	0.09xxx
CONFECTIONARY	-0.24xxx	-0.27xxx
DAIRY,PLANT BASED	0	-0.04xxx
DELICATESSEN	-0.02	-0.07xxx
DRY FRUIT & VEG	-0.09xxx	-0.12xxx
FROZEN FOOD	-0.32xxx	-0.43xxx
MEAT/SAUSAGES	0.02xxx	-0.06xxx
NON-ALCOH BEV	0.20xxx	0.11xxx
PET FOOD	-0.35xxx	-0.41xxx
RTE/ SOUPS	-0.38xxx	-0.45xxx
SNACKS	-0.06xxx	-0.08xxx
SPICES	-0.14xxx	-0.17xxx
SPREAD / DESERTS	-0.17xxx	-0.23xxx
SWEET BAKERY	0.12xxx	0.10xxx
YELLOW FATS	-0.07xxx	-0.14xxx

Figure 8: Sensitivity analysis: impact of the sales level variable on the estimated impact of the buying group on consumer prices.

2) Across product categories the predominant effect of the buying group is beneficial for shoppers. If an SKU in a specific product category belongs to AgeCore, then its average monthly price tends to be lower than the price of similar SKUs in that product category that are outside AgeCore, ceteris paribus.

3) Some product categories go against this overall trend. For example, the average monthly consumer prices for SKUs in the non-alcoholic beverages category within AgeCore are higher than similar SKUs for non-

alcoholic beverages outside AgeCore, ceteris paribus.For beverages, both alcoholic and non-alcoholic, belonging to AgeCore provides no price benefit to EDEKA's shoppers. If the three models are re-run without the beverage categories (see figure 9), not surprisingly, the buying group effects are reported as significantly more powerful in reducing consumer prices for AgeCore products.

SENSITIVITY ANALYSIS: RESULTS EXCLUDING BEVERAGE CATEGORIES				
	Model 1 # Observations = 4,139,393 R-Squared= .015	**Model 2** # Observations = 4,139,380 R-Squared = .025	**Model 3** # Observations = 4,139,380 R-Squared = .190	**Model 4** # Observations = 4,139,393 R-Squared = .184
EDEKA/AGECORE	-.24***	-.18***		
SALES MEDIUM		+.02***	0	
SALES LARGE		-.22***	-.18***	
AMBIENT FOOD			-0.11***	-0.18***
BAKERY			0.01	-0.05***
CHEESE			-0.11***	-0.17***
CHOCOLATE			-0.23***	-0.27***
COFFEE,TEA,CACAO			0.14xx	0.09***
CONFECTIONARY			-0.25***	-0.27***
DAIRY,PLANT BASED			-0.12***	-0.04***
DELICATESSEN			-0.03***	-0.07***
FROZEN FOOD			-0.35***	-0.43***
MEAT/SAUSAGES			0.004***	-0.06***
PET FOOD			-0.36***	-0.41***
RTE/ SOUPS			-0.39***	-0.45***
SNACKS			-0.06***	-0.08***
SPICES			-0.14***	-0.17***
SPREAD / DESERTS			-0.18***	-0.23***
SWEET BAKERY			0.11xxx	-0.10xxx
YELLOW FATS			-0.08xxx	-0.15xxx

Figure 9: Sensitivity analysis: impact of dropping the beverages categories (alcoholic and non-alcoholic)

4) Virtually all effects are significantly different from zero from a statistical point of view. Only three product categories, bakery, plant-based dairy, and delicatessen, show no statistically significant effect of being in the remit of AgeCore.

5) The 'advanced model' has a 'goodness of fit' of 34%, which is a dramatic improvement over both the previous models, indicating that it is important to add the product category variable into the model.

TOWARDS IMPROVING THE MATCHING

The fact that some product categories have positive coefficients is noteworthy. For both alcoholic and non-alcoholic beverages categories, EDEKA shoppers are penalized when the SKUs in those categories are part of the buying group. The analysis of the matching of the treatment and the control group by product category identifies some systematic biases in a limited number of product categories. Many criteria can be used to compare the two groups. Based on in-depth discussions with senior commercial managers at EDEKA and systematic statistical analysis, two specific criteria are identified which seem to contribute to the explanation of the outlier-results obtained in the advanced model: (1) product category market share of SKUs in the buying group and (2) average price differential between SKUs in the buying group and those not in the buying group.

As shown in figure 10 (where circle size represents the relative sales value of the product categories) a number of product categories seem to depart from the typical product category profile.
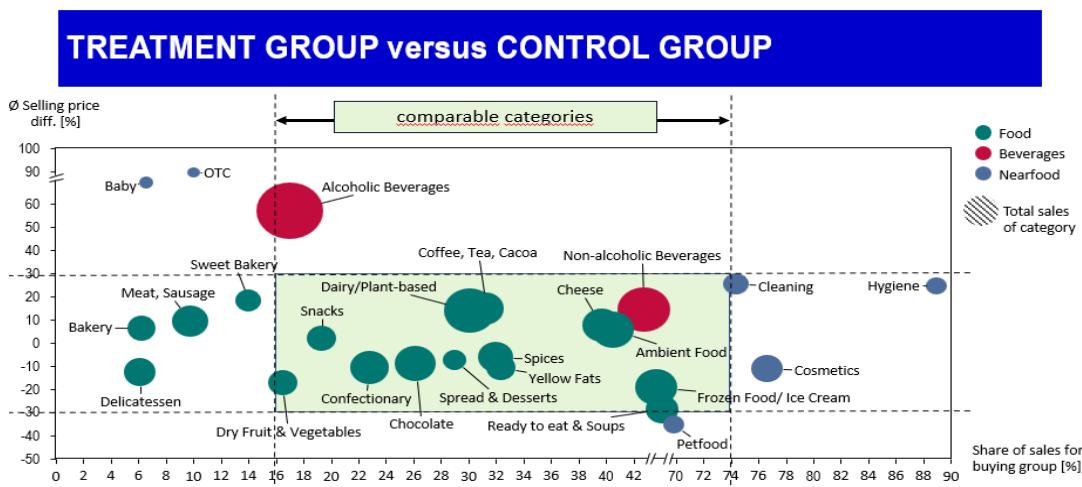

Figure 10: Matching 'in buying group' and 'not in buying group'

Qualitative analysis leads us to defining the 'matching zone' for 'typical' product categories in our analysis. The following ranges are considered typical: the average price differential in any product category between AgeCore and non-AgeCore SKUs was between plus and minus 30% and the market share of AgeCore category sales was below 70% and above 15%. Falling outside these ranges would reduce the comparability of the treatment and the control groups and therefore using product categories from outside these ranges would make

the use of a counterfactual impact evaluation approach more tenuous. These are evidently somewhat arbitrary and subjective criteria, but they seem reasonable given the inputs of experienced commercial staff at EDEKA.

Although the non-alcoholic beverages product category falls within the matching zone, the alcoholic product category does not. Similar to the non-alcoholic beverages, alcoholic beverages that are not in AgeCore are less ubiquitous German brands as compared to the well-known mostly megabrands within AgeCore (figures 11 and 12). However, they fall outside the acceptable range with respect to their average price level (AgeCore alcoholic beverages are on average 57% more expensive than the alcoholic beverages not part of AgeCore) and their share of sales in the category (AgeCore alcoholic beverages account for only 17% of the total product category sales) is at the limit of the acceptable range (figure 10). Therefore, alcoholic beverages are not included in the final analysis (figure 13). For similar reasons, the bakery, sweat bakery, delicatessen and meat & sausages categories also show significant compatibility problems between the AgeCore buying group SKUs and the SKUs not in the buying group (see figure 10).

Figure 11: Comparison of key SKUs in the buying group and out of the buying group

Figure 12: Comparison of key SKUs in the buying group and out of the buying group

Figure 13 shows the results for all 3 models when the inappropriate product categories are omitted from the analysis. Two categories remain with positive coefficients: non-alcoholic beverages and the 'coffee, tea and cacao' product category.

Other product categories, such as non-food categories in EDEKAa's assortment, were added to the matching zone analysis (figure 10) and it turns out that these product categories are not valid candidates to be added to our analysis. For some because they are marginal in their respective product category and over 70% more expensive than SKUs not in the buying group, such as baby products and OTC medications. Other non-food categories (such as cleaning, hygiene, and cosmetics products) were excluded because they were too dominant in their respective product categories. For these latter categories the non-AgeCore SKUs accounted for less than 25% of the sales in their product categories.

	BASIC Model # Obser.= 3,980,218 R-Squared=.010	ENHANCED Model # Obser. = 3,980,218 R-Squared=.017	ADVANCED Model # Obser. = 3,980,218 R-Square=.223
SENSITIVITY ANALYSIS: RESULTS MATCHING PRODUCT CATEGORIES			
EDEKA/AGECORE	-.19***	-.14ˣˣˣ	
SALES MEDIUM		-.02ˣˣˣ	+.02ˣˣˣ
SALES LARGE		-.20ˣˣˣ	-.12ˣˣˣ
AMBIENT FOOD			-0.12ˣˣˣ
CHEESE			-0.12ˣˣˣ
CHOCOLATE			-0.23ˣˣˣ
COFFEE,TEA,CACAO			0.13ˣˣˣ
CONFECTIONARY			-0.25ˣˣˣ
DAIRY,PLANT BASED			-0.02ˣˣˣ
FROZEN FOOD			-0.36ˣˣˣ
DRY FRUIT & VEG			-0.10ˣˣˣ
NON-ALCOH BEV			0.17ˣˣˣ
PET FOOD			-0.37ˣˣˣ
RTE/SOUPS			-0.40ˣˣˣ
SNACKS			-0.06ˣˣˣ
SPICES			-0.15ˣˣˣ
SPREADS/ DESERTS			-0.19ˣˣˣ
YELLOW FATS			-0.09ˣˣˣ

Figure 13: Results after correction for product categories outside the matching zone.

NEXT STEPS TO CONSIDER

In future studies considering the impact on final consumers of international retail buying groups, four potential improvements should be considered:

First, it would be helpful to generate hypotheses as to why average consumer prices might be higher for SKUs in a buying group as compared to similar SKUs in the same category which are not in the buying group, ceteris paribus. This might lead to explanations for results showing that for some product categories consumer prices are higher when they are part of the international retail buying group. Non-alcoholic beverages are a good example in our study. Further analysis showed that alcoholic beverages, which also had a positive coefficient, should not have been part of the analysis because the treatment and the control groups are too dissimilar. However, for non-alcoholic beverages, treatment and control groups were sufficiently similar and could therefore be integrated into the analysis. At this stage, the current results for non-alcoholic beverages remain a mystery, despite in-depth follow-up analyses, qualitative as well as quantitative.

Second, a more systematic analysis of the comparability of treatment and control groups would be valuable. Our approach to dealing with this issue accounted for share of category sales and average price differences between buying group SKUs and non-buying group SKUs. However, there may well be further significant factors.

Third, the goodness of fit of the advanced model, though better than the previous two, could be further improved. The advanced model presented in this paper left two thirds of the variance in the average monthly prices of SKUs unexplained. Identifying additional explanatory factors which have an impact on the variance in average monthly consumer prices across SKUs would be a valuable contribution by bringing additional insights into the impact of retail buying groups on consumer prices.

Fourth, micro-studies would be valuable to validate the results of broad-based studies. Currently, several studies have been published on the possible pass-through to final consumers of more favourable buying prices for retailers who are members of retail buying groups. These studies use large data bases, covering millions of observations for wide product assortments, to estimate this consumer price effect. Studies could be done comparing SKU consumer prices at one retailer, member of a retail buying group, for two of the retailer's suppliers, matched in terms of sales, brand ubiquity etc., where one of the suppliers is part of the buying group and the other is not.

CONCLUSIONS

- Based on rigorous statistical analysis of over 6 million monthly observations covering around 138,000 SKUs from food categories over a 6-year period (2014-2019), this analysis shows unambiguously that EDEKA's membership of AgeCore has resulted in significantly lower prices for their shoppers.

- The key result is that, on average, EDEKA shoppers paid approximately 12% less for the SKUs that were in the buying group compared to what they paid for similar SKUs in the same product category which were not part of AgeCore, ceteris paribus. Compared to the 5-7% finding in the Metro-Auchan study, the AgeCore/EDEKA results show almost double the benefits for shoppers. This is due to a number of factors. First, AgeCore/EDEKA represents a much bigger player than the Metro/Auchan alliance. Second, the scope of AgeCore is much wider (covering 6 European countries) than the Metro/Auchan combination. Third, the AgeCore/EDEKA is set in Germany, the largest European market as compared to the Metro/Auchan buying group mainly focused on France. Fourth, the results from the AgeCore/EDEKA study are all the more remarkable as they originated in the German grocery market, with a strong presence of world class hard discounters Aldi and Lidl and known for its price competitiveness compared to other countries, making consumers all the more sensitive to lower prices, especially for large ubiquitous brands. The results thus confirm the hypothesis that joining AgeCore has helped EDEKA compete on price with its large, international food retail rivals on the German market, at least partly passing on these lower prices to its shoppers.

- Sensitivity analysis confirms the above results. The results from the models are robust when subjected to stress testing with respect to the sales level variable and the configuration of the product categories in the analysis.

- The effect of the international buying group on EDEKA consumer prices varies considerably across product categories. It is predominantly beneficial for EDEKA shoppers, but not in all product categories, notably beverages. Evidence indicates that these results might have been caused by matching problems between the treatment and the control groups for some of those 'outlier' product categories. When the analysis is focused

on product categories with a reasonable match between treatment and control groups, virtually all product categories produce the same results: EDEKA shoppers have substantially benefited from EDEKA's membership of AgeCore via lower consumer prices. The remaining large outlier is the non-alcoholic beverages category, for which no convincing explanation could be found.

- Maybe as a result of regulatory pressures and concerns from large brand-owners doubting the benefits for consumers of retail buying groups, a body of evidence is emerging, across several European countries, on the effect of retail buying groups on consumer prices:
  - Molina (2019) Bottled Water France: 7% reduction in consumer prices
  - Metro/Auchan (2020): 5% to 7% reduction in consumer prices
  - AgeCore/EDEKA (2022): 12% reduction in consumer prices

These three independent studies are recent and encouragingly diverse, yet their results are consistent. The Metro/Auchan study focuses on France and covers a large assortment of food product categories, products, and SKUs. It examines the effect of an international retail buying group on consumer prices by comparing these prices before and after the creation of the retail buying group. The Molina study is also set in France and examines three national buying groups (Système U and Auchan, ITM and Casino, and Carrefour and Cora) to determine their effect on consumer prices for one particular product category: bottled water (Molina, 2019). Where the Metro-Auchan and the AgeCore/EDEKA studies use real retailer pricing data, the Molina study uses household level scanner data from the Kantar World Panel and studies consumer prices for bottled water before and after the creation of the buying groups.
The AgeCore/EDEKA study is widest in scope: it covers all food product categories, the largest German retailer, the largest European country and at the time, the largest and most international retail buying group, spanning 6 European countries where the members are the leaders in their respective home markets.

Summarising, even if more research is needed on a variety of variables possibly causing outlier effects for specific product categories, it seems reasonable to state that international retail buying groups do in fact contribute to enhanced competition and level playing field negotiations between (predominantly) national food retailers and multinational brand

owners, and that better buying conditions do result, via a 'trickle-down effect', in lower average consumer prices.

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