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RETAIL MARKET STRUCTURE AND CONSUMER PRICES IN THE EURO AREA

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In 2014 all ECB publications feature a motif taken from the €20 banknote.

GROCERY PRICES IN THE EURO AREA: FINDINGS FROM INFORMAL ESCB EXPERT GROUP SET-UP TO ANALYSE A DISAGGREGATED PRICE DATASETK

Grocery prices in the euro area: Findings from informal ESCN expert group to analsyse a disaggregated price dataset
This paper was prepared as part of a Eurosystem project group established to analyse a large-scale disaggregated dataset on grocery prices in the euro area. This proprietary dataset was obtained as a follow up to the 2011 Eurosystem Structural Issues Report (SIR) entitled "Structural features of the distributive trades and their impact on prices in the euro area". The main motivation for obtaining these data was to enable the analysis of a variety of issues that was previously not possible owing to data limitations. More specifically (i) analysis of Single Market issues and quantification of border effects (ii) measuring the impact of competition – both at the producer and retail level – on consumer price levels and (iii) consider potential implications for inflation measurement arising from structural changes in retail sector such as the growing importance of discounters and private label brands.

The data were obtained from Nielsen, an international market information and measurement company. The dataset is multi-dimensional with approximately 3.5 million observations each for the price, value and volume variables across a number of dimensions (13 countries; approximately 45 product categories; approximately 70 regions; approximately 10 store types on average per country; 4 brands per product category and 3 stock-keeping units - skus - per brand). The data are generally collected from barcode scanners. These cross country data are unique in a number of respects, in particular in that (a) there are data on average price levels across regions within countries, (b) there is information on both prices and volumes, and (c) there are data on aggregated private label sales and prices. The data have been cross-checked against HICP and PPP data and found to be highly congruent.

The expert group was chaired by Bob Anderton (ECB) and Aidan Meyler (ECB) acted as Secretary. We are also grateful to Stefanos Dimitrakopoulos (Warwick University) who, whilst at the ECB as a trainee, provided invaluable assistance in compiling and working with the database.

Preliminary results from the project group were initially presented at an informal Eurosystem workshop which took place in Frankfurt on 22 November 2013. Apart from the members of the expert group a small number of external participants were invited to the workshop. The following participants acted as discussants: Mario Crucini (Professor of Economics, Vanderbilt University, and Senior Fellow, Globalization and Monetary Policy Institute, Dallas Fed); Daniel S Hosken, US Federal Trade Commission (Deputy Assistant Director); Jarko Pasanen, Eurostat (Team Leader: Price Statistics, Purchasing Power Parities, Housing Statistics) and Thomas Westermann, European Central Bank (Head of Section: Prices and Costs). The refereeing process for the papers from this project was coordinated by the Secretary of the expert group (Aidan Meyler).

As the dataset is proprietary, it cannot be made available to outside researchers. Thus this paper is released in order to make the working papers and accompanying research carried out by the expert group publicly available. Additional papers from the project group will be published as they are finalised. Any queries regarding the project may be addressed to Aidan Meyler (aidan.meyler@ecb.europa.eu).

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Abstract

We investigate the empirical relationship between product market competition and prices in the retail grocery sector in the euro area. The study uses micro-data from ACNielsen on chain stores' census characteristics and price levels for a broad variety of products. We construct Herfindahl-Hirschman indices of concentration at different levels of market aggregation (buying group and parent company) to investigate their effects on prices. The analysis confirms the inverse relation between downstream market competition among retailers and price levels for most of the reference products. Though less conclusive in terms of statistical significance, the proposed estimates also point to a welfare enhancing role of buying groups. Our results indicate that buying groups provide a balancing mechanism between retailers' and producers' bargaining power, in support of the countervailing power hypothesis.

Keywords: Market concentration, price levels, buying group, parent company, regional Herfindahl-Hirschman indices.

JEL Codes: L1, L4, L8, E31.

Non-technical Summary

The distributive trades sector provides an 'intermediation' service between upstream (e.g. producers) and downstream economic agents (e.g. consumers). As such it influences the functioning of the market economy as a whole, and it is especially relevant to monetary policy because of its crucial role in price formation: increasing competition in the distributive trades sector may affect not only price levels, via a reduction of mark-ups, but also price dynamics, through greater price flexibility. The structural features of the sector are thus important for price determination and may also influence the measurement of consumer prices.

The relationship between market structure and price levels has engendered two strands of literature. Works bearing on industrial organization find that a more competitive market structure implies lower prices and enhances consumer welfare (see for instance Clarke and Davis, 1982; Hausman and Sidak 2007; Dobson and Waterson, 1997, 1999; Chen, 2003; Barros et al., 2006; Villas-Boas, 2009), while the macroeconomic literature analyses the relationship between the frequency of price adjustments and monopoly power, finding a positive relation between the absence of price changes and monopoly power (Alvarez and Hernando, 2007; Fabiani et al., 2007; Druant et al., 2009).

In this paper we provide a multi-product analysis of the relationship between market competition, proxied by concentration measures, and price levels for nine euro area countries at the regional level. We construct Herfindahl-Hirschman indices (HHI) both at the buying group[1] level (where wholesale prices and selling conditions are established) and at the parent company level (where final consumer prices are set). We consider 13 categories of goods, selected by Nielsen based on their availability on the shelves and aggregate them following their classification in the harmonized index of consumer price (HICP).

Our results point to an overall positive and statistically significant relationship between retail market concentration at parent company level and prices for the pooled sample of countries, using the regional concentration measures for most of the reference products. Therefore, we retrieve the well-established relation between competition and price levels: a

[1] A buying group is a consortium of retailers and producers that bargain over the conditions of the retail contract.

more competitive market structure implies lower prices and enhances consumer welfare.

Moreover, a higher degree of concentration at the buying group level tends to be associated with lower prices. Thus, our estimates suggest a welfare-enhancing role for buying groups, which could be explained in a countervailing-power framework, as a balancing mechanism between retailers' and producers' bargaining power, particularly in markets where the ex-ante contractual strength is widely asymmetric to the benefit of the latter.

The static nature of the dataset prevents exploiting the temporal dimension to account for endogeneity, as so precludes a causal interpretation of our results. An endogeneity bias could arise from several sources. One may be omitted-variable bias: when wholesale prices are raised smaller stores could exit the market or could join a buying group. In this case, consumer prices rise because of higher input costs, while buying group concentration decreases because of a decline in the demand share served by fringe firms. Additionally, a reverse causality problem could drive the results: concentration could be greater where prices are higher (it is more profitable to open new stores). We address these issues by an instrumental variable regression approach. The proposed instrument is the change in land cover/use from agriculture to urban, on the assumption that where many building permits are issued, local concentration should be lower. The results of the instrumental variable approach are broadly in line with those from the baseline model.

An interesting policy implication of our findings is that there are significant non-monetary determinants of the levels and short-run dynamics of prices, not under the direct control of monetary policy, but depending on the way specific markets work (and on how distant they are from the ideal benchmark of perfect competition). In a broader context, the study suggests that at least in the short run appropriate competition-enhancing policies may facilitate the monetary authorities' task of preserving price stability.

1 Introduction

Do large retailers help the pass-through between producers and consumers? Are buying groups beneficial or detrimental to the final consumer?[2] In this paper we conduct an empirical analysis to address these two questions. In particular, we investigate the relationship between market structure and prices in the retail grocery sector in the euro area.

The distributive trades provide an 'intermediation' service between upstream (producers) and downstream (consumers) economic agents. Accordingly, they affect the functioning of the market economy as a whole and are relevant to monetary policy, through their crucial role in price formation. In fact, from the monetary policy standpoint, increasing the degree of competition in the distributive trades may have effects not only on price levels, via a reduction of mark-ups, but also on price dynamics, through greater price flexibility. Structural features of the sector, such as the role of buying groups and the bargaining power of producers and retailers, are crucial to consumers and price determination, and may also affect the measurement of consumer prices.

Most of the industrial organisation literature studies the well-established relation between competition and price levels (see for instance Clarke and Davies, 1982; Hausman and Sidak, 2007), finding that a more competitive market structure implies lower prices and enhances consumer welfare (Dobson and Waterson, 1997, 1999; Chen, 2003; Barros et al., 2006; Villas-Boas, 2009). Our contribution to this literature is twofold. First, we analyse the association between market structure and price levels empirically, using micro-data harmonized across the euro area, whereas such scholars as Ciapanna and Colonna (2011) look at the Italian market only. Second, we consider price levels whereas Ciapanna and Rondinelli (2011) use consumer price indices.

[2]We recall that a buying group is an organization of retailers that combines the bargaining power of its members in order to be able to purchase goods at a more advantageous rate than might be achieved through individual negotiation. Buying groups are important because, by combining the bargaining power of their individual members, they can achieve a very large scale and potentially alter the balance of power in negotiations between retailers and suppliers. Their existence also implies that measures of competition based on company level data may overstate the true level of competition and understate their bargaining power relative to suppliers.

In this paper, we conduct a regional analysis of the relationship between the degree of retail market concentration and price levels for 13 categories of goods, selected by Nielsen based on their availability on retail shelves and classified by the harmonized index of consumer price (HICP) aggregation (1. baby food; 2. bread and cereals; 3. cat food; 4. chocolate; 5. coffee; 6. dog food; 7. frozen food; 8. milk; 9. oil and fats; 10. soft drinks; 11. spirits; 12. sugar and jam; 13. canned products). Data are available for Belgium, Germany, Spain, France, Greece, Italy, the Netherlands, Austria and Portugal. The reference period is year 2010.

Assembling a unique census-type dataset on large-scale retailers (Nielsen structural data), we construct Herfindahl-Hirschman indices (HHI) of concentration both at buying group level and at parent company level, considering the regional market definition. We investigate the relationship between these measures of concentration and regional patterns in price differences. The original contribution of this study is the multi-product analysis of the relationship between concentration and prices at different market levels: at the buying group level (where a consortium of retailers and producers bargain over the terms of the retail contract, and wholesale prices and selling conditions are set), and at the parent company level (where the degree of concentration influences the relationship between retailers and consumers and final prices are set).

Our results indicate an overall positive and statistically significant relationship between retail market concentration at parent company level and prices for the pooled sample of countries for most of the reference products. By contrast, prices are negatively affected by the degree of concentration at buying group level, although in this case the relationship is less statistically significant.

The paper is organised as follows: Section 2 describes the dataset, in Section 3 constructs the concentration indices. The econometric analysis and results are discussed in Section 4; Section 5 concludes.

2 Data description

Our econometric analysis is based on a unique data set, constructed by merging Nielsen structural and price data available at the regional level. The data set was supplemented by Eurostat regional data and LUCAS data on land cover/use.

2.1 Nielsen structural data

The structural data consists of census-type data on grocery chain stores released by AC-Nielsen for eight euro-area countries (Germany, Spain, France, Greece, Italy, the Netherlands, Austria and Portugal) and for Belgium by the National Bank of Belgium. The reference period is July 2010. The unit of observation is the store, for a total of 111,988 observations (115,713 including Belgium; see Table 1). Detailed data at store level are provided: name, address, banner name, outlet type, sales area in square metres, number of counters, turnover share. The dataset also indicates whether the store belongs to a parent company and/or a buying group.[3]

To construct a dataset harmonized across countries, the outlet type definition was based on the sales surface area range applicable to most of the countries: superettes (100-400 sqm), supermarkets (400-2500 sqm), hypermarkets (2500 sqm and over).[4]

Geographically, in many countries the level of aggregation is higher (NUTS2 in Table 1). The geographical detail is not an issue when considering the Nielsen structural dataset itself, as the address of the single store is available. The problem arises when we merge the highly detailed store-level data with the Nielsen price data at a broader regional level.

2.2 Regional price data

Our second source is the Nielsen regional price dataset, mostly collected from bar code scanners and supplemented, if necessary, by shop audits. Data are provided for 45 product

[3]Where the original dataset did not provide this information, we assume that the buying group for hard discounts at the national level coincides with the global banner name.

[4]A broad description of the dataset is provided in the Structural Issues Report of the Eurosystem Task Force, 2011.

categories[5]; these were then aggregated on the basis of their classification in the harmonized index of consumer prices (HICP). Our sample includes 21 pan-European brand product types: all purpose cleaners (apc), baby food, beer, bread and cereals (rice, dry pasta, wet soups, cereal), cat food, chocolate (Bars, Bites, Gift, Pralines, Xmas, Tablets, etc.), cigarettes, coffee (ground and instant), condoms, detergents (dish washer and laundry detergents), dog food (dry, snack, wet), fabric softener, frozen foods (fish and peas), milk, oil and fats (olive oil, margarine, butter), personal care products (shampoo, shave preps, toothpaste, deodorant, paper towels, pantyliner, toilet tissue, diapers), soft beverages (juices and soft drinks), spirits (vodka and whiskey), sugar and jam (strawberry jam, sugar, chewing gum, ice cream, bouillon), tinned products (peas and tuna) and water (sparkling and still). Detergents, all purpose cleaners, personal care products and condoms were excluded, as their prices are generally formed in multi-national buying groups, i.e. super buying groups [6]; cigarettes were dropped because of the state monopoly, beer was removed as it is often country-specific and fabric softeners appear to be influenced by other factors (exports, emerging economies) that are not related to the distributive supply side.

The dataset covers 13 euro area countries, of which nine were selected as they are also available in the census structural data. For the same reason the study was restricted to 2010 only, and the monthly data were aggregated on a yearly basis.

As to the regional dimension, one unique feature of the Nielsen price dataset is that it provides broadly comparable data on price levels for a range of products across regions within Europe. It should be noted that the Nielsen classification system does not correspond to

[5](1) 100% fruit juice, (2) all-purpose cleaners (apc), (3) automatic dishwasher detergent, (4) baby food, (5) beer, (6) bouillon, (7) butter, (8) carbonated soft drinks, (9) cat food, (10) cereals ready to eat, (11) chewing gum, (12) chocolate, (13) cigarettes, (14) coffee ground, (15) coffee instant, (16) condoms, (17) deodorant, (18) diapers, (19) dog food, (20) fabric softener, (21) fish frozen, (22) ice cream, (23) jam strawberry, (24) laundry detergent, (25) margarine, (26) milk refrigerated, (27) milk uht, (28) olive oil, (29) panty liners, (30) paper towels, (31) pasta/spaghetti, (32) peas frozen, (33) peas tinned, (34) rice, (35) shampoo, (36) shaving prep, (37) sugar, (38) toilet tissue, (39) toothpaste, (40) tuna tinned, (41) vodka, (42) water sparkling, (43) water still, (44) wet soups, (45) whiskey.

[6]Viviano et al. (2012) conducted 20 qualitative interviews with market operators, representative of the upstream and downstream markets (10 large retailers and 10 producers/suppliers). These interviews revealed that these products are traded by supranational buying groups.

official NUTS classifications, but we have tried to map one to the other. The Nielsen regions are quite heterogeneous in terms of size (both land area and population), income and wage levels, population density, geographical and other characteristics.

Our main dependent variable is unit prices, derived from information on sales values and volumes (either in terms of packs or equivalent units): i.e. what consumers actually pay on average, most useful for homogenous products.

Table 2 reports the mean log price net of VAT by product type and Nielsen region. It can be seen that baby food, oil and fats, sugar and jam and canned products are most expensive in Greece; cat food, frozen food and coffee cost most in Spain; Belgium has the highest price for bread and cereals, milk and soft drinks. Germany is the cheapest country for baby food, coffee, frozen food, soft drinks, sugar and jam and canned products; the Netherlands is cheapest for cat and dog food, chocolate, milk and oil and fats.

2.3 Eurostat data

The analysis is supplemented using data from the Eurostat regional statistics. At the Nielsen regional level we computed the population-weighted GDP per capita and the weighted unemployment rate as a measure of the evolution of labour costs; we also calculated a weighted measure of population density (population/km^2).

To avoid possible endogeneity in the HHI (see Section 4.3) we look for an econometric instrument to proxy retail market concentration that is uncorrelated with prices. We chose the Land Use/Cover Statistical Area Frame Survey (LUCAS) which is a field survey based on an area-frame sampling scheme.[7] It collects data on land cover and land use and takes photos of landscape, enabling detection of changes in land cover/use. The LUCAS surveys are carried out in-situ; this means that observations are made and registered on the ground all over the EU. Since 2006, they are triennial; the latest (2012) covers all 27 EU countries and observations on more than 270,000 points. To determine the share of land cover that changed from cropland, woodland, scrubland, grassland, bare land, water, wetland to artificial lands, we used the 2006 and 2009 waves, given that our Nielsen structural data refer to 2010 and

[7] See $http://epp.eurostat.ec.europa.eu/portal/page/portal/lucas/data/LUCAS_primary_data/2006$ for a detailed description of the Survey.

we would like to capture the changes in land cover prior to that date.

The econometric instrument is available for six of our sample countries; the survey was not carried out in 2006 for Portugal and Austria and never for Greece. The change in land use varies by Nielsen region: it ranges from no changes in some (like North-West Provinces of Eastezrn and Western Flanders) to a maximum variation in others (like North-East Provinces of Antwerp, Limburg and Flemish Brabant). The median change is registered in Alpes Jura region of France.[8]

3 Methods

3.1 Measures of concentration

Industry concentration and the construction of indices to measure it have been widely analysed in the economic literature. The two factors used are number of firms and equality/inequality of market shares. When such indicators are used, it is implicitly assumed that the degree of competition is higher the lower the share of demand served by each firm. The most common concentration measures are the concentration ratios and the Herfindahl-Hirschman Index (HHI). The general formula employed for HHI is:

$$HHI_j = \sum_{\substack{i=1 \\ i \in j}}^{n} s_i^2$$

where j is the Nielsen region, s_i is firm i's market share and $i = 1, ..., n$ are the buying groups or parent companies; $\frac{1}{n} \leq HHI \leq 1$, where the minimum is the case of perfect competition, the maximum a monopoly. We use HHI as our concentration measure.

Using the Nielsen structural data for 2010, we compute the HHI both at the buying group level and in the final market, among parent companies. First we take country level to get a broad picture of how concentrated the national retail market is. But these measures may be inaccurate or, at least, they should be complemented by local indices, particularly when they are used to proxy market power. Several studies have observed the need to

[8]For a description of the Nielsen regions and the correspondence with the NUT2 classification see Table 6.

measure local competition in the distributive trades; in that consumers may get information and compare prices for a restricted set of stores according to a proximity standard (see, for instance, Baugnet et al., 2009). In this respect, a national HHI is a poor indicator of actual competition, in that it is tantamount to assuming that all the stores in a country compete with one an other. On the other hand, a local HHI may also have shortcomings, as high concentration levels may merely reflect small market size.

In Sections 3.2 and 3.3 we discuss the concentration measures at the national and regional level.

3.2 National Herfindahl-Hirschman Index

The geographical reference is the entire country, which in this case is also reference market. Market shares are based on sales area (square metres), aggregated by buying and parent groups. To calculate the HHI, we sum the total square metres of all outlets belonging to the same buying or parent group, divide by the sum of all square metres sales in the country, and multiply by 100. Table 3 shows that the Austrian and German retail sectors are the most concentrated at the buying group level, Italy and France the most fragmented. Austria and Germany both have the first two buying groups with a market share of about 35 per cent (see Table 4). The Italian market structure is much more fragmented; the largest buying group is the only one with more than 20 per cent, while those from the third to the sixth place have about 10 per cent each. Fragmentation also characterises Portugal: the first buying group holds a 25 per cent share, the second 21.4 per cent. The other countries occupy intermediate positions in buying group concentration. Belgium and the Netherlands have only one buying group with a market share of a third, while in France and Spain the largest buying groups account for 25 and 28 per cent, respectively.

A broader classification of market concentration is offered by parent company market shares: Germany and Belgium have the most concentrated retail sector overall, well above the euro-area average; Italy and France show low concentration (see Table 3). In Germany, more than a third of the retail sector is accounted for by the largest parent group and about a fourth by the second (Table 5). The Italian market is more fragmented, as the first two parent companies hold a total of just 20 per cent, about 10 per cent each. The Austrian

retail sector is interesting: highly concentrated in terms of buying groups but fragmented in terms of parent companies, where the first group has just a 15 per cent market share, the second and third about 10 per cent each. The leading parent company has a market share of about 25 per cent in Greece, Belgium and Spain. In Portugal the top two companies cover about 40 per cent; France has some fifty parent groups, the largest two with about 30 per cent of the market.

3.3 Regional Herfindahl-Hirschman Index

The reference market is the Nielsen region. Market share is constructed taking as denominator the sum of the sales floor (square metres) in the region and as the numerator sales area further disaggregated by buying group and parent group.

As reported in Table 6, in Germany the Nielsen region 2 (Nord Rhein Westfalen) is the least concentrated. In Austria the highest concentration buying groups and parent companies is in the West region. In Italy the North West region tends to be the most competitive. In France, the Paris region buying groups are the most concentrated, whereas for parent companies it is Touraine Charentes. Spanish concentration is high in North Centre at buying group and parent company level. The Belgian "province du Brabant Wallon" and the Greek "North Greece" show the highest level of concentration in those countries. Distrikt2 in the Netherlands, which includes the province of Noord-Holland, is more concentrated than Drenthe, the least concentrated is the Dutch region. Oporto shows the highest concentration in Portugal at the buying group level.

4 Empirical model and results

In this section we propose an empirical model to analyze the role of product market structure (the degree of retail market competition) as a determinant of equilibrium prices. We address the question of whether greater retail market concentration is associated with higher prices and so detrimental to consumers (market power assumption) or whether, instead, in some cases the countervailing power assumption holds and the relationship is reversed (Galbraith, 1952). Our study is twofold: we construct the HHI both at the parent company level, which

describes the downstream market structure, where retailers compete for final demand; and at buying group level, to gauge the relative strength of retailers with respect to producers in the upstream market. The two measures are complementary and shed light on the pricing strategies of retailers on both sides of their market (see Section 3).

4.1 The baseline model

As a baseline specification, we consider the following model:

$$\ln p_{ij} = a_i + b_k + \alpha H_j^{BG} + \beta H_j^{PC} + \zeta X_j + \varepsilon_{ij}. \quad (1)$$

The dependent variable is the average log price level (net of VAT) for good i sold in Nielsen region j. The main explanatory variable is the Herfindahl-Hirschman Index, computed for buying groups $\left(H_j^{BG}\right)$, and parent companies $\left(H_j^{PC}\right)$.[9] The analysis covers 9 euro area countries and 13 reference products in 2010;[10] a_i and b_k denote product and country fixed effects, capturing the common component in prices, such as specific characteristics of product and local markets. X_j is a vector of other explanatory variables having a region-varying component that we include as controls. In particular, X_j comprises regional population density, per capita GDP (a measure of local wealth) and the regional unemployment rate. To account for a quantity effect, sales volumes at Nielsen region level are included as analytical weights in the regression. The identification strategy of the model is based on product and spatial variation, i.e. variability of retail market concentration for different goods and across regions.

The results are summarized in Table 7. For buying groups, the coefficient associated to the HHI is negative and statistically significant at the standard confidence levels. By magnitude an increase of one standard deviation in the Herfindahl-Hirschman index corresponds to a decrease of 2.6% in average prices. This result suggests that buying group concentration enhances consumer welfare, in the spirit of the countervailing power thesis (Galbraith 1952). In our model, an increase in the size of a buying group benefits consumers because it thins

[9] We consider concentration by parent company rather than by store as a proxy of horizontal market power, because we assume that there is no competition among stores within the same parent group.

[10] A fully fledged description of the data set is provided in Section 2.

the fringe (parent companies not joining any purchasing consortium), reducing the dominant producers' outside option and rebalancing bargaining power; and the buying group extends to all members of the consortium the better economic conditions previously reserved to large retailers, making them more competitive in the final market.[11]

Regarding our second regressor, the coefficient of the HHI at the parent company level is positive and statistically significant at the standard confidence levels. An increase of one standard deviation in the concentration index corresponds to a 3.4 percentage points rise in average prices; that is, regions with greater downstream retail market concentration tend to have higher prices. In other words, we retrieve the standard relation between competition and price levels (see for instance Clarke and Davies, 1982; Hausman and Sidak, 2007), a more competitive market implying lower prices and enhanced consumer welfare (Dobson and Waterson, 1997, 1999; Barros et al., 2006; Villas-Boas, 2009).[12] The static nature of the model does not allow us to account for regional fixed effects, as the regional difference is the only source of variation. To address common regional trends, we introduced control variables at the regional level and performed a fixed-effect estimation (with product and country dummies only) to asses the explanatory power of the concentration measures. We found that the HHI is highly significant both at buying group and parent company level. This is confirmed by a formal likelihood ratio test.

4.2 The full model

The richness of the Nielsen price data allows us to consider the possibility that upstream and downstream market concentration could impact prices differently according to product. Accordingly, we estimate the following model:

$$\ln p_{ij} = a_i + b_k + \alpha_i H_j^{BG} + \beta_i H_j^{PC} + \zeta X_j + \varepsilon_{ij} \tag{2}$$

which differs from the previous specification in that the concentration indices are now interacted with 13 product dummies (the coefficients are indexed by product).[13]

[11] The same result is found in Ciapanna and Colonna (2011) in a regression model based on Italian data.

[12] These results of a negative coefficient for H_j^{BG} and a positive for H_j^{PC} hold also when we control for per capita GDP, unemployment rate and population density.

[13] For the analytical description of the Nielsen price data set see Section 2.2.

The results of the regression are summarized in Table 8. Except in two cases, the coefficient of the Herfindahl-Hirschman index at buying group level is never statistically significant (it is negative and statistically significant at the 10% level for dog food, positive and significant, at the 10% level for coffee). Therefore, the analysis does not appear to be conclusive as regards the sign of the relationship.

At parent company level there is a positive correlation with prices for 10 of the 13 HHIs, and 7 of these are also also statistically significant.[14]

A possible explanation for the non-significance of the coefficients (as regards buying group concentration), is that the two measures themselves are highly correlated (the correlation is 0.6). This is by construction, in that both measures are based on market shares (sales area) and there is often a one-to-one relation between parent company and buying group. In fact, we can express one in terms of the other one as follows:

$$\begin{aligned} HHI(PC) &= \sum_p s_p^2 = \sum_p \left(\sum s_{p,b}\right)^2 \\ &= \sum_p \left(\sum s_{p,b}^2 + 2\sum s_{p,b}s_{p,h}\right) \\ &= \sum s_{p,b}^2 + 2\sum_P \sum s_{p,b}s_{p,h} \\ &= HHI(BG) + 2\sum_p s_p^2 \sum \alpha_{p,b}\alpha_{p,h} \end{aligned} \tag{3}$$

where $s_{p,g}$ is the market share of parent company p in buying group b, $h \neq b$.

This is not necessarily a limitation of the model's specification, as it reflects a feature of the euro area retail market. In fact, a buying group is usually a consortium with a leader (dominant firm) and many smaller satellite firms, that do not count for much in terms of sales area (see also Table 4). Testing whether the two measures are equal, we reject the null hypothesis at standard confidence level for 5 out of the 13 products.

[14]The coefficients of the HHI at parent company level are positive and statistically significant for baby food, dog food, oil and fats, spirits, cat food, milk and soft drinks; negative and statistically significant (at 5% level) for canned food; and not significant for the remaining five products (Table 8).

4.3 Controlling for the correlation between HHI(BG) and HHI(PC)

To disentangle the direct and indirect effects of the HHI(PC) regressor, we perform the Gram-Schmidt-Cholesky hierarchical orthogonalization and estimate the following model:

$$\ln p_{ij} = a_i + b_k + \beta_{1i} HHI(PC)_j + \beta_{2i} \widehat{u}_{ij} + \pi X_j + \eta_{ij} \tag{4}$$

where $\widehat{u}_{ij}$ are the residuals of the auxiliary regression of HHI(BG) on HHI(PC), interacted with product dummy i, reflecting the sole effect of buying group concentration, purged of the parent company component. The results of the decomposition are shown in Table 9. In general, we gain in terms of statistical significance in both coefficients, particularly for the parent company concentration index. Compared with the specification presented in Table 8, the coefficients for coffee turned positive although not statistically significant; the coefficient of parent company HHIs stay negative for sugar and jam and canned products (but lose significance for the latter).

In this regression the residuals represent the effect of the buying group after controlling for the correlation with parent company. The sign of residuals is negative in 8 out of 13 cases, a result that seems more consistent with the baseline model. The last specification also indicates a stronger effect of the downstream than of the upstream market structure, in view of the higher level of statistical significance of the HHI(PC) coefficient. Given this finding, we could shift to a more parsimonious model, in which parent company concentration is the sole explanatory variable. We do so in the rest of the analysis, where we address other possible sources of bias. We estimate the following equation:

$$\ln p_{ij} = a_i + b_k + \beta_{1i} HHI(PC)_j + \pi X_j + \eta_{ij} \tag{5}$$

which differs from equation (4) by excluding the residuals that proxy for the effect of the buying group. We use his simpler model to address an endogeneity problem that could affect our results. Endogeneity bias could arise from several sources. One is omitted variable bias, in that if there were an increase in wholesale prices, smaller stores might exit the market or join a buying group. In this case consumer prices rise because of an increase in input costs, and buying group concentration decreases because of a drop in the demand share served by fringe firms. Also, reverse causality could drive the results. That is, concentration might be

higher where prices are higher (it is more profitable to open new stores). We address these issues by an instrumental variable regression approach.

We look for an instrument to proxy retail market concentration that is not correlated with prices. We propose the change in land cover/use from agriculture to urban between 2006 and 2009, on the hypothesis that where many building permits are issued local market concentration should be lower. The instrument does appear to be correlated with our concentration measures (-0.23). We also perform the Hausman test for exogeneity, using our IV as the alternative model; we cannot reject the null at standard levels of confidence. The results of the IV regression are shown in Table 10 for parent companies.[15] We obtain very similar results for the OLS and the IV specifications; in particular, the coefficient of our IV is positive for all products but one (sugar and jam) and is statistically significant in 9 out of 13 cases.

We conduct several further robustness checks, including different measures of wealth in the vector of controls (regional GDP, growth rate of real value added, etc.). We also repeat the analysis on a country by country basis, investigating the specific dynamics of the two "extreme" countries Germany and Italy, the most and the least concentrated. Controlling for individual market structure characteristics and excluding outliers the main results of the pooled analysis are unchanged.

5 Concluding remarks

Based on a novel data set that matches structural information on large euro area retailers and prices both from Nielsen, we investigate the relationship between retail market concentration and price levels in 9 euro area countries.

The analysis is conducted at the upstream and downstream market to account for different attitudes among retailers towards producers and consumers. The empirical model is estimated for 55 Nielsen regions and 45 product categories; this is the main novelty of the study.

[15]Note that we change the sign of the IV when we instrument for concentration, as the variables are negatively correlated.

For most of the products our empirical analysis confirms the inverse relation between downstream market competition among retailers and price levels. Though less conclusive in terms of statistical significance, the estimates also suggest the welfare enhancing role of buying groups, which could be explained in a countervailing power framework, as a balancing mechanism between retailers' and producers' bargaining power, especially where ex ante bargaining power is heavily tilted towards producers.

We also consider the possible correlation between buying groups and parent companies, showing that the effect of the downstream market is stronger than that of the upstream market. However, the parent company HHI may have endogeneity bias, which could affect our estimates severely. We employ an instrumental variable approach and find that, using the change in land cover/use as an econometric instrument, the estimates are broadly similar to the baseline.

An interesting policy implication of our findings is that there are important non-monetary determinants of price levels and short-run price dynamics, factors that are not under the direct control of the monetary authorities but depend on how specific markets work (and how far they are from the ideal benchmark of perfect competition). In a broader context, the study suggests that, at least in the short run, appropriate competition-enhancing policies may help the authorities in coping with the challenges they face in preserving price stability.

Table 1: **Description of the Nielsen structural dataset (July 2010)**

	AT	**BE**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PT**
NUTS3				X		X	X		
NUTS2	X	X	X		X		X	X	X
Sales area	X		X	X	X	X	X	X	X
Counters			X		X		X		X
Turnover share	X		X		X		X		
Buying group	X	X	X	X	X	X	X	X	X
Parent group	X	X	X	X	X	X	X	X	X
Store	X	X	X	X	X	X	X	X	X
Obs	4,999	3,725	32,216	16,269	17,682	3,033	29,482	4,375	3,932

Notes: Belgian data released by National Central Bank. Buying group for Greece imputed from external datasource.

Table 2: **Mean (log)price at the regional level by product type**

Region	baby food	cereals	cat food	chocolate	coffee	dog food	frozen	milk	oil and fats	soft drinks	spirits	sugar	canned
at1	1.55	1.12	1.34	2.76	2.42	1.27	1.61	-0.42	1.61	0.01	2.78	0.11	1.60
at2	1.57	1.14	1.38	2.73	2.46	1.34	1.74	-0.39	1.63	0.09	2.76	0.13	1.63
at3	1.56	1.13	1.28	2.70	2.44	1.13	1.54	-0.37	1.62	0.01	2.77	0.11	1.59
at4	1.57	1.12	1.35	2.74	2.43	1.20	1.65	-0.37	1.61	0.05	2.79	0.11	1.61
at5	1.56	1.14	1.33	2.71	2.49	1.20	1.46	-0.38	1.63	0.07	2.77	0.11	1.59
be1	1.82	1.32	1.23	2.14	3.03	1.35	1.71	0.41	1.75	0.49	2.82	0.37	1.77
be2	1.83	1.33	1.27	2.15	2.97	1.39	1.68	0.42	1.76	0.48	2.82	0.37	1.78
be3	1.80	1.32	1.25	2.12	2.95	1.37	1.74	0.43	1.77	0.48	2.82	0.37	1.74
be4	1.81	1.31	1.19	2.12	2.91	1.30	1.72	0.42	1.77	0.47	2.82	0.37	1.71
be5	1.81	1.30	1.20	2.14	2.95	1.33	1.63	0.40	1.77	0.45	2.81	0.37	1.71
de1	1.38	1.24	1.41	1.99	2.32	1.02	1.74	-0.06	1.64	-0.17	2.72	-0.19	1.18
de2	1.35	1.21	1.40	1.97	2.36	1.10	1.72	-0.06	1.63	-0.15	2.72	-0.24	1.17
de3	1.34	1.24	1.40	1.97	2.39	1.07	1.46	-0.06	1.64	-0.14	2.72	-0.18	1.22
de4	1.35	1.24	1.41	1.98	2.43	1.04	1.50	-0.05	1.64	-0.13	2.74	-0.09	1.24
de5	1.32	1.21	1.40	1.96	2.39	1.00	1.46	-0.08	1.62	-0.14	2.73	-0.10	1.21
de6	1.33	1.24	1.40	1.95	2.33	0.95	1.72	-0.06	1.62	-0.17	2.73	-0.18	1.17
de7	1.29	1.21	1.40	1.92	2.33	0.91	1.70	-0.08	1.60	-0.18	2.70	-0.15	1.18
es1	1.64	0.93	1.67	2.27	2.76	0.93	1.87	-0.01	1.49	0.11	2.62	1.10	1.94
es2	1.62	0.95	1.60	2.21	2.77	0.90	1.86	0.00	1.48	0.09	2.60	1.08	1.97
es3	1.62	0.94	1.60	2.42	2.75	0.96	1.86	-0.14	1.46	0.06	2.61	1.05	1.98
es4	1.57	0.92	1.61	2.32	3.13	0.98	1.84	-0.03	1.49	0.06	2.61	1.02	1.96
es5	1.50	0.90	1.66	2.16	2.71	0.90	1.87	-0.05	1.48	0.06	2.61	1.05	1.83
es6	1.51	0.90	1.68	2.24	2.74	0.99	1.83	-0.04	1.49	0.09	2.60	1.08	1.95
es7	1.63	0.93	1.69	2.24	2.77	0.93	1.91	0.00	1.50	0.14	2.62	1.11	1.96
es8	1.56	0.91	1.69	2.24	2.74	1.01	1.86	-0.03	1.48	0.09	2.61	1.06	1.94
fr1	1.61	1.12	1.27	2.52	2.89	1.09	1.83	0.02	1.76	0.29	2.84	1.44	1.80
fr2	1.57	1.05	1.22	2.49	2.82	1.05	1.74	-0.05	1.70	0.24	2.81	1.40	1.74
fr3	1.55	1.04	1.20	2.51	2.82	1.04	1.73	-0.10	1.69	0.25	2.81	1.37	1.71
fr4	1.56	1.02	1.18	2.49	2.82	1.00	1.75	-0.02	1.69	0.23	2.81	1.35	1.72
fr5	1.55	1.02	1.18	2.48	2.81	0.98	1.73	-0.03	1.69	0.23	2.81	1.34	1.72
fr6	1.56	1.03	1.18	2.51	2.82	0.99	1.76	-0.04	1.70	0.24	2.82	1.36	1.73
fr7	1.57	1.06	1.23	2.52	2.84	1.03	1.76	-0.04	1.71	0.25	2.83	1.38	1.74
fr8	1.58	1.08	1.27	2.55	2.86	1.04	1.80	0.03	1.73	0.28	2.83	1.41	1.74
fr9	1.56	1.03	1.21	2.53	2.83	0.99	1.75	0.01	1.71	0.25	2.81	1.37	1.72
gr1	2.37	1.23	1.56	2.29	2.60	1.75	.	0.23	1.84	0.31	2.95	2.46	2.44
gr2	2.39	1.23	1.55	2.31	2.58	1.70	.	0.25	1.82	0.31	2.92	2.50	2.47
gr3	2.39	1.25	1.53	2.29	2.61	1.70	.	0.25	1.87	0.29	2.95	2.48	2.48
gr4	2.38	1.26	1.58	2.32	2.60	1.72	.	0.24	1.80	0.31	2.88	2.46	2.49
gr5	2.38	1.21	1.54	2.31	2.62	1.63	.	0.23	1.84	0.30	2.95	2.49	2.46
gr6	2.35	1.26	1.61	2.30	2.60	1.72	.	0.22	1.78	0.28	2.92	2.45	2.44
it1	2.01	1.13	1.44	2.19	2.60	1.90	1.80	-0.02	1.75	0.00	2.52	1.84	1.48
it2	2.06	1.16	1.44	2.25	2.63	1.92	1.87	0.02	1.76	-0.05	2.53	1.84	1.48
it3	2.04	1.14	1.42	2.32	2.61	1.93	1.84	0.05	1.72	0.02	2.54	1.90	1.53
it4	2.04	1.19	1.49	2.39	2.66	2.04	1.85	0.04	1.67	-0.02	2.58	1.94	1.50
nl1	1.67	1.13	1.12	1.94	2.67	0.69	1.47	-0.45	1.26	0.16	3.04	0.88	1.40
nl2	1.65	1.11	1.07	1.91	2.62	0.72	1.49	-0.46	1.26	0.13	3.03	0.90	1.39
nl3	1.68	1.11	1.04	1.94	2.61	0.73	1.50	-0.44	1.26	0.15	3.05	0.93	1.40
nl4	1.66	1.11	1.06	1.93	2.61	0.74	1.48	-0.45	1.26	0.13	3.05	0.91	1.38
nl5	1.67	1.10	1.08	1.92	2.61	0.76	1.50	-0.45	1.26	0.13	3.05	0.88	1.37
pt1	1.43	0.87	1.51	2.25	2.94	1.02	1.62	-0.26	1.36	0.00	2.73	1.33	2.17
pt2	1.39	0.84	1.47	2.22	2.91	0.94	1.58	-0.38	1.35	-0.01	2.74	1.31	2.13
pt3	1.40	0.79	1.44	2.22	2.94	0.87	1.58	-0.38	1.36	0.00	2.72	1.31	2.13
pt4	1.41	0.81	1.47	2.23	2.96	0.92	1.62	-0.27	1.34	-0.04	2.72	1.32	2.12
pt5	1.42	0.80	1.45	2.24	2.94	0.88	1.61	-0.39	1.34	-0.05	2.72	1.31	2.13
pt6	1.43	0.82	1.48	2.24	2.96	0.95	1.63	-0.30	1.35	-0.01	2.72	1.33	2.13

Notes: Our's calculation from the Nielsen price data. Log prices are net of the VAT rate. Cereals comprises bread and cereals; sugar comprises sugar and jam.

Table 3: **HHI at buying group and parent company level by country**

Country	HHI - Buying group	Country	HHI - Parent company
IT	12.8	**IT**	5.8
FR	15.1	**FR**	7.9
PT	15.8	**AT**	8.2
ES	19.9	**ES**	9.5
GR	21.2	**GR**	11.0
NL	21.4	**NL**	12.1
BE	22.5	**PT**	13.2
DE	24.7	**BE**	19.0
AT	25.2	**DE**	21.6
Euro Area average	19.4	**Euro Area average**	12.6

Notes: Our calculation from the Nielsen Structural data.

Table 4: Market share by country and buying group

Country	Buying group (BG)	Market share	Country	Buying group (BG)	Market share	Country	Buying group (BG)	Market share
AT	1st BG	34,4%	PT	1st BG	25,5%	IT	7th BG	4,1%
	2nd BG	33,1%		2nd BG	16,1%		8th BG	3,5%
	3rd BG	10,7%		3rd BG	13,8%		9th BG	2,7%
	4th BG	7,0%		4th BG	13,2%		10th BG	2,4%
	5th BG	5,8%		5th BG	9,7%		11th BG	2,2%
	6th BG	4,7%		6th BG	9,5%		12th BG	1,9%
	7th BG	3,9%		7th BG	5,3%		13th BG	1,7%
	8th BG	0,4%		8th BG	3,9%		14th BG	0,4%
BE	1st BG	35,6%		9th BG	2,8%	NL	1st BG	31,8%
	2nd BG	21,7%		10th BG	0,4%		2nd BG	27,1%
	3rd BG	16,9%		11th BG	0,0%		3rd BG	14,8%
	4th BG	10,5%	GR	1st BG	38,9%		4th BG	8,0%
	5th BG	9,1%		2nd BG	16,0%		5th BG	7,6%
	6th BG	6,3%		3rd BG	14,4%		6th BG	6,8%
DE	1st BG	36,3%		4th BG	7,7%		7th BG	2,7%
	2nd BG	26,7%		5th BG	5,8%		8th BG	0,7%
	3rd BG	13,7%		6th BG	4,3%		7th BG	0,5%
	4th BG	12,8%		7th BG	3,3%		8th BG	31,8%
	5th BG	9,6%		8th BG	3,0%		9th BG	27,1%
	6th BG	0,9%		9th BG	2,1%	PT	1st BG	24,5%
	7th BG	0,1%		10th BG	1,2%		2nd BG	21,4%
ES	1st BG	28,5%		11th BG	1,1%		3rd BG	13,4%
	2nd BG	20,1%		12th BG	1,1%		4th BG	11,0%
	3rd BG	19,3%		13th BG	0,7%		5th BG	9,6%
	4th BG	17,9%		14th BG	0,3%		6th BG	9,0%
	5th BG	7,4%		15th BG	0,1%		7th BG	6,0%
	6th BG	4,9%	IT	1st BG	21,6%		8th BG	2,5%
	7th BG	2,0%		2nd BG	18,0%		9th BG	1,1%
FI	1st BG	45,9%		3rd BG	11,2%		10th BG	0,9%
	2nd BG	38,9%		4th BG	11,2%		11th BG	0,3%
	3rd BG	12,8%		5th BG	11,0%		12th BG	0,2%
	4th BG	2,4%		6th BG	8,2%			

Notes: Our calculation from the Nielsen structural data 2010.

Table 5: Market share by country and parent company

Country	PC	Market share	Country	PC	Market share	Country	PC	Market share
AT	1st PC	14,9%	ES	17th PC	1,1%	IT	1st PC	11,1%
	2nd PC	11,1%		18th PC	1,0%		2nd PC	10,2%
	3rd PC	10,7%		19th PC	1,0%		3rd PC	8,4%
	4th PC	8,4%		20th PC	0,8%		4th PC	7,8%
	5th PC	8,4%		21th PC	0,7%		5th PC	6,7%
	6th PC	6,5%		22-186 PC	13,6%		6th PC	5,3%
	7th PC	6,5%	FR	1st PC	15,7%		7th PC	4,6%
	8th PC	5,8%		2nd PC	12,0%		8th PC	4,1%
	9th PC	5,0%		3rd PC	9,9%		9th PC	3,8%
	10th PC	5,0%		4th PC	8,6%		10th PC	3,5%
	11th PC	4,7%		5th PC	8,6%		11th PC	3,3%
	12th PC	4,0%		6th PC	8,3%		12th PC	3,0%
	13th PC	3,9%		7th PC	5,1%		13th PC	2,6%
	14th PC	1,0%		8th PC	4,2%		14th PC	2,5%
	15th PC	0,9%		9th PC	3,9%		15th PC	2,3%
	16th PC	0,9%		10th PC	3,3%		16-30 PC	13,8%
	17th PC	0,6%		11th PC	3,1%	NL	1st PC	27,1%
	18th PC	0,6%		12th PC	2,8%		2nd PC	11,2%
	19-21 PC	1,2%		13th PC	2,7%		3rd PC	10,1%
BE	1st PC	31,7%		14th PC	2,6%		4th PC	8,0%
	2nd PC	19,3%		15th PC	2,5%		5th PC	7,6%
	3rd PC	15,0%		16th PC	1,1%		6th PC	6,8%
	4th PC	9,3%		17th PC	1,1%		7th PC	4,7%
	5th PC	8,1%		18th PC	0,7%		8th PC	3,6%
	6th PC	5,6%		19th PC	0,6%		9th PC	3,6%
DE	1st PC	33,0%		20-47 PC	3,0%		10th PC	2,7%
	2nd PC	23,5%	GR	1st PC	25,8%		11th PC	2,4%
	3rd PC	14,5%		2nd PC	9,6%		12th PC	1,9%
	4th PC	12,2%		3rd PC	8,8%		13th PC	1,7%
	5th PC	1,6%		4th PC	8,3%		14th PC	1,6%
	6th PC	1,3%		5th PC	7,8%		15th PC	1,5%
	7th PC	0,8%		6th PC	6,7%		16th PC	1,1%
	8th PC	0,8%		7th PC	5,1%		17th PC	1,0%
ES	1st PC	21,6%		8th PC	4,0%		18th PC	0,9%
	2nd PC	13,9%		9th PC	3,8%		19th PC	0,9%
	3rd PC	13,3%		10th PC	2,9%		20th PC	0,7%
	4th PC	5,6%		11th PC	2,8%		21-22 PC	0,9%
	5th PC	4,7%		12th PC	2,2%	PT	1st PC	20,7%
	6th PC	3,7%		13th PC	2,0%		2nd PC	17,7%
	7th PC	3,6%		14th PC	2,0%		3rd PC	11,3%
	8th PC	2,4%		15th PC	1,4%		4th PC	9,3%
	9th PC	2,1%		16th PC	0,8%		5th PC	8,1%
	10th PC	1,5%		17th PC	0,7%		6th PC	7,6%
	11th PC	1,5%		18th PC	0,7%		7th PC	2,1%
	12th PC	1,4%		19-27 PC	1,7%		8th PC	1,5%
	13th PC	1,3%					9th PC	1,4%
	14th PC	1,3%					10th PC	0,9%
	15th PC	1,3%					11th PC	0,8%
	16th PC	1,2%					12-31 PC	3,5%

Notes: Our calculation from the Nielsen structural data 2010. The residual market share for Belgium, Germany, Spain, France Greece, Italy and Portugal is represented by independent parent companies.

Table 6: HHI at Nielsen region level by buying group (BG) and parent company (PC)

Country	Nielsen Region	Region	BG	PC
AT	at1	East	27,2	9,5
	at2	West	37,3	21,1
	at3	North	25,3	9,2
	at4	South	28,4	11,0
	at5	Vienna	30,1	13,0
BE	be1	NW prov. of E. & W. Flanders	21,7	18,1
	be2	NE prov. of Antw, Limb & Fl. Brab	25,0	21,3
	be3	Brussels	24,4	21,5
	be4	SW prov. of Hain & Wa. Brab	26,0	22,7
	be5	SE prov. of Nam, Liege & Lux	23,2	20,1
DE	de1	Hamb, Brem, Sch-Hols & N.Sachs	26,2	25,2
	de2	Nord Rhein Westfalen	23,7	20,6
	de3	Hess, Rh-Pfalz & Saarland	26,8	24,9
	de4	Baden-Wuttemburg	25,9	24,7
	de5	Bayern	28,7	23,8
	de6	Berlin, Meck-Vorp, Brand & S-Anh	27,7	25,2
	de7	Thüringen, Sachsen	27,5	26,1
ES	es1	North East	34,0	25,1
	es2	Centre East	25,4	16,8
	es3	South	25,2	14,9
	es4	Centre	31,1	16,6
	es5	North West	23,9	23,7
	es6	North Centre	40,0	34,3
	es7	Barcelona (Area Metropolitana)	21,7	11,4
	es8	Madrid (Area Metropolitana)	24,3	13,9
FR	fr1	Paris Region	21,3	10,8
	fr2	Champagne Alsace	19,5	12,4
	fr3	Nord Picardie	20,7	11,5
	fr4	Normandie Bretagne	21,0	13,4
	fr5	Touraine Charentes	20,8	15,4
	fr6	Bourgone Auvergne	18,3	11,0
	fr7	Alpes Jura	19,3	9,7
	fr8	Provence Lanquedoc	21,2	11,1
	fr9	Pyrenees Aquitane	17,1	11,2
GR	gr1	Attica	22,8	14,3
	gr2	Salonica	27,3	17,6
	gr3	North Greece	29,6	19,0
	gr4	Central Greece	33,3	18,4
	gr5	Peloponnese	24,0	14,4
	gr6	Crete	30,6	17,5
IT	it1	NW	14,1	10,3
	it2	NE	29,0	21,2
	it3	Centre and Sardinia	24,3	25,0
	it4	South and Sicily	19,6	13,9
NL	nl1	Distrikt1 - Cities of Ams, Rott & Hague	29,5	27,1
	nl2	Distrikt2 - Prov. of N. Holl, S. Holl & Utrecht	30,4	20,2
	nl3	Distrikt3 - Prov. of Gron., Friesl. & Drente	20,9	14,5
	nl4	Distrikt4 - Prov. of Overij, Gelderl. & Flevol.	23,4	16,0
	nl5	Distrikt5 - Prov. of Zeel., N. Brab. & Limb.	24,9	17,2
PT	pt1	Lisbon (Greater)	19,9	16,6
	pt2	Oporto (Greater)	21,9	17,9
	pt3	North	16,5	15,6
	pt4	South	15,0	12,7
	pt5	North West	16,5	14,9
	pt6	South East	18,5	15,1

Notes: Our calculation from the Nielsen structural data 2010.

Table 7: **Effect of regional concentration on price levels**

	Coef.	Std. Err.	Coef.	Std. Err.
HHI Buying Group	- 0.005**	0.002	-0.004**	0.002
HHI Parent Company	0.006***	0.002	0.009***	0.002
Controls:				
Product dummies	yes		yes	
Country dummies	yes		yes	
Per capita GDP			yes	
Unemployment rate			yes	
Population density			yes	
Obs.	32,242		32,242	
R^2	0.568		0.568	
p-value (F-test)	0.000		0.000	

Source: Our calculation from Nielsen data and Eurostat.

Notes: Dependent variable is the log of average unit price levels. HHI=Herfindahl-Hirschman Index. Sales volumes included as analytical weights. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: **Effect of regional concentration on price levels**

	HHI Buying Group		HHI Parent Company	
	Coef.	Std. Err.	Coef.	Std. Err.
Baby food	-0.011	0.009	0.028***	0.007
Bread and cereals	-0.002	0.019	0.026	0.023
Cat food	0.008	0.010	0.018*	0.010
Chocolate	0.008	0.013	0.011	0.010
Coffee	0.041*	0.021	-0.007	0.019
Dog food	-0.031*	0.019	0.027***	0.008
Frozen food	0.024	0.020	0.012	0.021
Milk	0.006	0.009	0.014*	0.009
Oil and fats	-0.012	0.012	0.022***	0.009
Soft drinks	0.001	0.013	0.016*	0.011
Spirits	-0.024	0.018	0.037***	0.014
Sugar and jam	-0.049	0.047	-0.019	0.046
Canned food	0.018	0.012	-0.012**	0.005
Controls:				
Product dummies		yes		
Country dummies		yes		
Per capita GDP		yes		
Unemployment rate		yes		
Population density		yes		
Obs.		32,242		
R^2		0.586		
p-value ($Wald$ test)		0.000		

Source: Our calculation from Nielsen data and Eurostat.

Notes: Dependent variable is the log of average unit price levels. HHI=Herfindahl-Hirschman Index. Standard errors clustered at the regional level. Sales volumes included as analytical weights. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: **Gram Schmidt Choleski Hierarchical Orthogonalization**

	HHI Parent Company		residuals	
	Coef.	Std. Err.	Coef.	Std. Err.
Baby food	0.023***	0.006	-0.027*	0.016
Bread and cereals	0.017*	0.009	-0.06	0.013
Cat food	0.035***	0.011	0.015	0.022
Chocolate	0.016***	0.004	-0.02	0.015
Coffee	0.005	0.006	0.034	0.014
Dog food	0.057***	0.011	-0.022	0.027
Frozen food	0.012	0.010	0.024	0.016
Milk	0.011***	0.004	-0.05	0.005
Oil and fats	0.003	0.005	-0.018**	0.009
Soft drinks	0.014***	0.003	0.002	0.007
Spirits	0.025***	0.006	-0.015	0.013
Sugar and jam	-0.069***	0.018	-0.022	0.028
Canned food	-0.001	0.006	0.014	0.012
Controls:				
Product dummies	yes			
Country dummies	yes			
Per capita GDP	yes			
Unemployment rate	yes			
Population density	yes			
Obs.	32,242			
R^2	0.723			
p-value (*Wald* test)	0.000			

Source: Our calculation from Nielsen data and Eurostat.

Notes: Dependent variable is the log of average unit price levels. HHI=Herfindahl-Hirschman Index. Standard errors clustered at the regional level. Sales volumes included as analytical weights. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: **IV regression for parent company (variation in land cover/use)**

	OLS		IV	
	Coef.	Std. Err.	Coef.	Std. Err.
Baby food	0.022***	0.005	0.059	0.056
Bread and cereals	0.028*	0.016	0.030*	0.018
Cat food	0.030***	0.008	0.034***	0.013
Chocolate	0.026***	0.005	0.029***	0.008
Coffee	0.027	0.019	0.029	0.021
Dog food	0.007	0.013	0.012	0.017
Frozen food	0.038**	0.016	0.041**	0.019
Milk	0.021**	0.010	0.023**	0.011
Oil and fats	0.020***	0.007	0.026**	0.012
Soft drinks	0.021***	0.008	0.025**	0.011
Spirits	0.026**	0.010	0.032**	0.014
Sugar and jam	-0.068*	0.037	-0.065*	0.036
Canned food	0.006	0.007	0.010	0.009
First stage (F-stat in brackets):				
Variation in land coverage (LUCAS: 2009-2006)			-0.234	
			[135.96]	
Controls:				
Product dummies	yes		yes	
Country dummies	yes		yes	
Per capita GDP	yes		yes	
Unemployment rate	yes		yes	
Population density	yes		yes	
Obs.	21,664		21,664	
R^2	0.591		0.589	

Source: Our calculation from Nielsen data and Eurostat.

Notes: Dependent variable is the log of average unit price levels. HHI=Herfindahl-Hirschman Index. Standard errors clustered at the regional level. Austria, Greece and Portugal are excluded from the analysis. Sales volumes included as analytical weights. *** p<0.01, ** p<0.05, * p<0.1.

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