The Rise of Discounters and its Impact on Concentration, Market Power and Welfare

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Abstract

We quantify changes in concentration, market power and welfare in the UK grocery retail sector from 2002 to 2021. We document that an expansion of discounter-format retailers coincided with declining retail and manufacturer concentration across most narrowly defined product categories. We develop an equilibrium model that incorporates consumer choice over retailers and products with Nash-in-Nash bargaining between manufacturers and retailers. Applying this model to the breakfast cereals market, we find that discounter expansion—through store openings, efficiency gains and changes to products—reduced concentration and average prices, increased consumer and total surplus, and especially benefited households near newly opened stores.

Keywords: discounters, concentration, market power, distributional effects

JEL classification: D12, L11, L13, L81

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1 Introduction

The grocery retail sector is of substantial economic importance, accounting for a significant share of household expenditure. Competition authorities in many countries have expressed concerns over rising market concentration, growing retailer market power, and barriers to entry—particularly those stemming from zoning and planning regulations. These concerns have shaped decisions to block further consolidation in the sector, such as the rejection of the 2024 Kroger–Albertsons merger in the US and the 2019 ASDA–Sainsbury's merger in the UK.[1]

In recent years, a retail format known as *discounters*—or *limited assortment stores*—has grown rapidly in both store count and revenue share. This trend has occurred simultaneously in the UK, the US, and across much of the EU. Discounters follow a no-frills business model centered on a limited product range composed primarily of private-label goods, i.e., products exclusive to a single retailer and lacking manufacturer branding. In contrast to traditional retailers, discounters make relatively limited use of branded goods, i.e., products that carry manufacturer branding and are sold across multiple retailers. Firms in this format—such as Aldi and Lidl—operate smaller stores than traditional supermarket chains, enabling them to largely circumvent government planning restrictions that constrain rivals using large-store formats. Due to their focus on private-label goods, the expansion of discounters has potentially significant implications for market concentration at both the manufacturer and retailer levels of the grocery supply chain, as well as for overall economic surplus and its distribution between consumers and producers.

In this paper, we provide novel evidence on the impact of the rise of discounters. We combine longitudinal microdata, a structural model of surplus division among retailers, manufacturers, and consumers, and variation arising from policy reforms that facilitated discounter store openings. We make two main contributions.

First, we provide evidence from the UK grocery sector on changes in retailer and manufacturer concentration across a large number of narrowly defined product categories. We exploit microdata from the Kantar Take Home Purchase Panel, which tracks purchases of disaggregate products (UPCs) brought into the home by over 100,000 households across 2002 to 2021. These products are grouped into more than 100 narrowly defined categories, each designed to represent a distinct product market. We document substantial changes in market structure over this period, with broadly similar patterns across categories. At the retail level, concentration—measured using a Herfindahl-Hirshman Index (HHI) of retail market shares within

[1] See, respectively, Federal Trade Commission (Feb. 26, 2024) complaint and Competition and Markets Authority (2019).

each category—initially rose and then declined. The average category-level HHI increased from 1,552 in 2002 to 1,850 in 2011, before falling back to 1,560 by 2021. At the manufacturer level, concentration (measured by a within-category manufacturer HHI) remained stable from 2002 to 2011, then declined as the market share of branded manufacturers fell. The reduction in concentration at both levels coincided with the rapid expansion of the discounters. This expansion was facilitated by a planning regime that was relatively favorable to the discounters, and was stimulated by a regulatory change in 2010 that prohibited incumbent traditional retailers from restricting nearby discounter entry through anti-competitive land practices.

Second, in the main part of the paper, we assess the impact of the rise of the discounter format on market power and the distribution of economic surplus. To enable a disaggregated analysis of the supply chain that accommodates the rise of discounters and their private-label suppliers, we focus on a single category: ready-to-eat breakfast cereals. This category exhibits concentration patterns that are broadly representative of those in other categories.

We develop an equilibrium model that captures the differences between branded and private-label suppliers in their vertical relations with retailers. Retail prices are determined by Nash-Bertrand competition among retailers, who optimize against a set of product- and retailer-specific marginal costs that depend on the wholesale prices paid to manufacturers. Private-label suppliers lack market power and therefore set wholesale prices equal to their marginal cost. In contrast, branded goods suppliers negotiate wholesale prices, which we model using a Nash-in-Nash bargaining framework.[2] Given the negotiated wholesale prices, each party's gain from trade is defined as its profit relative to the case where negotiations break down and no trade occurs. The bargaining solution equates the relative gains from trade, weighted by a bargaining skill parameter. For any bargaining parameter, a firm with a larger portfolio of products outside the negotiation (e.g., a retailer stocking many other manufacturers' products) suffers less from failure to trade and thus enjoys a stronger bargaining position. We show that, conditional on a system of product-retailer demands, the bargaining skill and marginal cost parameters can be estimated using a simple linear instrumental variable strategy. We show that our main quantitative take-aways are robust to alternative supply models, and that our model can account for cross-category demand and pricing effects (Thomassen et al., 2017).

We model product-retailer demand using a discrete choice framework in which consumers choose among retailers and the set of disaggregated breakfast cereal prod-

[2] Empirical applications of this framework include Draganska et al. (2010), Ho and Lee (2017), Crawford et al. (2018), and Noton and Elberg (2018).

ucts available at those retailers. A key determinant of retailer choice is the travel distance to the nearest store, which we incorporate using data on store locations spanning 2002 to 2021. Our model allows for heterogeneous consumer preferences across key product and retailer attributes. These include a preference for breakfast cereal relative to the outside option (not purchasing), variation in retailer shopping experience, preferences across cereal types (e.g., wheat, rice) and price sensitivity. To identify the parameters governing this heterogeneity, we exploit the panel structure of our microdata, constructing moments based on the persistence of household choices over time and variation in household-specific choice sets.

Our model estimates indicate that the distribution of price-cost margins (i.e., additive markups) across all breakfast cereal products exhibit a modest inverted U-shape over 2002 to 2021, peaking in 2008, mirroring the changes to retailer concentration noted above. This pattern is primarily driven by traditional retailers, whose margins rose initially but declined as competitive pressure from discounters intensified. In contrast, margins on products sold by discounters increased over this period, narrowing much of the initial gap with traditional retailers. We show that this pattern reflects strengthening portfolio effects among discounters: the diversion ratio from an average discounter product to other products sold by the same discounter rose by approximately 50% between 2002 and 2021. This increase in within-firm substitutability, combined with the expansion of discounter store networks, enabled discounters to raise margins while continuing to exert downward pressure on traditional retailer prices and expand market share—ultimately increasing their share of total industry profits by more than 10 percentage points.

To quantify the impact of the rise of the discounters, we simulate what the market would have looked like had they not expanded beyond their 2002 position. We do so by eliminating post-2002 efficiency gains and holding fixed their store network, product quality, and portfolio at 2002 levels. Comparing observed outcomes with this counterfactual allows us to isolate the causal effect of the discounters' expansion on market performance.

We show that the rise of discounters led to reduced retailer- and manufacturer-level HHIs by over 270 and 236 points, respectively—equivalent to more than a 10% decline. This expansion also led to an average price reduction of 5%. The decline reflects both discounter efficiency gains, reflected in lower marginal costs partially passed through to prices, and reduced margins on products sold by traditional retailers. Thus, discounters contributed not only to greater product variety but also to lower prices—through their own cost advantages and by intensifying competition. Overall, total market surplus increased by 3.6% of total revenue, with the consumer surplus rising by 6.6% of total revenue. Although discounter profits grew, these gains were more than offset by losses incurred by traditional retailers and manufacturers.

Our model generates counterfactual predictions at the consumer level, enabling us to quantify the distributional effects of the discounters' rise. We find substantial heterogeneity in consumer welfare gains: in 2021, the interquartile range of gains—as a share of total cereal spending—spanned from 3% to 9%. These gains are evenly distributed across the income distribution. However, they exhibit systematic spatial variation. Households that saw the opening of a nearby discounter—where previously none existed—experienced the largest gains. Nevertheless, even households without a new nearby store benefited substantially, reflecting the competitive pressure that discounters exerted on traditional retailers.

Related literature We contribute to the literature on the impact of new retail formats. Prior work has linked the entry of non-traditional retailers to productivity growth and consumer gains (e.g., Foster et al., 2006; Hausman and Leibtag, 2007; Atkin et al., 2018). Other research focuses on Walmart's expansion (see Basker, 2007 for a survey), emphasizing effects on rival retailers and the role of economies of density (Jia, 2008; Holmes, 2011). Cleeren et al. (2010) document rising competitive pressure from discounter entry. We extend this literature by quantifying the effects of new format entry on market power, surplus, and its distribution across consumers, retailers, and manufacturers. To do so, we estimate a structural model of demand and supply at the product-store level.

The model captures the role played by private-label products using a vertical bargaining framework, building upon the Nash-in-Nash approach in Draganska et al. (2010) and Ho and Lee (2017). More broadly, the paper relates to the literature on vertical relations in retailing (e.g., Villas-Boas, 2007; Bonnet and Dubois, 2010; Bonnet et al., 2025) and work on private-label products and retail competition (e.g., Meza and Sudhir, 2010; Dubois and Jodar-Rosell, 2010; Griffith et al., 2018). We also contribute to the literature modeling market power in the breakfast cereal market (e.g., Nevo, 2000, 2001; Backus et al., 2021; Barahona et al., 2023) by allowing both retailers and manufacturers to exert pricing power.

Our results also contribute to a growing literature documenting trends in market concentration. Several recent studies challenge the narrative of rising concentration in the US by showing that increases in national-level establishment data do not hold when markets are defined more narrowly (e.g., Rossi-Hansberg et al., 2020; Affeldt et al., 2021; Benkard et al., 2021; Smith and Ocampo, 2025; see also Peltzman, 2014; Shapiro, 2018). We contribute new evidence for the UK by tracking changes in concentration across a wide set of narrowly defined fast-moving consumer goods markets, documenting trends at both retail and manufacturer levels of the supply chain.

Finally, we contribute to a literature measuring the evolution of market power. One strand estimates markups using production function approaches across industries, typically finding rising markups (e.g., De Loecker et al., 2020). A complementary approach uses structural models in specific sectors to infer markups and their distribution (e.g., De Loecker and Scott, 2022 on beer; Grieco et al., 2024 on autos; Miller et al., 2023 on cement; Döpper et al., 2025 and Atalay et al., 2023 across consumer goods). We extend this work by studying how the expansion of a new retail format over a twenty-year period shaped market power at both the retail and manufacturer levels.

The rest of the paper is structured as follows. In Section 2 we introduce our microdata and document the evolution of concentration across grocery markets. In Section 3 we present our equilibrium model of the breakfast cereal market and in Section 4 we discuss model identification and estimation. In Section 5 we present our estimates and document the evolution of markups. In Section 6 we quantify the effect of the discounters' rise on market performance. A final section concludes.

2 Data, Market, and Trends in Concentration

Consumer data We use longitudinal microdata collected by a market research firm, Kantar's Worldpanel, as part of their Take Home Purchase Panel. This dataset covers households residing in Great Britain (i.e., the UK excluding Northern Ireland) over the period 2002-2021. The sample consists of approximately 15,000 households in 2002 rising to 30,000 from 2011. Participating households typically remain in the panel for a couple of years and record all purchases of fast-moving consumer goods, including food, drinks (including alcohol), toiletries, pet food and cleaning products. Each household tracks all UPCs (or barcodes) they purchase using a handheld scanner or mobile phone app, and they send their receipts (either electronically or by post) to Kantar.[3] For each transaction, we observe quantity, expenditure, retailer and UPC characteristics (including product category and manufacturer).

[3]For non-barcoded items, such as loose fruit and vegetables, households scan a code in a book provided by Kantar.

For panel members, we observe annual information on their household income and the number and age of household members. We also observe the specific geographic postal sector (out of approximately 1,500 in Great Britain) in which the household resides.

Store location and input price data We use a dataset we compiled from multiple sources that records the geographical location of retailers' stores over 2002-2021. For 2014-2021, we use data from Geolytix Retail Points, and for 2002-2007, we use data from the Institute for Grocery Distribution. We fill in store openings during intermediate years using data from Glenigan, a company that records new supermarket construction projects. We combine this information with the location of households in our sample to construct household-specific, time-varying distances to the nearest store of each retailer. See Appendix A for details. We also make use of official data on input prices, including the prices of several cereal grain products and sugar. See Appendix C for further details.

Retail formats and private labels We refer collectively to Asda, Morrisons, Safeway, Sainsbury's and Tesco as the *traditional retailers*. Safeway operated as a separate retail brand prior to its acquisition by Morrisons in 2005. These retailers have long had a significant presence in the UK grocery market and typically operate large stores that stock a wide range of products.

We refer to the retailers Aldi and Lidl as *discounters*. Discounters market themselves as offering good value through an every-day-low-pricing strategy, rather than relying on promotions. They sell a relatively limited range of products, with a focus on offering these at low prices. While both traditional retailers and discounters sell private-label goods, discounters do so to a much greater extent: on average, private-label products account for 90% of Aldi's sales and 80% of Lidl's, compared to about 50% for traditional retailers. Like the traditional retailers, discounters operate stores across the UK.

For private-label goods the retailer controls quality, marketing, pricing and quantity decisions, effectively replicating a vertically integrated structure. This vertical organization allows retailers to switch private-label manufacturers without the consumer noticing, weakening manufacturers' bargaining position. The Competition and Markets Authority (CMA)—the UK's antitrust regulator, which succeeded the Competition Commission—investigated the food supply chain across various product categories and found that retailers generally secure competitive prices from private-label suppliers.[4]

As well as operating store networks throughout the UK, the traditional retailers and discounters have *national pricing* policies.[5]

Planning policy and controlled land use Two features of the planning system during this period were favorable to the discounters. First, the Competition Commission (CC, 2000, 2008) found the planning system to be highly restrictive toward retailers seeking to open 'larger stores' (defined as having a sales area over 1400 square meters). This format is mainly used by the traditional retailers. In contrast, discounters typically operate 'mid-sized' stores (280-1400 square meters), which are subject to fewer planning restrictions. Second, before 2010, traditional retailers restricted the expansion of the discounters through anti-competitive land site controls, such as restrictive covenants and exclusivity clauses. However, the Controlled Land Order (2010) prohibited traditional retailers from doing this, leading to the release of many mid-size sites well-suited to discounters. The Order exempted discounters, allowing them to continue using such controls against rivals, thereby strengthening their incentives to expand store coverage.[6] See Appendix B for further discussion.

Market trends A major change in the UK grocery market over the first two decades of the 21^{st} century was the growing popularity of discounters relative to traditional retailers. This shift has had important consequences for downstream and upstream concentration.

A key element of the discounters' growth was their expanding store coverage, summarized in Figure 2.1, which illustrates the dramatic rise in the number of Aldi and Lidl stores. In 2002, these retailers operated a combined total of 507 stores nationwide (214 Aldi and 293 Lidl). By 2011, this number had increased by 49%, reaching 757 stores. By 2021, Aldi and Lidl had grown their store counts by 440%

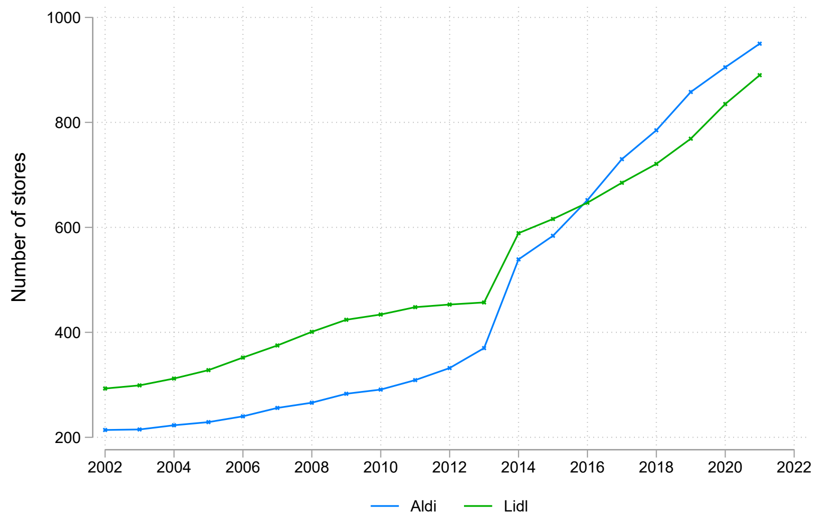
[4]Specifically, they report "own-label food and drink manufacturers compete with each other to win and retain contracts from retailers. Although for some of our product categories (e.g. milk and poultry), there are relatively few own-label manufacturers, competition to win and retain supply contracts appears to be strong, switching does occur, and retailers generally appear to obtain competitive prices, assisted by the transparency of the costs of their own-label suppliers." (CMA 2023, paragraph 10).

[5]"Most retailers set their prices uniformly, or mostly uniformly, across their store network [...]. Various other facets of the retail offer, such as promotions, may also be applied uniformly, or mostly uniformly, across a retailers store network" (CC 2008, paragraph 4.98, pp. 498–501).

[6]Schneier (2025) shows that land use restrictions of the type banned by the Order are also in widespread use in the US and that they have substantial effects on entry, reducing entry by firms that are restricted by them and promoting entry by firms that can use them against others.

and 300%, respectively, to a combined total of 1840 stores. The acceleration of stores openings after 2010 coincides with the Controlled Land Order (2010). Of all discounter stores opened between 2002 to 2021 over 90% were in postal sectors already served by an incumbent traditional retailer. In contrast, over the same period, the number of stores operated by traditional retailers grew by only 40%,[7] reflecting continued planning restrictions.

Figure 2.1: *Discounter store coverage growth over time*



Notes: Based on authors' calculations using a store coverage dataset based on Geolytix Retail Point, Institute for Grocery Distribution and Glenigan data.

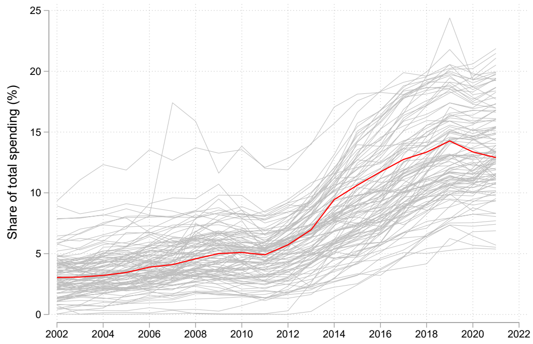
The expansion in store coverage was mirrored by a substantial rise in Aldi and Lidl's average market share, from about 3% in 2002 to about 14% in 2021, across the 227 product categories that comprise the fast-moving consumer good segment of the UK economy (see Figure 2.2 panels (a) and (e)).[8] This growth in market share had significant implications for retail concentration, as shown in panel (b), where we track Herfindahl-Hirshman Indexes (HHIs), calculated using retailer revenue shares in each product category. Between 2002 and 2006, retail HHIs increased, indicating a rise in retail concentration, coinciding with Morrison's acquisition of Safeways and a number of other smaller mergers. From 2006 to 2011, retail HHIs remained relatively stable. However, between 2011 and 2021, retailer concentration declined significantly, reflecting the rapid expansion of the discounters. Panel (e) shows that average retail HHIs rose from 1552 in 2002 to 1850 in 2011, but by 2021 had fallen to 1560, below the level observed in 2002.

[7] This figure excludes stores some of these firms operate in the "convenience store" format, which have very low floorspace (less than 280 square meters).

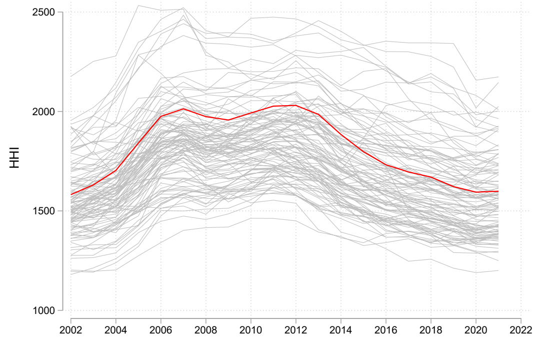
[8] These categories are based on a classification developed by Kantar and designed to reflect distinct consumer markets, with slight adjustments for consistency over time. We report them in Appendix N.

Figure 2.2: *Evolution of market concentration*

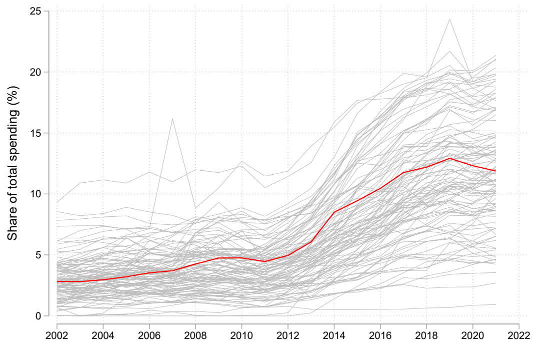
(a) Discounter retail market shares



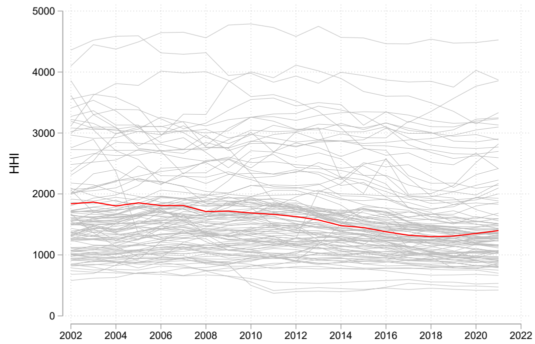
(b) Retail HHIs

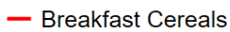


(c) Discounter private-label market shares



(d) Manufacturer HHIs





(e) Across category mean shares and HHIs

	Discounter share:		HHI	
	Retail	Manufacturer	Retail	Manufacturer
2002	3.23	3.04	1552	1636
2011	4.82	4.03	1850	1675
2021	14.04	12.44	1560	1436

Notes: Based on authors' calculations using Kantar's Worldpanel Take Home Panel, 2002-2021. Panel (a) shows the share of spending made in discounters, and panel (c) shows the share of spending on discounter private-label products. Panels (b) and (d) show the evolution of retail and manufacturer HHIs. The red line corresponds to breakfast cereal; the gray lines represent all other product categories with average spending shares greater that 0.25% over 2002-2021 (they collectively account for 88% of fast-moving consumer good spending). Panel (e) reports the mean discounter shares and HHIs across categories in 2002, 2011 and 2021, weighted by each category's mean revenue-share over 2002-21.

The rise of Aldi and Lidl also has implications for manufacturer-level concentration, calculated using manufacturer revenue shares in each product category. For private-label goods we treat the manufacturer as being a distinct firm for each retailer. There is limited information on the identities of private-label manufacturers. Our approach treats the retailer as the relevant firm for concentration measurement: as we note above, the private-label supply chain is in effect a retailer-controlled vertically integrated structure. We summarize changes to manufacturer-level concentration in panels (c) and (d) of Figure 2.2. As noted above, private-label products occupy a very high share of discounter sales. As a result, the evolution of discounter private-label market shares (panel (c)) exhibits a similar pattern to that observed for discounter retailing, with a pronounced rise beginning around 2011. The mean share rises from around 4% in 2011 to over 12% in 2021. This growth in discounter private-label market shares contributes to a fall in manufacturer-level concentration (panel (d)), with the mean HHI falling from 1675 to 1436 between 2011 and 2021.

Breakfast cereals In our analysis of market power and surplus, we focus on the market for multi-portion breakfast cereals. As shown in Figure 2.2, where the trend lines for breakfast cereals are highlighted in red, this category exhibits changes in manufacturer and retailer concentration that are representative of other product categories.

We exclude a small number of single-portion cereal products from the market definition, as well as products and manufacturers with very small market shares. Specifically, we require that a manufacturer accounts for at least 1% of breakfast cereal spending in any single year over 2002-2021; a brand accounts for at least 0.1% of breakfast cereal spending in any year; and a brand-pack size either accounts for at least 0.1% of breakfast cereal spending in any year or be the most popular available pack size for that brand in any year. These conditions leave us with approximately 90% of total breakfast cereal spending.

We define products at the barcode level, capturing differences in brand and pack size. For instance, "Kellogg's Cornflakes 750g" is a specific product with 750g pack size within the Kellogg's Cornflakes brand.

Market structure Table 2.1 summarizes the structure of the breakfast cereal market. Panel A focuses on retailers and panel B focuses on manufacturers of branded products. Retailers stock both branded products and their own private-label products, which are exclusive to a single retailer.

Column (1) reports the average number (across years) of branded products sold by each retailer or produced by each manufacturer. Column (2) shows the average number of private-label products sold by each retailer. Column (3) shows the average number of vertical links each firm has—for instance, in a typical year, Asda stocks products from all six branded manufacturers, and Kellogg's sells its products in six retailers. The remaining columns report the average prices of branded and private-label products, and firm-level market share summary statistics.

Table 2.1: *Breakfast cereal retailers and manufacturers*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Number of:			Price (£/kg)		Spending share (%)		
	branded products	private-label products	vertical links	branded products	private-label products	Mean	2002	2021
Panel A: Retailers								
Traditional retailers								
Asda	97	37	6	5.01	2.87	16.57	16.34	14.57
Morrisons	83	22	6	5.16	3.14	9.93	5.80	9.94
Safeway	70	9	5	5.03	3.17	6.05	8.55	-
Sainsbury's	92	31	6	5.20	3.09	15.60	16.29	14.02
Tesco	114	46	6	5.11	3.05	32.88	29.04	29.53
Discounters								
Aldi	3	28	1	3.86	2.80	4.68	1.83	8.06
Lidl	4	23	1	3.95	2.50	3.09	0.98	5.30
Small retailers								
Other	86	-	6	4.81	-	16.04	21.16	18.59
Panel B: Branded manufacturers								
Dorset	5	-	4	4.50	-	0.67	0.16	0.73
Halo	4	-	5	4.78	-	1.58	3.14	0.20
Kelloggs	60	-	6	5.47	-	34.52	40.57	32.11
Nestle	39	-	6	4.96	-	17.60	21.01	13.65
Jordans	8	-	5	4.20	-	2.50	2.51	2.82
Whitworths	28	-	6	4.53	-	14.36	13.17	15.65

Notes: Based on authors' calculations using Kantar's Worldpanel Take Home Panel, 2002-2021. Numbers describe sample we use to estimate our model and cover 90% of total breakfast cereal spending (see text for details). Columns (1)-(6) are means across years firm was in operation. All firms were in operation over 2002-2021 except Safeway, which ceased operation as an independent firm in 2005. Price is deflated by the all-item CPI and are expressed in 2021 £s.

On average, 76% of annual breakfast cereal spending takes place in the traditional retailers. They typically stock products produced by all six manufacturers of branded products and offer a broad selection of private-label breakfast cereals. The discounters' share of breakfast cereal retailing has grown rapidly since 2002, rising from under 3% to 13%, and mirroring their broader expansion in the grocery sector. Over this time, Aldi and Lidl have increased the number of vertical links they have with manufacturers of branded goods–rising from zero to two for Aldi, and from one to three for Lidl. We aggregate together a set of smaller national retailers, all with relatively small market shares, into a composite "Other" retailer.[9]

[9] These include retailers that focus on convenience store formats (Co-op, Kwik Save, Somerfield), high quality products (Waitrose and Marks & Spencer) and internet only shopping (Ocado). We exclude from our analysis a set of minor outlets, including independent stores, which collectively account for 6% of breakfast cereal spending.

Each branded breakfast cereal product is produced by one of six manufacturers. The largest of these is Kellogg's, followed by Nestle, Whitworths, and three smaller manufacturers, Dorset, Halo and Jordans. The manufacturers all sell their products in several retailers, with the mean annual number ranging from four for Dorset to six for Kellogg's, Nestle and Whitworths. The largest two manufacturers have seen a decline in their market share from 2002 to 2021, in part due to a rise in private-label sales.

In summary, the growing market penetration of the discounters coincided with substantial declines in both retail and manufacturer concentration in the breakfast cereal market; a pattern typical of other fast-moving consumer good product categories. To evaluate how market power and economic surplus have been impacted by the rise of the discounters, we turn to a structural model of demand and supply.

3 A Model of the Breakfast Cereal Market

3.1 Overview

We develop a model of equilibrium pricing in the breakfast cereal market that allows us to recover retail and manufacturer markups and to simulate counterfactual market outcomes absent the rise of discounters. The supply side captures horizontal competition among retailers and among manufacturers, as well as vertical bargaining between retailers and branded-good manufacturers. On the demand side, households choose both a product and a retailer. The timing is as follows: in each quarter-year market t, manufacturers and retailers negotiate wholesale markups, and, simultaneously, retailers set retail prices. On each household-week choice occasion i within market t, the household selects either a product-retailer pair or the outside good.

3.2 Supply

In this subsection, we condition on a given market and suppress the market subscript t. Consumer choice options, indexed $j = [k(j), r(j)]$, represent a combination of product k and retailer r. The manufacturer of product j is $f(j)$. Let $q_j(\boldsymbol{p}, \mathcal{J})$ be the market-level consumer demand (measured in units of weight, kilograms) for option j, given the $|\mathcal{J}| \times 1$ vector of retail prices $\boldsymbol{p}$ and choice set $\mathcal{J}$. Define the retailer and manufacturer additive markups as $\Gamma_j^R = p_j - w_j - c_j^R$ and $\Gamma_j^F = w_j - c_j^F$ respectively, where w_j is the wholesale price and (c_j^R, c_j^F) denote the retailer and manufacturer marginal costs. At retail prices $\boldsymbol{p}$ and manufacturer margins $\boldsymbol{\Gamma}^F$, the profits of retailer r and manufacturer f are

$$\pi_r(\boldsymbol{p}, \boldsymbol{\Gamma}^F) = \sum_{j\in\mathcal{J}_r}(p_j - \Gamma_j^F - c_j)q_j(\boldsymbol{p}, \mathcal{J}), \text{ and} \tag{3.1}$$
$$\pi_f(\boldsymbol{p}, \boldsymbol{\Gamma}^F) = \sum_{j\in\mathcal{J}_f}\Gamma_j^F q_j(\boldsymbol{p}, \mathcal{J}), \tag{3.2}$$

respectively, where $\mathcal{J}_r$ denotes the set of options sold by retailer r, $\mathcal{J}_f$ is the set of options supplied by manufacturer f (i.e., product-retailer pairs for products it produces), and $c_j = c_j^R + c_j^F$ is total marginal cost.

Retailer r sets prices to maximize the profits in equation (3.1) treating manufacturer markups and rival seller prices as given. The first-order conditions for retail prices in vector form are

$$\boldsymbol{\Gamma}^R(\boldsymbol{p}) = \boldsymbol{\Delta}(\boldsymbol{p})^{-1}\boldsymbol{q}(\boldsymbol{p}, \mathcal{J}), \tag{3.3}$$

where $\boldsymbol{\Delta}$ is a $|\mathcal{J}|\times|\mathcal{J}|$ matrix of demand own- and cross-price derivatives multiplied by -1, in which off-diagonals are zero for options not sold by retailer r.

Manufacturer markups are negotiated bilaterally by the retailer-manufacturer pair $n = (r, f) \in \mathcal{N}$, where $\mathcal{N}$ is the set of trading pairs, treating retail prices as given.[10] The disagreement point in negotiation n is that retailer r no longer stocks manufacturer f's products, implying quantity gains from trade for each $j \in \mathcal{J}$ given by $\Delta_n q_j(\boldsymbol{p}, \mathcal{J}) = q_j(\boldsymbol{p}, \mathcal{J}) - q_j(\boldsymbol{p}, \mathcal{J} \setminus \mathcal{J}_n)$ where $\mathcal{J}_n$ is the set of options covered in negotiation n.[11] For retail prices $\boldsymbol{p}$ and manufacturer markups $\boldsymbol{\Gamma}^F$ the pecuniary gains from trade in negotiation n for retailer r and manufacturer f are

$$\Delta_n\pi_r(\boldsymbol{p}, \boldsymbol{\Gamma}^F) = \sum_{j'\in\mathcal{J}_r}(p_{j'} - \Gamma_{j'}^F - c_{j'})\Delta_n q_{j'}(\boldsymbol{p}, \mathcal{J}), \text{ and}$$
$$\Delta_n\pi_f(\boldsymbol{p}, \boldsymbol{\Gamma}^F) = \sum_{n'\in\mathcal{N}_f}\sum_{j'\in\mathcal{J}_{n'}}\Gamma_{j'}^F\Delta_n q_{j'}(\boldsymbol{p}, \mathcal{J}),$$

where $\mathcal{N}_f$ denotes manufacturer f's set of bilateral negotiations. A change in wholesale markups, given retail prices $\boldsymbol{p}$, redistributes but does not change the total gain from trade; consequently, the agents in any bilateral negotiation n have a single objective (splitting the surplus) and need only a single negotiating instrument. We

[10]This simultaneous approach to retail prices and manufacturer markups is used in Draganska et al. (2010), Ho and Lee (2017), Crawford et al. (2018) and Noton and Elberg (2018). An alternative assumption, with greater computational cost, is that wholesale and retail prices are determined sequentially (see Bonnet et al., 2025); to make the sequential model computationally feasible it is necessary to focus on a small number of options. See Lee et al. (2021) for a discussion.

[11]An alternative assumption for the disagreement point is that the retailer no longer stocks product j, while continuing to stock all other products sold by the manufacturer. Since disagreement points are out-of-equilibrium behavior there is no direct evidence for this assumption. However, we note that CC and CMA investigations detail cases where retailers threaten to delist a range of a manufacturer's products wider than just a single product. See also Bonnet et al. (2025) who find their results are robust to alternative disagreement point specifications.

assume they negotiate over the per-unit manufacturer markup Γ_n^F which is common for all $j \in \mathcal{J}_n$.[12] The Nash Bargaining problem is

$$\Gamma_n^F = \underset{\Gamma_n^F \geq 0}{\arg\max} \big[\Delta_n \pi_r(\boldsymbol{p}, \boldsymbol{\Gamma}^F)\big]^{(1-b_n)} \times \big[\Delta_n \pi_f(\boldsymbol{p}, \boldsymbol{\Gamma}^F)\big]^{b_n}, \tag{3.4}$$

where b_n and $(1 - b_n)$ represent the bargaining skills of the manufacturer and retailer respectively. Since the manufacturer's markup transfers surplus between the negotiating parties one-for-one, it follows that $\partial\Delta_n\pi_r/\partial\Gamma_n^F = -\partial\Delta_n\pi_f/\partial\Gamma_n^F$, and the solution to equation (3.4) is

$$\rho_n \textstyle\sum_{j' \in \mathcal{J}_r} (p_{j'} - \Gamma_{n(j')}^F - c_{j'}) \Delta_n q_{j'}(\boldsymbol{p}, \mathcal{J}) = \sum_{n' \in \mathcal{N}_f} \Gamma_{n'}^F \sum_{j' \in \mathcal{J}_{n'}} \Delta_n q_{j'}(\boldsymbol{p}, \mathcal{J}), \tag{3.5}$$

where $\rho_n = b_n/(1-b_n)$ is the manufacturer's relative bargaining skill. This solution balances the two parties' gains from trade, weighted by bargaining skill. It implies that a manufacturer's markups are increasing in its *leverage*: the extent to which the gain from trade is high for the retailer relative to the manufacturer. For private-label products, we set $b_n = 0$, which means for those products retailers set prices optimizing against marginal cost, c_j.

We use the Nash-in-Nash solution concept: in equilibrium the vector $\boldsymbol{\Gamma}^F$ solves the system of Nash bargaining problems defined in equation (3.4) for all $n \in \mathcal{N}$.[13] To express the bargaining problem compactly, let $\boldsymbol{A}(\boldsymbol{p})$ be the $|\mathcal{N}| \times |\mathcal{J}|$ matrix, where the element A_{nj} in row n and column j is the quantity gain for option j if negotiation n is agreed, relative to the disagreement point, and zero otherwise, i.e.,

$$A_{nj}(\boldsymbol{p}) = \begin{cases} \Delta_n q_j(\boldsymbol{p}, \mathcal{J}) & \text{if } j \in \mathcal{J}_{r(n)} \\ 0 & \text{otherwise.} \end{cases}$$

Let $\boldsymbol{B}(\boldsymbol{p})$ denote the $|\mathcal{N}| \times |\mathcal{N}|$ matrix of manufacturer quantity gains from trade, where the element $B_{nn'}$ in row n and column n' is

$$B_{nn'}(\boldsymbol{p}) = \begin{cases} \sum_{j' \in \mathcal{J}_{n'}} \Delta_n q_{j'}(\boldsymbol{p}, \mathcal{J}) & \text{if } f(n) = f(n') \\ 0 & \text{otherwise,} \end{cases}$$

[12] As these are per-unit, the manufacturer's per-pack markups for $j \in \mathcal{J}_n$ are proportional to pack quantity, $(\text{kg})_j$.

[13] We use the standard Nash-in-Nash solution with no explicit outside options in the bargaining problem. While it is possible to incorporate outside options—see, for example, Ho and Lee (2019)—we opt not to do so here. This is because outside options are likely to be of limited relevance in our setting, where the most important retail counterparties—traditional retailers—typically stock products belonging to the full set of major branded manufacturers.

which is the manufacturer's quantity change in negotiation n' if negotiation n is agreed. With these definitions, the system of $|\mathcal{N}|$ Nash bargaining solutions (3.5) is

$$\boldsymbol{\Gamma}^F = \boldsymbol{\rho}\boldsymbol{B}(\boldsymbol{p})^{-1}\boldsymbol{A}(\boldsymbol{p})(\boldsymbol{p} - \boldsymbol{\Gamma}^F - \boldsymbol{c}), \tag{3.6}$$

where $\boldsymbol{\rho}$ is a diagonal matrix of ρ_n terms. Equilibrium retail prices and manufacturer markups are obtained when (i) the $|\mathcal{J}|$ retail pricing first-order conditions in (3.3) and (ii) the $|\mathcal{N}|$ bargaining solutions in (3.6) are mutually consistent.

Retailers may account for cross-category effects (i.e., substitution to non-cereals) when pricing breakfast cereals (Thomassen et al., 2017). In Appendix E, we show that our model accommodates this possibility. In this case, breakfast cereal retail markups are interpreted as the difference between price and the retailer's marginal cost, net of the marginal benefit—arising from increased profits in other categories—of inducing an additional unit of breakfast cereal demand. We return to this point when discussing our counterfactual analysis in Section 6.

Alternative supply models When $\rho_n > 0$, the bargaining model implies double marginalization, and negotiations are not bilaterally efficient. While there is evidence of double marginalization—for example, Luco and Marshall (2020) find support for its presence in the US branded soft drink market, and Noton and Elberg (2018) document that wholesale prices exceed marginal costs in the Chilean branded retail coffee market—vertical contracts can also be designed to avoid it. Therefore, we also present results under two alternative supply models in which prices are bilaterally efficient: retailer pricing and manufacturer pricing.

Under *retailer pricing*, manufacturer margins are zero ($\Gamma_j^F = 0$ for all j), and total margins are determined solely by the retailers' pricing condition (3.3). Retailer pricing is nested within our supply model as the special case when $\rho_n = 0$ for all n. This outcome is consistent with the equilibrium of a two-stage model of negotiated two-part tariffs, in which manufacturers and retailers simultaneously negotiate over wholesale prices w_j and transfer T_j in the first stage, and retailers set retail prices in the second stage. Wholesale prices are set equal to the manufacturer's marginal cost to ensure the resulting retail prices are bilaterally efficient. The transfer T_j then determines how the joint surplus is divided between parties. See Appendix D for a discussion of the theoretical foundations of this efficient bargaining model.

Under *manufacturer pricing*, manufacturers directly set retail prices, so there is no distinction between retail and wholesale prices (i.e., $p_j = w_j$ for all j). Each manufacturer simultaneously sets the price of options it produces to maximize its total variable profits, optimizing against total variable costs, c_j.

3.3 Demand

We now reintroduce market t subscripts. Let i be a household-week, let $h = h(i)$ be the relevant household and let $t = t(i)$ be the (quarter-year) market. Each household-week, the household participates in grocery shopping, and makes a discrete choice among the set of available breakfast cereal options, $\mathcal{J}_t$, and the outside option, $j = 0$, of grocery shopping without buying breakfast cereal.

The utility for household-week i in market t from choosing option $j \in \mathcal{J}_t$, with per pack price, $\tilde{p}_{jt}$,[14] observable option characteristics $\mathbf{x}_j$, and distance dist_{ir} to nearest store of retailer $r = r(j)$, is

$$U_{ij} = \boldsymbol{\beta}_i \mathbf{x}_{jt} - \alpha_i \tilde{p}_{jt} - \tau \ln(\text{dist}_{ir}) + \Delta\xi_{jt} + \epsilon_{ij},$$

where the parameters $(\boldsymbol{\beta}_i, \alpha_i, \tau)$ are the marginal utility of observable characteristics, price and log of distance respectively, $\Delta\xi_{jt}$ is an option-market deviation, and ϵ_{ij} is an idiosyncratic term. The observable characteristics $\mathbf{x}_{jt} = [1, \mathbf{x}_{k(j)}, \mathbf{x}_{r(j)}, \mathbf{x}_t]$ include a constant term, product characteristics $\mathbf{x}_{k(j)}$, namely a vector of indicator variables for the product and the product's cereal base (i.e., which crop they are made from), a vector $\mathbf{x}_{r(j)}$ of retailer indicator variables and a vector $\mathbf{x}_t$ of market indicator variables.

We allow heterogeneous preferences for a subset of the observed (non-price) option characteristics $\mathbf{x}_j$ and the price $\tilde{p}_{jt}$. Let $l \in \mathcal{L} = \mathcal{L}_1 \cup \mathcal{L}_2$ index the characteristics where $\mathcal{L}_1$ and $\mathcal{L}_2$ are respectively the sets of characteristics with and without random coefficients.

The taste coefficient for the lth characteristic, and the price coefficient, are[15]

$$\beta_i^l = \theta_2^l + \begin{cases} \sigma^l \nu_h^l + \sigma^\phi \nu_i^\phi 1_{[l=1]} & \forall l \in \mathcal{L}_1 \\ 0 & \forall l \in \mathcal{L}_2, \text{and} \end{cases}$$

$$\alpha_i = \exp(\bar{\alpha} + \alpha^y y_{ht} + \sigma^\alpha \nu_h^\alpha)$$

respectively, where $(\theta_2^l, \bar{\alpha})$ are common taste effects, $\boldsymbol{\nu}_h = ([\nu_h^l]_{l \in \mathcal{L}_1}, \nu_i^\phi, \nu_h^\alpha)$ are independent draws from a standard normal distribution, $\boldsymbol{\sigma} = ([\sigma^l]_{l \in \mathcal{L}_1}, \sigma^\phi, \sigma^\alpha)$ are scaling terms and y_{ht} is annual equivalized household income.[16] The parameter on the constant term ($l = 1$) has an additional shock at the household-week level which

[14]The pack price $\tilde{p}_{jt} \equiv p_{jt} \times (\text{kg})_j$ where p_{jt} is the price per unit weight as defined in the previous subsection and $(\text{kg})_j$ is the weight of j in kilograms.

[15]Some elements (e.g., dummies for cereal bases) have $\theta_2 = 0$, as they would otherwise be collinear with the product effects.

[16]Equivalized household income is a per-capita measure given by dividing income by the number of adult-equivalent persons in the household.

captures short-run (week-by-week) variation in whether the household wishes to buy breakfast cereal. The price coefficient is log-normal and varies across households, with income, y_{ht}, and a household-specific unobserved effect, ν_h^{α}. Utility comprises market-level mean and heterogeneous components as follows

$$U_{ij} = \delta_{jt} + \mu_{ij} + \epsilon_{ij} \tag{3.7}$$

$$\delta_{jt} = \boldsymbol{\theta}_2 \mathbf{x}_{jt} + \Delta\xi_{jt} \tag{3.8}$$

$$\mu_{ij} = \sigma^{\phi}\nu_i^{\phi} + \textstyle\sum_{l\in\mathcal{L}_1} \sigma^l \nu_h^l x_j^l - \alpha_i p_{jt} - \tau \mathrm{dist}_{ir}. \tag{3.9}$$

The parameters of the model are $\boldsymbol{\theta} = (\boldsymbol{\theta}_1, \boldsymbol{\theta}_2)$ where $\boldsymbol{\theta}_1 = (\sigma^{\phi}, \boldsymbol{\sigma}, \bar{\alpha}, \alpha^y, \tau)$ denotes parameters in the household-week specific term μ_{ij} and $\boldsymbol{\theta}_2$ denotes parameters in mean utility δ_{jt}.

We interpret the utility from the outside good as that of grocery shopping without buying breakfast cereal. The outside good is a composite option encompassing the same set of retailers as the inside options. As is standard, we normalize the mean utility from the outside option so that $U_{i0} = \epsilon_{i0}$, meaning δ_{jt} is interpreted as the mean utility difference between option j and the outside good.

The mean utility δ_{jt} includes non-cereal factors that influence the choice of retailer r for cereal, such as utility derived from other services or product categories co-purchased with cereal at the store. In Section 6, we outline the assumptions under which it is possible to separately identify changes over time to cereal-specific and non-cereal components of mean utility for each retailer.

We assume the idiosyncratic term is distributed Type I Extreme Value. The choice probability of household-week i in market t for option $j \in \mathcal{J}_t$ is

$$s_{ij} = s_j(\boldsymbol{\delta}_t, \boldsymbol{\mu}_i(\boldsymbol{\theta}_1)) = \frac{\exp(\delta_{jt} + \mu_{ij}(\boldsymbol{\theta}_1))}{1 + \sum_{j'\in\mathcal{J}_t} \exp(\delta_{j't} + \mu_{ij'}(\boldsymbol{\theta}_1))}.$$

Integrating over the distribution $F_t(\boldsymbol{\mu}|\boldsymbol{\theta}_1)$ of $\boldsymbol{\mu}$ in market t gives the market share: $s_{jt} = s_j(\boldsymbol{\delta}_t, \boldsymbol{\theta}_1) = \int_{\mu} s_j(\delta_{jt}, \boldsymbol{\mu}) \mathrm{d}F_t(\boldsymbol{\mu}|\boldsymbol{\theta}_1)$. We approximate the integral by simulation, using the household data as described in Section 4.1. To obtain demand q_{jt}, as in Section 3.2, which is in units of weight, we multiply the market share of j by its weight, i.e. $q_{jt} = M \times (\mathrm{kg})_j \times s_{jt}$ where M is the market size in terms of number of consumers.[17]

[17]In practice, since marginal costs are assumed constant in output, M does not affect markups and can be normalized to one.

4 Identification and Estimation

We estimate demand in a first stage, without imposing any supply-side restrictions. In the second stage, we use the estimated demand system to recover the supply-side parameters. We discuss our identification strategy for each stage in turn.

4.1 Demand Parameters

We use a method of moments estimator to obtain the demand parameters. The estimator combines market-level moment conditions with household-level (micro) moment conditions that compare predicted moments to observed counterparts.

Market-level moments We make the standard assumption that product attributes and assortment decisions are determined prior to the realization of the structural demand shocks, but allow for the possibility that prices are correlated with this unobserved component.[18] We use the approach developed by Berry (1994) and Berry et al. (1995). Given a parameter vector $\boldsymbol{\theta} = (\boldsymbol{\theta}_1, \boldsymbol{\theta}_2)$, we solve for the mean utilities $\boldsymbol{\delta}(\boldsymbol{\theta}_1)$ by equating observed market shares, S_{jt}, with model-predicted shares: $S_{jt} = s_j(\boldsymbol{\delta}_t(\boldsymbol{\theta}_1), \boldsymbol{\theta}_1)$ for all (j, t). We then recover the structural errors as $\Delta\xi_{jt}(\boldsymbol{\theta}) = \delta_{jt}(\boldsymbol{\theta}_1) - \boldsymbol{\theta}_2 \boldsymbol{x}_{jt}$. We assume that the unobserved utility component $\Delta\xi_{jt}(\boldsymbol{\theta})$ is mean-independent of a set of instruments $\mathbf{z}_{jt}$, i.e., $\mathbb{E}(\Delta\xi_{jt}(\boldsymbol{\theta})|\mathbf{z}_{jt}) = 0$. This implies an estimator that sets the sample moments $\mathbf{g}_A(\boldsymbol{\theta}) = N_A^{-1} \sum_{jt} \mathbf{z}'_{jt} \Delta\xi_{jt}(\boldsymbol{\theta})$, as close as possible to zero, where N_A is the number of option-market observations. The instrument vector $\mathbf{z}_{jt}$ includes the observed characteristics $\boldsymbol{x}_{jt}$ (used as their own instruments), eight cost-shifter instruments,[19] and a set of BLP-style instruments, constructed from observable characteristics of rival options to capture the intensity of competition (see Berry et al. (1995), Gandhi and Houde (2019), and Appendix F for details).

Micro moments The micro moment conditions are particularly informative about the parameter vector $\boldsymbol{\theta}_1$ which governs taste heterogeneity. For micro moment condition m, and household h, let Y_h^m be the observed moment and let y_h^m be the

[18] Observed breakfast cereal attributes are fixed over time, so the first assumption is automatically satisfied. We assume assortment decisions are made prior to pricing decisions. For recent work that explicitly addresses demand estimation with endogenous product assortment, see Aguirregabiria et al. (2023).

[19] These are the eight input prices in $\mathbf{x^s_{jt}}$ which are given in Table 5.1(c), (i.e., maize price × corn base, through to sugar price).

corresponding model prediction. The population moment conditions are

$$\mathbb{E}(Y_h^m) - \mathbb{E}(y_h^m(\boldsymbol{\theta})) = 0, \quad \forall m$$

where expectations are taken over households. We calculate the micro moment conditions using the consumer dataset. Since this dataset is large, computing the predicted moments using the full sample is computationally infeasible. O'Connell et al. (2025) show that using the full dataset for the observed moments and a subsample for the predicted moments can be significantly more efficient than using a subsample for both. Let N_H denote the full set of households in the dataset and I the full set of household-weeks. We draw a random subset N_H^* of 2000 households and, for each, draw three household-weeks (from different markets), yielding a total of 6000 household-weeks, denoted $I^* \subset I$. Each drawn household-week includes observed demographics (location and equivalized household income) and random taste effects that determine the heterogeneous components of utility $\boldsymbol{\mu}_i$. The sample analogue of the observed moment $\bar{Y}^m$ is an average over the full dataset (N_H), while the predicted moments $\bar{y}(\boldsymbol{\theta})^m$ average over the subsample (N_H^*). Thus, the sample analogue of the m'th micro moment is

$$\mathrm{g}_M^m(\theta) = \underbrace{\frac{1}{|N_H|}\sum_{h \in N_H} Y_h^m}_{\bar{Y}^m} - \underbrace{\frac{1}{|N_H^*|}\sum_{h \in N_H^*} y_h^m(\boldsymbol{\theta})}_{\bar{y}^m(\boldsymbol{\theta})}. \tag{4.1}$$

We use 10 micro moments, grouped into three sets. We summarize them here and provide further details in Appendix F.

The first set of micro moments uses persistence in the characteristics of household choices across choice occasions to identify the spread parameters for random coefficients on product characteristics. Let $\mathbb{x}_{ji} = ([\mathbf{x}_j^l]_{l \in \mathcal{L}_1}, \tilde{p}_{jt(i)})$ denote the option j value of product characteristics, including price, with random coefficients. Let $\mathbb{x}_i^l$ denote characteristic l for the option we observe chosen in household-week i, and let $\mathbb{x}_i^l(\boldsymbol{\theta})$ denote the corresponding value predicted by the model.[20] The observed moment for household h is the centered covariance of the attribute across household-week pairs, i.e.,

$$Y_h^m = \frac{1}{|\mathcal{P}_2(I_h)|} \sum_{(i,i') \in \mathcal{P}_2(I_h)} (\mathbb{x}_i^l - \bar{\mathbb{x}}^l)(\mathbb{x}_{i'}^l - \bar{\mathbb{x}}^l) \tag{4.2}$$

[20]Specifically, $\mathbb{x}_i^l(\boldsymbol{\theta}) = \sum_{j \in \mathcal{J}_{t(i)}} s_{ij}(\boldsymbol{\theta})\mathbb{x}_{ij}^l$.

and the corresponding predicted moment is

$$y_h^m(\boldsymbol{\theta}) = \frac{1}{|\mathcal{P}_2(I_h^*)|} \sum_{(i,i')\in\mathcal{P}_2(I_h^*)} (\mathbb{x}_i^l(\boldsymbol{\theta}) - \bar{\mathbb{x}}^l(\boldsymbol{\theta}))(\mathbb{x}_{i'}^l(\boldsymbol{\theta}) - \bar{\mathbb{x}}^l(\boldsymbol{\theta})), \tag{4.3}$$

where the sets I_h and I_h^* are household h's weeks in the full and subsample respectively, $\mathcal{P}_2(I')$ is the set of (unordered) pairs from the set $I' \in \{I_h, I_h^*\}$, and $\bar{\mathbb{x}}^l$ and $\bar{\mathbb{x}}^l(\boldsymbol{\theta})$ are the observed and predicted product characteristic means across households in N_H and N_H^* respectively (weighting households equally).[21] If Y_h^m is positive this indicates that h's choices exhibit persistently high or low values of the characteristic relative to the choices of the average household. There are four moments, one for each characteristic with persistent taste heterogeneity, i.e., price, inside good, retailer, and cereal base.[22]

The second set of micro moments is based on characteristics that vary over both options and household-weeks, which we denote by $\mathbb{d}_{ij}$. The observed and predicted moments are

$$Y_h^m = \frac{1}{|I_h|} \sum_{i\in I_h} \sum_{j\in\mathcal{J}_{t(i)}} 1_{[i \text{ chooses } j]}\mathbb{d}_{ij}, \qquad y_h^m(\boldsymbol{\theta}) = \frac{1}{|I_h^*|} \sum_{i\in I_h^*} \sum_{j\in\mathcal{J}_{t(i)}} s_{ij}(\boldsymbol{\theta})\mathbb{d}_{ij}. \tag{4.4}$$

There are two moment conditions here: one for the product of option price and household income, and another for distance from the household to the retailer.[23] These are informative about the price-income interaction parameter and the distance parameter.

The third set of micro moments is informative about the variance σ^ϕ governing the household-week-specific shock to the utility of the inside good. A standard strategy for identifying a shock of this form, e.g., the nest-specific effect in a nested logit model, is to use variation in the total number of inside-good options across markets. The intuition is that, holding average product quality fixed, a larger number of inside-good options increases the aggregate utility from the inside good, making consumers more likely to choose it—and the strength of this effect is governed by the variance of the common shock across those options. We adopt a similar strategy using variation in choice set composition across households and markets observed

[21]As all characteristics l are zero for the outside good, I_h in Y_h^m only contains household-weeks where h chooses inside options, and $\bar{\mathbb{x}}^l(\boldsymbol{\theta})$ in y_h^m is computed over inside options only. For a discussion of why we use centered moments, see Appendix F.

[22]In the case of retailers and cereal bases, we constrain the spread parameters σ^l to be identical within each group. We aggregate over retailers and, separately, over cereal bases to generate a single moment for each.

[23]We condition these moments on choice of options for which $\mathbb{d}_{ij}$ is defined—that is, inside options for the price moment, and on inside options excluding those available in the "Other" retailer for the distance moment.

in the microdata. Let $\mathbb{z}_i$ denote a household-week level measure of the choice set for observation i. The moments we use measure the covariance between $\mathbb{z}_i$ and choice of an inside good and are given by

$$Y_h^m = \frac{1}{|I_h|} \sum_{i \in I_h} \mathbb{z}_i 1_{[i \text{ chooses } j>0]} \qquad \text{and} \qquad y_h^m(\boldsymbol{\theta}) = \frac{1}{|I_h^*|} \sum_{i \in I_h^*} \mathbb{z}_i s_{i,j>0}(\boldsymbol{\theta}) \tag{4.5}$$

for observed and predicted moments respectively. $s_{i,j>0}(\boldsymbol{\theta})$ is the model-predicted counterpart of the observed choice indicator $1_{[i \text{ chooses } j>0]}$. We use four measures of the household's choice set: (i) the number of available options within 2 kilometers, (ii) an indicator for whether this count is strictly positive, (iii) the distance to the 50th nearest option and (iv) the distance to the 200th nearest option. Variation in these measures arises from the relative spatial configurations of households and nearby stores. We assume that this variation is orthogonal to unobserved breakfast cereal preferences. This exclusion restriction is natural, as the main demand-side determinant of store locations is overall grocery demand, which is largely determined by population density, rather than by idiosyncratic demand for a specific product category like breakfast cereal.

Estimation We estimate utility parameters by solving $\hat{\boldsymbol{\theta}} = \arg\min_{\boldsymbol{\theta}} \mathbf{g}(\boldsymbol{\theta})'\mathbf{W}\mathbf{g}(\boldsymbol{\theta})$ where $\mathbf{g}(\boldsymbol{\theta}) = [\mathbf{g}_A(\boldsymbol{\theta}), \mathbf{g}_M(\boldsymbol{\theta})]$ is the vector of stacked sample moments: $\mathbf{g}_A(\boldsymbol{\theta})$ denotes the market-level moments and $\mathbf{g}_M(\boldsymbol{\theta}) = [\mathbf{g}_M^m(\boldsymbol{\theta})]_{\forall m}$ represents the micro moments. The weighting matrix W is block diagonal: $\boldsymbol{W} = \text{diag}(\boldsymbol{W}_A, \boldsymbol{W}_M)$. For the market-level moments, $\boldsymbol{W}_A$ is the standard 2SLS weighting matrix. For the micro moments, $\boldsymbol{W}_M$ is a diagonal matrix, with each entry equal to the reciprocal of the square of the predicted component of the corresponding moment. This weighting normalizes the micro moments to a units-free percentage deviation between predicted and observed contributions (see Low and Meghir, 2017). See Appendix G for further details of the estimator and Appendix H for details on how we compute standard errors.

4.2 Supply-Side Parameters

The supply-side parameters consist of the cost and bargaining parameters. To identify these we combine the model's equilibrium pricing conditions, (3.3) and (3.6), to obtain

$$\boldsymbol{\Gamma}_t^F = \boldsymbol{\rho}\boldsymbol{\ell}_t \quad \text{where} \quad \boldsymbol{\ell}_t \equiv \boldsymbol{B}_t^{-1}\boldsymbol{A}_t\boldsymbol{\Gamma}_t^R(\boldsymbol{p}_t). \tag{4.6}$$

The leverage term $\boldsymbol{\ell}_t$ is known given the estimated demand system and observed prices. This term includes retailer margins, $\boldsymbol{\Gamma}_t^R$, which we recover using equation

(3.3). We specify total marginal cost for option j in market t as a linear function

$$c_{jt} = \boldsymbol{\gamma} \boldsymbol{x}^s_{jt} + \omega_{jt}, \tag{4.7}$$

where $\boldsymbol{\gamma}$ are cost parameters, $\boldsymbol{x}^s_{jt}$ is a vector of observed cost shifters, and ω_{jt} is an unobserved cost shock. The cost shift vector $\boldsymbol{x}^s_{jt}$ includes eight cereal input prices, quarter effects, retailer effects, year effects interacted with retailer dummies, year effects interacted with manufacturer dummies, and product effects.

By definition $\Gamma^R_{jt} + \Gamma^F_{g(j)t} = p_{jt} - c_{jt}$, so we can write

$$[p_{jt} - \Gamma^R_{jt}] = \rho_{n(j)} \ell_{n(j)t} + \boldsymbol{\gamma} \boldsymbol{x}^s_{jt} + \omega_{jt}, \tag{4.8}$$

for observation (j, t), where $\ell_{n(j)t}$ is the element from $\boldsymbol{\ell}$, associated with bargaining pair $n(j)$. We allow the coefficient on leverage to vary by retailer size. Additionally, we set this parameter to zero for private-label products, consistent with pricing under a vertically integrated structure. We specify: $\rho_{n(j)} = \chi_j \times (\rho_0 + \rho_1 \chi_n)$, where χ_j is an indicator for whether option j is branded (as opposed to private-label), and χ_n is an indicator for whether bargaining pair n involves one of the three large retailers.

We identify the parameters $(\boldsymbol{\rho}, \boldsymbol{\gamma})$ based on the condition that the cost shock is mean independent of supply-side instruments $\mathbf{z}^s_{jt}$, i.e., $\mathbb{E}[\omega_{jt} | \mathbf{z}^s_{jt}] = 0$, where $\mathbf{z}^s_{jt}$ stacks the vector $\boldsymbol{x}^s_{jt}$ and a vector of instruments for the leverage term $\ell_{n(j)t}$. These instruments are necessary because the leverage term depends on retail markups. For this purpose, we use a set of "portfolio" variables that affect the leverage of the manufacturer relative to the retailer. These include the number of options offered by the manufacturer and, separately, by the retailer, as well as the share of each party's options that fall within the negotiated set.

5 Model Estimates

5.1 Parameters

In Table 5.1(a), we report estimates of the demand parameters. The negative distance coefficient indicates that, all else equal, households prefer geographically closer retailers. We allow for unobserved preference heterogeneity in price sensitivity and tastes for breakfast cereal (i.e., inside options), cereal base, and retailer. For each of these, the spread parameters is large and statistically significant. Note, we do not report mean taste parameters as these are absorbed by the product and retailer effects. Additionally, we allow for a household-time varying shock to preferences for breakfast cereals, which also has substantial spread parameter (σ^{ϕ}).

We estimate these parameters, in part, by targeting a set of micro moments. In Table 5.1(b), we report the fit of these moments, comparing values from the data with model predictions. The panel moments, which capture within-household covariance in choices and primarily inform the preference heterogeneity spread parameter, align closely with the data. Similarly, the demographic moments, based on cross-sectional covariances, match almost exactly. The inside option nest moments, which use local measures of households' choice sets to help identify the household-time varying inside option shock, also fit well. In Appendix I, we show that the model-predicted relationship between the average cumulative probability of a household choosing an option and the travel distance to the nearest store selling that option closely matches the corresponding pattern in the data. In other words, the model successfully recovers the how purchase probabilities vary spatially.

We report supply estimates (based on equation (4.8)) in Table 5.1(c). Column (1) presents results based on OLS, while column (2) reports our main estimates, which use the set of retailer and manufacturer portfolio variables to instrument for leverage. In our main specification, the estimated bargaining parameter—computed from the leverage coefficient as $\hat{b} = \hat{\rho}/(1 + \hat{\rho})$—is 0.5 for smaller retailers and 0.4 for larger retailers. This is consistent with larger retailers having greater relative bargaining skill in negotiations with manufacturers. The instruments are strong predictors of leverage, with an F-statistic of 74.4 for their joint significance in the first-stage. The table also reports coefficients for the set of cost shifters, most of which are positive and statistically significant, as expected.

Table 5.1: *Parameter estimates and model fit*

(a) Demand parameters

	Estimate	Standard error
Price		
Baseline ($\bar{\alpha}$)	1.38	0.25
$\times$ income (α^y)	-0.50	0.35
Spread (σ^α)	0.32	0.10
Inside option		
h spread (σ^1)	9.77	5.40
i spread (σ^ϕ)	8.20	4.14
Option attributes		
Cereal base (σ^2)	1.38	0.02
Retailer (σ^3)	2.82	0.09
Travel distance		
Log distance (τ)	-1.70	0.11
Product effects	Yes	
Retailer effects	Yes	
Market effects	Yes	

(b) Demand model fit: Micro moments

	Data	Model
Panel moments		
Price	0.169	0.168
Inside good	0.036	0.036
Cereal base	0.131	0.131
Retailer	0.370	0.355
Demographic moments		
Price×income	0.759	0.759
Distance	0.918	0.939
Inside option nest moments		
# opt. in 2km	53.7	56.7
1[# opt. in 2km > 0]	0.243	0.254
km to 50^{th} nearest opt.	0.696	0.636
km to 200^{th} nearest opt.	1.32	1.19

(c) Supply parameters

	(1)		(2)	
	Estimate	Standard error	Estimate	Standard error
Bargaining parameter (b)				
Small retailers	0.398	0.022	0.506	0.119
Large retailers	0.367	0.026	0.400	0.201
Leverage (ρ_0)	0.662	0.060	1.026	0.490
Leverage×large retailers (ρ_1)	-0.084	0.055	-0.360	0.094
Maize price×base	0.104	0.014	0.105	0.014
Maize price×base	0.082	0.014	0.082	0.014
Wheat price×base	0.044	0.021	0.046	0.021
Wheat price×base	-0.057	0.013	-0.057	0.013
Rice price×base	0.086	0.023	0.088	0.023
Oats price×base	0.026	0.034	0.028	0.035
Oats price×base	0.003	0.017	0.003	0.017
Sugar price	-0.015	0.008	-0.015	0.009
Product effects	Yes		Yes	
Retailer-year effects	Yes		Yes	
Manufacturer-year effects	Yes		Yes	
Quarter effects	Yes		Yes	
Instruments	No		Yes	
First stage F-stat	-		74.4	

Notes: Panel (a) reports demand parameter estimates. Panel (b) reports the large sample observed moments and corresponding model prediction for the micro moment conditions used for demand estimation. Panel (c) reports the supply parameter estimates. Column (1) are OLS and column (2) IV estimates. The bargaining parameter is obtained from the leverage coefficient according to $b = \rho/(1+\rho)$.

5.2 Elasticities and Markups

We estimate that the sales-weighted average elasticity for breakfast options (i.e., product-retailer choice alternatives) across our sample is -6.76, while the average elasticity at the breakfast cereal category level is -0.38. Our option-level elasticities are larger in magnitude than the brand-level elasticities reported for the US in Nevo (2001) (ranging from -2.3 to -4.3) and Backus et al. (2021) (median of -2.4). This difference reflects our more disaggregate definition of options, which allows the model to capture both within-brand (across pack sizes) and cross-retailer substitution. Conversely, our category-level elasticity is similar to that reported in Backus et al. (2021). In Table 5.2, we report average option-level elasticities for branded and private-label options, separately for traditional retailers and discounters, in 2002, 2011, and 2021. In each group, demand has become less elastic over time, partly reflecting increases in household real incomes.

From equations (3.3), (4.6), and (4.8), we recover retailer and manufacturer price-cost margins, $\mathbf{\Gamma}_t^R$ and $\mathbf{\Gamma}_t^M$, respectively, and thus total vertical marginal costs, defined as $\boldsymbol{c}_t \equiv \boldsymbol{p} - \left(\mathbf{\Gamma}_t^R + \mathbf{\Gamma}_t^M\right)$. Table 5.2 summarizes total vertical marginal costs alongside price-cost margins, Lerner indexes, and the share of total margins accruing to retailers.

Table 5.2: *Average elasticities, cost and markups*

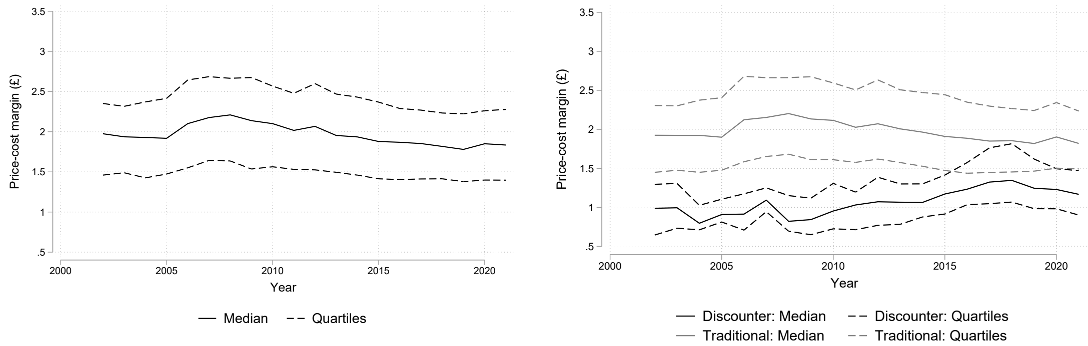
		Traditional retailers		Discounters		All options
		Branded	Private-label	Branded	Private-label	
2002	Own price elasticity	-7.88	-7.03	-7.18	-5.47	-7.59
	Marginal cost c (£/kg)	2.88	2.05	2.73	1.83	2.60
	Total margin $\gamma^R + \gamma^F$ (£/kg)	2.11	1.22	1.36	0.91	1.93
	Lerner index ($\frac{\gamma^R+\gamma^F}{p}$)	0.44	0.39	0.33	0.34	0.43
	Retailer share (%)	71%	100%	59%	100%	77%
2011	Own price elasticity	-7.81	-6.32	-6.54	-5.28	-7.32
	Marginal cost c (£/kg)	3.04	1.71	1.92	1.79	2.66
	Total margin $\gamma^R + \gamma^F$ (£/kg)	2.25	1.37	1.66	0.97	1.99
	Lerner index ($\frac{\gamma^R+\gamma^F}{p}$)	0.44	0.46	0.47	0.36	0.44
	Retailer share (%)	75%	100%	60%	100%	80%
2021	Own price elasticity	-7.12	-4.87	-6.21	-4.10	-6.32
	Marginal cost c (£/kg)	2.64	1.21	1.92	1.08	2.09
	Total margin $\gamma^R + \gamma^F$ (£/kg)	2.05	1.26	1.93	1.08	1.84
	Lerner index ($\frac{\gamma^R+\gamma^F}{p}$)	0.44	0.54	0.50	0.54	0.49
	Retailer share (%)	72%	100%	59%	100%	79%

Notes: Table reports average own-price elasticities, total vertical marginal costs and Lerner indexes in 2002, 2011 and 2021. Retailer share is average share of total margins accruing to retailers. For private-label products this is 100%. Marginal costs and margins are expressed in 2021 £s.

Several notable patterns emerge. First, branded products, on average, have higher costs than private-label products.[24] Second, there is evidence of declining breakfast cereal costs, particularly for private-label products and for branded products sold by discounters, consistent with economies of density associated with their store expansion (see Figure 2.1 and Holmes (2011)). Third, price-cost margins for traditional retailer products rise between 2002 and 2011, then decline between 2011 and 2021. In contrast, margins for discounter products increase steadily over the full period. This translates into rising Lerner indexes for discounters, a trend also observed for traditional retailers' private-label products, but not for their branded offerings. Finally, in the case of branded products, traditional retailers capture approximately 70% of total margins, with manufacturers capturing the remainder 30%. By contrast, discounters captures a smaller share of around 60%.

Figure 5.1: *Markups over time*

(a) Across all retailers (b) By retailer type



Notes: Graph shows 25^{th}, 50^{th} and 75^{th} percentiles of total vertical price-cost margins across all options (panel (a)) and separately across options sold by discounters and traditional retailers (panel (b)). Margins are expressed in 2021 £s.

In Figure 5.1, we summarize the evolution of the markup distribution (measured by total vertical price-cost margins) from 2002 to 2021. Panel (a) shows the interquartile range and median of markups over time. The markups follow a shallow inverted U-shape, peaking in 2008. The gradual decline after 2008 coincides with the main phase of discounter expansion. Panel (b) splits options according to whether they are sold by traditional retailers or discounters. The distribution for the traditional retailers closely mirrors that in panel (a). In contrast, markups for discounter products display a clear upward trend beginning around 2009. In that year, the 25^{th}, 50^{th} and 75^{th} percentiles of the discounter margin distribution (per kilogram) were £0.65, £0.84 and £1.12, respectively—similar to their levels in 2002.

[24]The finding is consistent with CC (2000), which, reports (paragraph 7.206) that "most [retail] companies agreed that higher margins could be obtained from own-label products because of lower costs."

By 2021, these had risen to £0.90, £1.17 and £1.47, reflecting a substantial increase in discounter margins over the period.

Each option's (i.e., retailer-product's) price-cost margin can be decomposed as:

$$p - c = \frac{1}{\varepsilon} + \left(\Gamma^R - \frac{1}{\varepsilon}\right) + \Gamma^M.$$

The first component, $\frac{1}{\varepsilon}$, represents the inverse of the option's own-price semi-elasticity and would equal the margin if all options were priced by single-product firms. $\Gamma^R - \frac{1}{\varepsilon}$ captures the increase in the markup, relative to single product firm pricing, under retailer pricing. This component reflects the strength of retailers' portfolio effects on markups. Finally, Γ^M represents the additional markup accruing to manufacturers due to the market power they exert in negotiations with retailers.

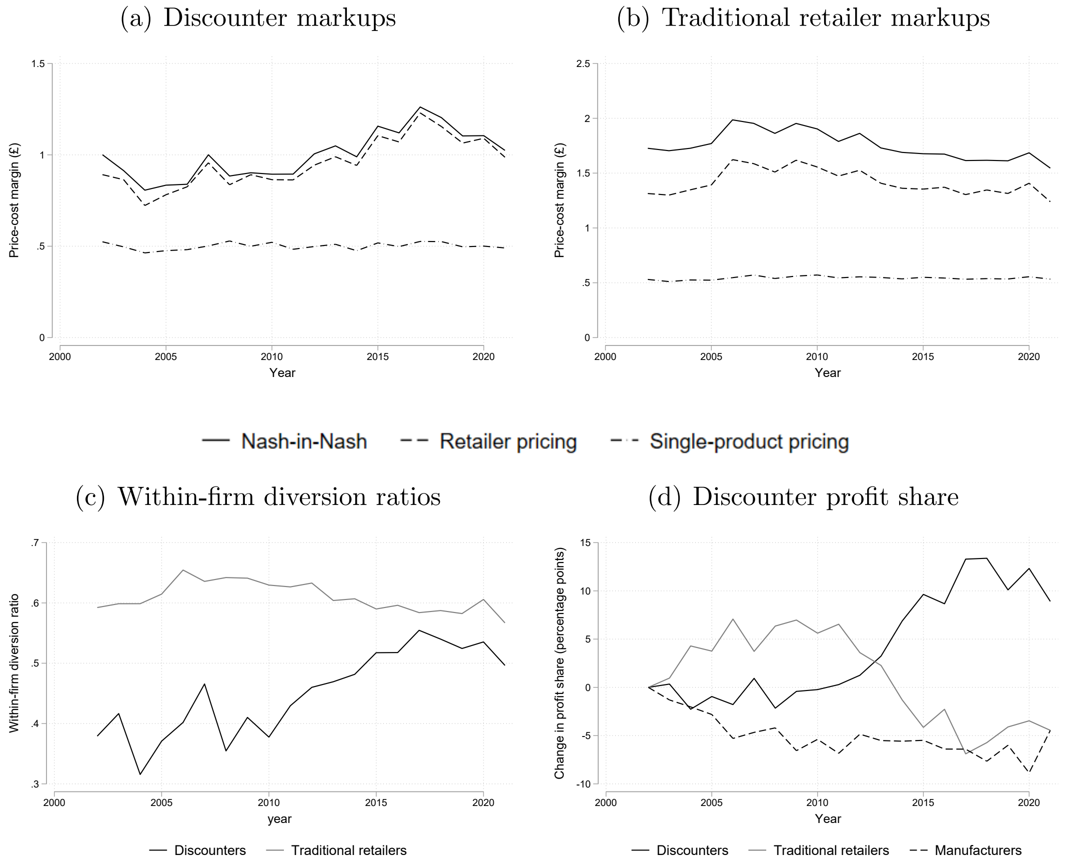
Figure 5.2 presents the decomposition, applied to the sale-weighted average price-cost margin for discounters (panel (a)) and traditional retailers (panel (b)). Total margins exhibit different patterns for the two retailer types over time. Discounter margins grow significantly. Traditional retailer margins, on the other hand, first rise and then fall, where the fall coincides with the rise of the discounters. These changes are driven almost entirely by retailer portfolio effects (i.e., the difference between retailer and single-product firm pricing). Manufacturer market power has little impact on discounter markups, as discounters primarily stock private-label products. In contrast, manufacturers account for a larger portion of the total vertical price-cost margin, for traditional retailers, due to the significant role of branded products in their product offerings.

Panel (c) of Figure 5.2 further illustrates the role of within-retailer portfolio effects, based solely on demand estimates. It reports within-firm diversion ratios over time, separately for options sold in discounters and traditional retailers. Specifically, for each option in a retailer's offering, we compute the share of lost demand resulting from a price increase that is diverted to other options sold by the same retailer. The figure presents a revenue-weighted average across options. This diversion ratio initially rises and then gradually declines for traditional retailers, reflecting increasing competitive pressure from discounters, as consumers at traditional retailers are increasingly likely to divert to discounters. The corresponding diversion ratio for discounters rises significantly over time, reflecting their growing market power.

Panel (d) shows that these trends translate into discounter retailers capturing an increasing share of total breakfast cereal profits at the expense of traditional retailers and branded manufacturers. Prior to 2008, discounters accounted for 3.5% of total profits, with the remainder split between non-discounter retailers (73.5%)

and manufacturers of branded products (23%). By 2017-2021, the discounter share had risen by 12.2 percentage points to 16%, with other retailers' share falling by 8.2 percentage points and manufacturers' share declining by 4 percentage points.

Figure 5.2: *Markup decomposition, within-firm diversion ratios and profits*



Notes: The top two panels show sales-weighted averages of price-cost margins across options under alternative supply models sold by discounters (panel (a)) and traditional retailers (panel (b)). Panel (c) shows revenue-weighted average within-firm diversion-ratios for option sold by discounters and traditional retailers. Panel (d) shows the profit share accruing to discounters, traditional retailers and manufacturers of branded products. Margins are expressed in 2021 £s.

6 Counterfactual Analysis

The goal of the counterfactual analysis is to measure the impact of discounter expansion between 2002 and 2021 on equilibrium outcomes. We do this by restoring the discounters' structural primitives to their 2002 values, simulating market outcomes, and comparing them with the corresponding observed equilibrium outcomes. This approach isolates the effect of the discounters' expansion on market performance and avoids extrapolation beyond the observed range of the data. Let $\mathrm{Y}(\mathcal{S}_t, \mathcal{J}_t, \mathbf{c}_t, \boldsymbol{\delta}_t)$ denote the reduced form mapping from key structural primitives to the endogenous outcome Y_t, where $\mathcal{S}_t$ is the set of active stores, $\mathcal{J}_t$ is the set of available breakfast-cereal product–retailer options, and $\mathbf{c}_t$ and $\boldsymbol{\delta}_t$ are the vectors of marginal costs and mean utilities, respectively. In the counterfactuals, we modify these primitives to isolate the effects of discounter expansion.

6.1 Counterfactual Specification

We consider three counterfactual scenarios to assess the contribution of different factors associated with the rise of the discounters. The first isolates the impact of the expansion in the number of discounter stores, $\mathcal{S}_t$. The second focuses on changes to the in-store offering—captured by the set of available options, marginal costs, and mean utilities $(\mathcal{J}_t, \mathbf{c}_t, \boldsymbol{\delta}_t)$. The third combines both of these changes. In each case, we solve for the resulting equilibrium in wholesale and retail prices. We calculate counterfactuals for each of the quarter-year markets t in the final year (2021).[25]

Store entry counterfactual This counterfactual measures the impact of the expansion in the number of discounter stores, holding the in-store offering as observed in each period. Let $\mathcal{S}_t^D \subset \mathcal{S}_t$ denote the set of discounter stores in period t. In the counterfactual, we fix the set of discounter stores at its initial value $\mathcal{S}_t^D = \mathcal{S}_1^D$, so that the counterfactual set of stores in period t is given by $\mathcal{S}_t' = \mathcal{S}_1^D \cup (\mathcal{S}_t \setminus \mathcal{S}_t^D)$. The change in the endogenous outcome Y_t resulting from this counterfactual (CF1) is:

$$\Delta_{CF1} Y_t = Y(\mathcal{S}_t, \mathcal{J}_t, \mathbf{c}_t, \boldsymbol{\delta}_t) - Y(\mathcal{S}_t', \mathcal{J}_t, \mathbf{c}_t, \boldsymbol{\delta}_t).$$

In this scenario, the distances from consumer i to discounter stores in period t are fixed at their initial values, dist_{ir1}, while distances to all other retailers remain unchanged.

In-store counterfactual This counterfactual measures the impact of changes to the in-store offering at discounter stores since 2002, keeping the set of stores $\mathcal{S}_t$ as observed in each period. We modify three primitives: the set of breakfast cereal options $\mathcal{J}_t$, marginal costs $\mathbf{c}_t$, and mean utilities $\boldsymbol{\delta}_t$. The change in the outcome Y_t in period t from this counterfactual (CF2) is:

$$\Delta_{CF2} Y_t = Y(\mathcal{S}_t, \mathcal{J}_t, \mathbf{c}_t, \boldsymbol{\delta}_t) - Y(\mathcal{S}_t, \mathcal{J}_t', \mathbf{c}_t', \boldsymbol{\delta}_t')$$

[25] We recover counterfactual manufacturer and retailer margins in each market by jointly solving the retailers' first-order conditions (equation (3.3)) and the Nash bargaining solution (equation (3.6)). We provide details of the solution algorithm in Appendix J.

where counterfactual primitives (denoted with primes) are defined as follows.

1. *Product-retailer options.* In the counterfactual, we replace the set $\mathcal{J}_t^D$ of product-retailer options available at discounters in period t with the set $\mathcal{J}_1^D$ available in period $t = 1$.[26] The resulting counterfactual set of options in period t is $\mathcal{J}_t' = \mathcal{J}_1^D \cup (\mathcal{J}_t \setminus \mathcal{J}_t^D)$.

2. *Marginal costs* The marginal cost of option j, where (r, k, f) are retailer, product and manufacturer, in market t, where (y, q) are year and quarter, is

$$c_{jt} = \gamma_w \mathbf{w}_{kt} + \gamma_{\mathrm{q}(t)} + \gamma_r + \gamma_k + \gamma_{ry(t)} + \gamma_{fy(t)} + \omega_{jt}, \tag{6.1}$$

   where $\mathbf{w}_{kt}$ is a vector of input prices, and γ_{ry} and γ_{fy} are retailer-year and manufacturer-year effects, respectively, expressed relative to the base year (2002).[27] In the counterfactual, we assume that, for discounters, retailer-year effects γ_{ry} and manufacturer-year effects γ_{fy} for private-labels, follow the corresponding values for traditional retailers. Formally, for $y > 2002$, we replace these terms with the average across traditional retailers:

$$\begin{aligned} \gamma'_{r(j)y} &= |\mathcal{J}_y^{Tr}|^{-1} \textstyle\sum_{j' \in \mathcal{J}_y^{Tr}} \gamma_{r(j')y} && \text{for all } j \in \mathcal{J}_y^D \\ \gamma'_{f(j)y} &= |\mathcal{J}_y^{(Tr,PL)}|^{-1} \textstyle\sum_{j' \in \mathcal{J}_y^{(Tr,PL)}} \gamma_{f(j')y} && \text{for all } j \in \mathcal{J}_y^{(D,PL)} \end{aligned}$$

   where $\mathcal{J}_y^{Tr}$ and $\mathcal{J}_y^D$ are the sets of options in traditional retailers and discounters, respectively, in year y.[28] The sets $\mathcal{J}_y^{(Tr,PL)}$ and $\mathcal{J}_y^{(D,PL)}$ are the corresponding subsets restricted to private-label options only. Substituting these values into equation (6.1) yields counterfactual costs c'_{jt}.

3. *Mean utility.* The mean utility of option $j = (k, r)$—i.e., product k at retailer r—in market t is the sum of a fixed product effect, a fixed retailer effect, and a time-varying product-retailer effect: $\delta_{jt} = \theta_k + \theta_r + \xi_{jt}$.[29] We further decompose ξ_{jt} as $\xi_{jt} = \xi_{rt} + \Delta\xi^*_{jt}$, where ξ_{rt} is a retailer-market-specific effect and $\Delta\xi^*_{jt}$ is a mean-zero product-retailer deviation. Substituting this

[26]More precisely, for each period t, we use the same quarter in the year 2002—represented as $t = 1$ for notational simplicity. In post-2002 markets, this entails removing products from Aldi and Lidl introduced after 2002 and reinstating the smaller number of products available in the same quarter of 2002 but subsequently discontinued.

[27]Equation (6.1) rewrites equation (4.7) by expanding $\mathbf{x}^s_{jt}$ into its components.

[28]Options in different markets t in the same year are treated as distinct in these sets.

[29]In Section 3.3, equation (3.8), we write $\delta_{jt} = \boldsymbol{\theta}_2 \mathbf{x}_{jt} + \Delta\xi_{jt}$. $\mathbf{x}_{jt}$ comprises product, retailer and market fixed effects, meaning we can rewrite $\delta_{jt} = \theta_k + \theta_r + \theta_t + \Delta\xi_{jt}$. Defining $\xi_{jt} \equiv \theta_t + \Delta\xi_{jt}$ leads the equation in the text.

decomposition, mean utility can be expressed as

$$\delta_{jt} = \theta_k + \theta_r + \xi_{rt} + \Delta\xi^*_{jt}. \tag{6.2}$$

In the counterfactual, we adjust the retailer-time effects for discounters so that they follow the path observed for the traditional retailers, rather than their discounter-specific trajectories. Specifically, for each period t, we replace $\xi_{r(j)t}$ for discounter products with the average across traditional retailers:

$$\xi'_{r(j)t} = |\mathcal{J}^{Tr}_t|^{-1} \textstyle\sum_{j \in \mathcal{J}^{Tr}_t} \xi_{r(j)t} \quad \text{for all } j \in \mathcal{J}^D_t$$

where $\mathcal{J}^{Tr}_t$ is the set of options in traditional retailers in market t. Substituting these values into equation (6.2) yields counterfactual mean utility δ'_{jt}.[30]

Full counterfactual This counterfactual (CF3) combines the changes from both the store entry and in-store-offering counterfactuals, to measure the overall effect of the rise of the discounters. The change in outcome Y_t in period t is given by:

$$\Delta_{CF3}\mathrm{Y}_t = \mathrm{Y}(\mathcal{S}_t, \mathcal{J}_t, \mathbf{c}_t, \boldsymbol{\delta}_t) - \mathrm{Y}(\mathcal{S}'_t, \mathcal{J}'_t, \mathbf{c}'_t, \boldsymbol{\delta}'_t).$$

By comparing the results of this counterfactual with those of CF1 and CF2, we can assess the relative importance of store entry versus changes to the in-store offering in shaping changes to market power and economic surplus.

Discussion We compare the observed 2021 market to a counterfactual in which discounter primitives are set to their 2002 levels. This exercise captures how retailers and manufacturers adjust their pricing in response to the rise of discounters. We hold traditional retailers' product assortments and store networks fixed at their observed 2021 configurations, so the counterfactual does not incorporate potential strategic responses by traditional retailers along those margins.

In practice, however, the scope for such responses is limited. Traditional retailers already offer a wide assortment of breakfast cereals, including a broad set of branded products—which encompasses the smaller branded assortment carried by discounters—and an extensive range of private-label options. Their offerings span the product characteristic space, leaving little room for major assortment increases in response to unwinding discounter expansion.

Regarding store networks, as discussed in Section 2, traditional retailers faced significant constraints on opening new stores due to planning regulations. Moreover,

[30] We also assume that the counterfactual $\Delta\xi^*_{jt}$ and the cost shocks ω_{jt} take the values from the corresponding quarter of the first year, denoted t'. That is, we set $\Delta\xi^*_{jt} = \Delta\xi^*_{jt'}$ and $\omega_{jt} = \omega_{jt'}$.

the expansion of discounter store networks was largely driven by the 2010 prohibition of anti-competitive land practices previously used by traditional retailers. This regulatory change enabled discounters to enter sites near incumbent traditional retailers—locations that were previously inaccessible. Given the regulatory barriers to traditional retailer expansion, and the fact that discounters primarily opened stores in areas already served by traditional retailers, it is unlikely that traditional retailers would have materially altered their geographic footprint in the absence of discounter growth.

6.2 Results

Table 6.1 summarizes the results of the counterfactual analysis by comparing observed and counterfactual equilibrium outcomes in the final year of our sample, 2021.

Primitives Panel (A) reports changes to model primitives across counterfactual scenarios. By 2021, the average household lived 4 km from an Aldi or Lidl store. Under the counterfactual based on the 2002 store network, this distance increases to 11 km. Counterfactual changes to the in-store offering reduce the average number of breakfast cereal options available at discounter stores from 80 to 26. They also lower the average mean utility of these options. This decline holds both when comparing the full set of discounter products available in 2021 to those available in 2002 and therefore included in the counterfactual, and when conditioning on the set "overlapping options"—that is, products available in both years.

The average marginal cost across all discounter options available in 2021 is £1.22/kg, compared to £0.99/kg in the counterfactual. This reflects a compositional shift in discounter product portfolios towards higher-cost products over time. However, conditioning on the overlapping options reverses the pattern: average marginal costs are higher in the counterfactual (£0.77/kg) than in 2021 (£0.64/kg), consistent with discounters achieving efficiency gains over time.

Market equilibrium Panel (B) summarizes the impact of the rise of the discounters on market concentration and the exercise of market power. In 2021, the retail and manufacturer HHIs for breakfast cereals were 1942 and 2073, respectively. Had discounters remained at their 2002 market positions, these figures would have been 2212 and 2309. Thus, the rise of discounters reduced retail and manufacturer HHIs by 270 and 236 points, respectively. The separate store entry and in-store counterfactuals show that the expansion of discounter store networks, and improvements in their in-store offerings, both made important contributions to lowering market concentration.

The impact of the discounters' rise on market concentration is mirrored in equilibrium prices. In 2021, the average price of breakfast cereals was £3.93/kg, and £3.24/kg when sales-weighted. In absence of the discounters' rise, these figures would have been £4.13/kg and £3.40/kg, respectively. Thus, the rise of the discounters reduced average prices. This reduction is a consequence of changes to discounters' marginal costs and product portfolios, and the exercise of market power—by discounters themselves, as well as by competing retailers and breakfast cereal manufacturers.

In 2021, the total vertical price-cost margin for products sold in discounters was £1.22/kg, compared to £0.92/kg had they remained at their 2002 market position. This increase reflects the strengthening of discounters' market position and the associated rise in their ability to exercise market power. The overall effect combines compositional changes in discounters' product portfolios with changes in margins for products available in both the observed and counterfactual equilibria.[31]

To isolate the latter factor, we also report price-cost margins for the set of "overlapping" options—those products available in 2021 and in all three counterfactuals. This comparison shows that the rise of the discounters led to increases in margins for both overlapping branded and private-label products. For branded products, there was an increase in both the retail and manufacturer components of price-cost margins. While the improved market position of discounters enhanced their own market power, manufacturers of branded goods were also able to capture a larger share of the total vertical margin. In fact, the increase in the manufacturer component of the price-cost margin exceeds the increase of the retail component. This reflects the fact that the expansion of discounters' product ranges to include more branded products strengthened the relative bargaining position of manufacturers. Overall, the increase in discounter margins more than offsets the reduction in marginal costs, meaning that the rise of the discounters led to higher prices for breakfast cereals sold in their stores.

Panel (B) also summarizes the impact of the discounters' rise on price-cost margins for product sold in traditional retailers. For both branded and private-label products, the competitive pressure generated by the discounters' strengthening market position led to a reduction in margins. In the case of branded products, the decline in margins is driven entirely by a reduction in the retail component, with

[31] Specifically, the set of discounter products available in the observed equilibrium and CF1 differs from that in CF2 and CF3, meaning comparison between the first two and the latter two scenarios involves different product sets.

manufacturer margins remaining largely unchanged. The intermediate counterfactuals (CF1 and CF2) show that both the expansion of discounter store networks and improvements in their in-store offerings contributed to the erosion of traditional retailers' market power.

Market surplus Panel (C) summarizes the impact of the discounters' rise on market surplus, by reporting changes in consumer, producer, and total surplus under each counterfactual scenario, relative to the 2021 observed equilibrium. The expansion of the discounters increased consumer surplus in the breakfast cereal market by £95.7 million—equivalent to 6.6% of total breakfast cereal spending in 2021. The intermediate counterfactuals show that consumers benefited from both expansion of discounter store networks and improvement in their in-store offerings.

Discounters' profits in 2021 were £63.4 million higher than they would have been had their market position remained at 2002 levels, equivalent to 67.9% of their profits in 2021. These profit gains are more than offset by declines in profits from traditional retailers and manufacturers, equivalent to 19.2% and 10.6% of their respective profits in 2021. Nonetheless, the combined surplus gains to consumer and discounters exceed the losses to traditional retailers and manufacturers. In other words, the rise of the discounters generated a net increase in total market surplus of £52.6 million (3.6% of total breakfast cereal spending in 2021), with both store network expansion and in-store improvements contributing to this gain.

Table 6.1: *Counterfactual analysis*

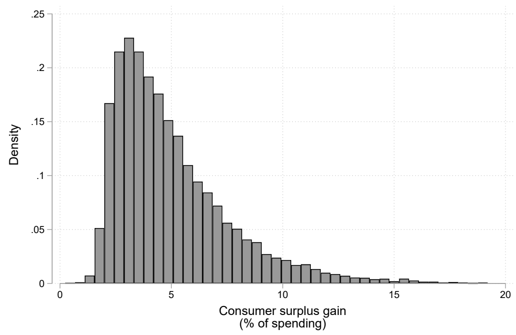
	Observed equilibrium	Counterfactual equilibrium: Store (CF1)	In-store (CF2)	Full (CF3)
A) Discounter primitives				
Distance (km)	3.99	10.99	-	10.99
Portfolio size	80	-	26	26
Mean utility (δ)				
All options	-2.28	-	-2.99	-2.99
Overlapping options	-2.27	-	-2.73	-2.73
Marginal cost (£/kg)				
All options	1.22	-	0.99	0.99
Overlapping options	0.64	-	0.77	0.77
B) Market equilibrium				
Concentration (HHI)				
Retail	1942	2100	2101	2212
Manufacturer	2073	2218	2221	2309
Average market price (£/kg)				
Unweighted	3.93	3.97	4.09	4.13
Sales-weighted	3.24	3.41	3.20	3.40
Discounter margins (£/kg)				
All options	1.22	1.14	0.99	0.92
Overlapping options				
Branded				
Retail component	0.58	0.49	0.54	0.47
Manufacturer component	0.78	0.68	0.58	0.47
Private-label	1.03	0.98	0.93	0.89
Traditional retailer margins (£/kg)				
Branded				
Retail component	1.51	1.57	1.55	1.59
Manufacturer component	0.62	0.62	0.62	0.63
Private-label	1.26	1.32	1.29	1.34
C) Δ annual market surplus (£m)				
Consumer surplus	-	-63.3	-51.4	-95.7
% of spending		*(-4.38%)*	*(-3.55%)*	*(-6.63%)*
Producer surplus				
Traditional retailers	-	58.8	44.4	90.4
% change		*(12.51%)*	*(9.46%)*	*(19.23%)*
Discounters	-	-40.7	-36.7	-63.4
% change		*(-43.63%)*	*(-39.35%)*	*(-67.93%)*
Manufacturers	-	11.5	7.2	16.1
% change		*(7.56%)*	*(4.75%)*	*(10.64%)*
Total surplus	-	-33.8	-36.4	-52.6
% of spending		*(-2.34%)*	*(-2.52%)*	*(-3.64%)*

Notes: Table compares average outcomes in the 2021 observed and counterfactual equilibrium. Panel (A) summarizes the change to market primitives in each counterfactual scenario. Panels (B) and (C) summarize the change in endogenous market outcomes. Marginal costs, prices, margins and surplus are expressed in 2021 £s.

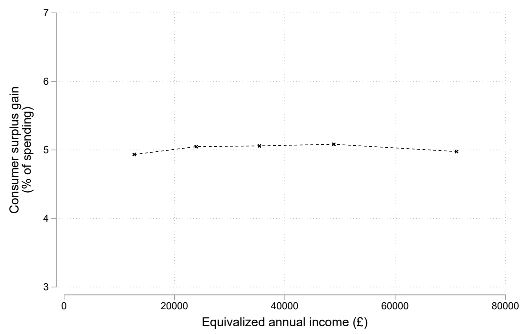
Distributional effects In Figure 6.1, we illustrate how the consumer surplus gains from the rise of the discounters are distributed across households. We report the difference in consumer surplus between the observed and full counterfactual (CF3) equilibria in 2021, expressed as a fraction of household-level breakfast cereal spending. Panel (a) shows the distribution of household-level gains. There is substantial heterogeneity: the interquartile range spans 3% to 6%, and the 95th percentile household experiences a gain of around 10%. Panel (b) shows that, on average, gains do not vary systematically with equivalized household income, suggesting that the surplus benefits were broadly shared across the income distribution.

Figure 6.1: *Distributional impact*

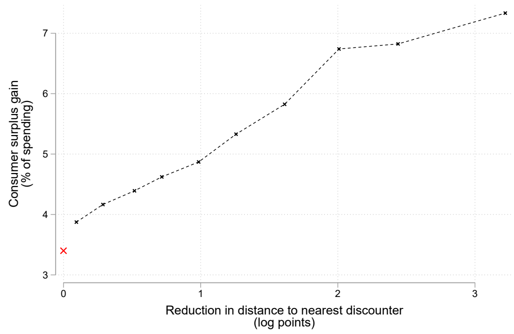
(a) Distribution across households



(b) Impact by income quintiles



(c) Impact by travel distance reduction



Notes: Figures show the difference in consumer surplus, expressed as a fraction of total expenditure, between the observed and full counterfactual equilibria for the year 2021. Panel (a) reports the distribution of consumer changes across households. Panel (b) shows the average change for each household income quintile. Panel (c) presents the average change by the reduction in travel distance to the nearest discounter store.

Panel (c) relates consumer gains to changes in proximity to discounter stores. Some households did not experience a reduction in travel distance to the nearest discounter. These households—indicated by the red cross—saw average gains of around 3.5%, reflecting both benefits from in-store improvements in discounters and indirect benefits from discounters placing competitive pressure on traditional retailers. The black crosses plot average gains by the size of the reduction in travel distance. Households that experienced the largest drop in distance to the nearest discounter enjoyed the largest surplus gains, highlighting the importance of the geographical pattern of store expansion in delivering consumer benefits.

Cross-category effects Consumers often purchase multiple product categories during a store visit (see Smith and Thomassen, 2012). Our demand and supply model allows for this possibility.

In the utility specification, we include a time-varying component ξ_{rt}, which decomposes into a cereal-specific term ξ^*_{rt} and a non-cereal term ψ_{rt}, so that $\xi_{rt} = \xi^*_{rt} + \psi_{rt}$. The cereal-specific term captures factors intrinsic to breakfast cereal products, while the non-cereal term reflects changes in other categories typically purchased alongside cereals, as well as general improvements in the shopping experience. For example, if consumers increasingly buy cereals from discounters due to enhancements in non-cereal offerings—beyond what can be explained by changes in cereal assortment, product attributes, or travel distance—this shift would be reflected in a rising ψ_{rt}.

In Appendix K, we show how ξ^*_{rt} and ψ_{rt} can be separately identified using an auxiliary moment condition: for each retailer r, we assume that, for continuing options (cereal products sold by r in consecutive periods), the change in the cereal-specific component of mean utility over time has mean zero. Since the characteristics of continuing products are unchanged, any shift in their mean utility must stem from changes in ψ_{rt}. This moment condition is similar to those in Pakes et al. (1993) and Grieco et al. (2024), which recover the evolution of the mean utility of the outside option over time.[32] We use this decomposition below when discussing the aggregate implications of the discounters' rise.

On the supply side (see Section 3.2), we model retailers as setting cereal prices to maximize category-level profits. However, retailers may also incorporate cross-category effects into pricing decisions (see Thomassen et al., 2017). In this case, the retailer's first-order condition contains an additional term capturing the marginal profit from other categories generated by an extra unit of cereal demand. This term is retailer-time specific and enters additively with marginal costs, yielding an "effective marginal cost" that embeds the cross-category externality.

[32] Pakes et al. (1993) and Grieco et al. (2024) assume that changes in the mean unobserved component of all inside options reflects changes in outside option's quality. By contrast, we apply a retailer-specific moment condition to identify retailer-specific effects driven by non-breakfast-cereal factors. In our setting, identifying the mean utility of the outside option is unnecessary, as the counterfactual analysis focuses on within-period changes in consumer surplus in the breakfast cereal market due to the rise of discounters, rather than changes over time.

Our specification allows marginal costs c_{jt} to include retailer-year effects, making it consistent with cross-category effects that vary over time. Under this interpretation, markups equal price minus effective marginal cost (see Appendix E for a formal derivation). In our counterfactual, we return discounter marginal costs to their 2002 levels, effectively restoring cross-category pricing effects to their initial strength. Consequently, under this interpretation, our consumer welfare estimates of the rise of discounters also incorporate changes in cross-category pricing over time.

Aggregate implications The descriptive analysis in Section 2 shows that the decline in retail and manufacturer concentration in breakfast cereals since 2012 mirrors broader trends across fast-moving consumer good categories. Our structural analysis demonstrates that the fall in breakfast cereal concentration is a consequence of the rise of the discounters. This suggests that the consumer surplus gains we estimate for breakfast cereals are likely indicative of similar gains across other categories.

To provide a sense of the aggregate gains across all product categories from the rise of the discounters, we perform a back-of-the-envelope calculation that grosses up our estimate of breakfast cereal consumer surplus effects to the full range of categories sold by discounters. Specifically, we first decompose the estimated consumer surplus gain—measured as the difference between the observed 2021 equilibrium and the full counterfactual (CF3)—into three components: (i) gains from reduced travel costs due to discounter store expansion, (ii) gains arising from changes in cereal-specific factors, including changes in product availability, prices, and mean utilities, and (iii) gains arising from changes to non-cereal utility effects.[33] The split between these components is 13.4%, 82.7%, and 3.9%, respectively.

To approximate the total impact of the discounters' rise on consumer surplus, we scale up the breakfast cereal component of our estimate using the reciprocal breakfast cereals' share of total fast-moving consumer good spending, which is 1.3%. Similarly, we scale up the travel cost component by the reciprocal of the share of weekly shopping trips in which breakfast cereals are purchased, which is 31.3%. Applying these adjustments implies that the rise of the discounters led to a total consumer surplus gain in 2021 of approximately £6.3 billion.

[33]The total change in consumer surplus between the observed and counterfactual equilibrium equals the sum of these three components. To isolate each, we compute the expected utility changes attributable to travel costs and time-varying non-cereal utility effects. The remaining portion of consumer surplus reflects breakfast cereal-specific changes. See Appendix L for full details.

While the back-of-the-envelope nature of this calculation introduces uncertainty around the precise magnitude, this exercise underscore that the rise of the discounters have delivered substantial benefits to consumers.

Sensitivity to supply model. In Appendix M, we report results for two alternative supply models, retailer- and manufacturer-pricing, discussed in Section 3.2. The main welfare findings from the counterfactual are preserved: the rise of discounters led to substantial increases in total surplus and consumer surplus. Consumer gains under retailer pricing are very similar to those under our baseline Nash-in-Nash model: in the absence of discounters' rise, consumer surplus—relative to total breakfast cereal spending in 2021—would have been 6.8% lower under retailer pricing, compared to 6.6% under our baseline (see Table 6.1). Under manufacturer pricing, predicted consumer gains are somewhat smaller, at 4.3%.

In all cases, gains are largest for households that experienced the biggest reductions in travel distance to the nearest discounter. For example, across all supply models, households in the top decile of distance reductions (averaging 25 km) gained roughly 4 percentage points more than those whose travel distance to a discounter did not change (see Figure 6.1(c) and corresponding figures in Appendix M).

7 Conclusion

The rise of the discounter format has been a common feature of grocery retailing across many countries in recent decades, with potentially significant implications for market structure and performance. Using rich microdata from the UK, we document that discounter expansion coincided with substantial declines in retail and manufacturing concentration across most narrowly defined product categories. Focusing on the breakfast cereal market, we estimate a structural model of consumer demand and vertical relationships and find that discounter growth led to lower prices, reduced concentration, and increases in both consumer and total surplus. These effects arise directly from an increase in the number of stores, efficiency gains, and changes in product offerings, and indirectly from heightened competitive pressure on traditional retailers and branded manufacturers. While discounters increased their own market power over time, the net effect of their expansion was pro-competitive. Our findings highlight the importance of retail format innovation in shaping market outcomes and underscore the value of analyzing narrowly defined product markets to understand broader trends in concentration and market power.

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Appendix: For online publication

The Rise of Discounters and its Impact on Concentration, Market Power and Welfare

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A Store Locations

There is not a single data source for store locations that covers the entire period of study. We combine data from three sources to construct a dataset of store locations for each retailer in each year. The first data source is the Institute of Grocery Distribution (IGD) store dataset, which gives the locations of stores for each retailer in the years 2002-2006. The second data source is the Geolytix Retail Points dataset, which gives the same information for the years 2014-2019. This leaves the period 2007-2013. For this period we use data from Glenigan. Glenigan is a company that records new building projects including new supermarkets and gives the date of completion and the identity of the retailer. The data from Glenigan gives the supermarket outlets that were completed in the period 2007-2013 including their location by post code. We matched these to the Geolytix stores using the location data. The store locations for 2007-2013 are given by working back from the set of stores for 2014 from Geolitix and eliminating the stores that were completed each year. This method is based on store openings but gives an accurate count of open stores because the number of store closures is few. As an external validation exercise we compared the data to information from company annual reports and found that this method closely matched the total number of stores operated by each retailer in each year. To calculate the distance from each consumer to each retailer we draw at random a residential postcode, and its exact grid reference, from the consumer's Postal Sector, and calculate the distance to the nearest store of each retailer.

B Planning Policy and Controlled Land

Competition Commission's store and retailer classifications Two market inquiries by the Competition Commission (CC)—CC, 2000, 2008—considered the issue of planning and controlled land from a competition perspective. To define terms note that CC (2008) classified *mid-sized* and and *larger* stores as those with a sales areas of 280-1400 and greater than 1400 square meters respectively (paragraph 4.63). It classified grocery retailers into *discounters* and *large grocery retailers* (paragraphs 3.3-3.7). In this paper we refer to the latter as traditional retailers. It found that nearly all of the larger grocery stores are operated by traditional retailers and that discounters exclusively used mid-sized stores.

Restrictive planning policy in the 2000s Before the mid 1990s, planning policy had been relatively liberal, and had resulted in traditional retailers opening a proliferation of larger stores (CC 2000, paragraph 2.165). In the mid 1990s, however, the government changed planning policy by adding two tests, which made it harder to open larger stores, which thus impacted mostly on traditional retailers. The first was the *sequential* test which required authorities to favor town center and retail park developments (which tend to be mid-sized) relative to out-of-town developments (which tend to be larger stores). The second was the *need* test, which required there to be a need for another store in the area (in terms of total food retail sales are per capita in the local area). As larger stores were the preferred format of the traditional retailers, these changes to planning policy greatly inhibited their expansion. This was not, however the case for discounters, because they exclusively used mid-sized stores which were less adversely affected by these tests. These changes constituted a barrier to entry which "had a major impact on store development plans" (CC 2008, paragraph 2.168), "locked in" (CC 2008, paragraph 2.175) the market structure for traditional retailers, and "made entry into and expansion within multiple grocery retailing more difficult for parties wanting to acquire large sites in out of town locations" (CC 2008, paragraph 2.202). Discounters were less seriously affected by these policies (CC 2008, paragraph 2.205). For example, Aldi claimed that because its stores were smaller and not out-of-town (e.g., could be accommodated in town centers, retail parks, and edge of town) they were not inhibited by them (CC 2008, paragraph 5.150). The CC concluded that the planning system after these changes "constrains new entry by larger grocery stores" but that "these constraints are less significant for mid-sized grocery stores" given that "for these stores suitable locations that are not subject to planning restrictions are more easily found" (CC 2008, paragraph 7.44).

Proposed changes to planning policy The CC made proposals to reform the working of the sequential and need tests in the planning system. These were not taken up by the government. As the planning regime therefore did not change, traditional retailers continued to be constrained throughout the period 2002-2021.

Anti-competitive controlled land The CC also investigated a set of anti-competitive practices called *controlled land* that prevent land from being used by rival grocery firms. These include restrictive covenants on land sales, making exclusivity arrangements when joining a mall or retail park, and the leasing or subleasing of land sites to third parties not involved in grocery sales. These practices are particularly problematic when combined with restrictive planning regime. The combination of a restrictive planning system and controlled landsides frustrates new entry that would strengthen competition (see paragraph 7.121). Controlled land sites restricted the opening both of mid-sized and larger stores.

The Controlled Land Order CC (2008) made proposals to address controlled land which resulted in the Controlled Land Order 2010. The aim of the Order was to limit large grocery retailers' ability to use land site control to prevent land from being used by competing grocers. It designated a list of retailers to be restricted by the Order; this list included the traditional retailers but not the discounters. The Order bans restrictive covenants and exclusivity clauses in land deals, which prohibited rivals from opening stores. Traditional retailers were required to release existing restrictive covenants and were prohibited from entering new ones. After the Order, discounters could enter into sites which previously landlords would not have let to them. Not restricted by the Order, discounters now have the advantage, relative to traditional retailers, that they can use land control to prevent competitors from establishing near their stores.

C Cereal Input Prices: Data Description

We use three data sources for crop prices:

1. *UK Agricultural Price Index (API)*. Price index of agricultural outputs in GBP, 2015=100.
2. *EU official import prices*. Price index of EU imports in Euro per 100kg.
3. *UN Food and Agriculture Organization (FAO) market data*. International export prices in USD per tonne.

We use these data sources to construct the eight cost variables in Table 5.1(c). The first seven of these consist of a crop input price interacted with a cereal base dummy, for each of the seven cereal bases. The eighth is a sugar price index interacted with a dummy which takes the value 1 for some of the cereal bases. There are multiple candidate crop input prices to interact with each cereal base, e.g., for the cereal base corn there are different types of maize product, etc. To select a series for each cereal base we run a regression of retail prices on alternative input prices for each of seven cereal bases and select the input price with the highest statistical significance. This results in the following input price for each cereal base:

1. Corn: UN FAO market data, USA (Gulf), maize (US no. 2, yellow).
2. Wheat: EU Import prices, common wheat.
3. Rice: UN FAO market data, Pakistan, Rice (25
4. Oats: UK API, oats.
5. Bran: as wheat.
6. Multi: EU Import price, maize.
7. Granola: UK API, oats.

The eighth cost variable is a sugar price index. We use the following sugar price series: UN FAO market data, ICE futures USA sugar. We find this is significant only for cereal bases 1, 3, 5, 6 and 7 so we interact it with a single dummy which indicates whether the cereal is from one of these bases.

We convert all series in Euros or US dollars to GBP using the exchange rate where they are in another currency. Since input prices are monthly, we average to the quarterly level. We also normalize by dividing all series by its price in market 1 (year 2001, quarter 1). So, input prices in the first period are all equal to 1.

D Efficient Bargaining Case

In this appendix, we explain that our supply model nests, as a special case, a specification consistent with a two-stage model of negotiated two-part tariffs. This occurs when $b = 0$ for all retailers. In this setup, manufacturers and retailers bilaterally and simultaneously negotiate, in the first stage, over a wholesale price and transfer (w_j, T_j) for each product-retailer combination j. The wholesale price w_j is set to the manufacturer's marginal cost, ensuring that prices are bilaterally efficient, while the transfer T_j allocates the joint surplus between parties.

Firms payoffs are given by profits net of transfer payments $\Pi_r = \pi_r - \sum_{j \in J_r} T_j$ and $\Pi_f = \pi_f + \sum_{j \in J_f} T_j$. At the time of negotiation, the terms are private to the negotiating pair. In the second stage, wholesale prices are revealed, and retailers simultaneously set prices.

Let $\pi_f(\boldsymbol{w}, J)$ and $\pi_r(\boldsymbol{w}, J)$ denote the payoffs to manufacturer f and retailer r at Nash equilibrium retail prices, before accounting for transfers.[34] Negotiations are bilateral and take place between individual manufacturer-retailer pairs. Let $\boldsymbol{w}_a$ denote the vector of wholesale prices negotiated by a specific pair $g = (f, r)$ and let $\boldsymbol{w}_{-g}$ represent the vector of wholesale prices for all other pairs. The vector $\boldsymbol{w}_a$ is said to be *bilaterally efficient* (or *pairwise stable*) if it maximizes the joint surplus of the negotiating pair, taking all other wholesale prices as given:[35]

$$\boldsymbol{w}_a = \arg\max_{\boldsymbol{w}'_a} \pi_f(\boldsymbol{w}'_a, \boldsymbol{w}_{-g}, J) + \pi_r(\boldsymbol{w}'_a, \boldsymbol{w}_{-g}, J). \tag{D.1}$$

Bilateral efficiency implies wholesale prices are set to the manufacturer's marginal costs. This eliminates vertical externalities within each negotiating pair, ensuring that the joint surplus is maximized between the manufacturer and retailer. However, externalities remain between different negotiating pairs, which means that the outcome is not efficient for the vertical structure as a whole.

[34] Unlike our main model, this two-part tariff framework assumes sequential price setting: manufacturers anticipate how changes in wholesale prices will affect downstream retail prices, resulting in a (subgame-perfect) Stackelberg equilibrium.

[35] Rey and Verge (2016) show that wholesale prices satisfying pairwise stability may not survive *multilateral* deviations—i.e., coordinated renegotiation across multiple retailer–manufacturer pairs—under certain patterns of own- and cross-price elasticities. To address this concern, one can either (i) verify that profitable multilateral deviations do not exist under the estimated model, or (ii) adopt a delegated-agent framework in which each manufacturer negotiates independently with different retailers through agents who do not coordinate, preventing such multilateral deviations from arising.

The total markups implied when condition (D.1) holds for *all* manufacturer-retailer pairs corresponds to an equilibrium in the bargaining framework of de Fontenay and Gans (2003) and the Nash-in-Nash approach in Horn and Wolinsky (1988), both applied to negotiations over two-part tariffs. While these models feature different transfer prices and assume sequential rather than simultaneous price setting, they yield the same wholesale and retail prices as implied by our model when $b = 0$. In this case, total markups coincide with those from a Bertrand-Nash equilibrium, where retailers optimize against total marginal cost—see conditions (3.3). A key assumption driving this equivalence is the that each negotiating pair takes as given the contracts agreed by all other pairs.[36]

E Cross-Category Effects

Let q_{ort} be the aggregate quantity of other categories sold at retailer r and let $\Gamma_{ort} = (p_{ort} - c_{ort})$ be the retailer's markup. We discuss this using the baseline bargaining model, which nests the retailer pricing model. In the manufacturer pricing model we assume the manufacturer does not sell products in other categories so that cross-category effects are not relevant.

Bargaining model The objective function of retailer r in period t in the bargaining model is

$$\Pi_{rt} = \textstyle\sum_{j' \in \mathcal{J}_{rt}} q_{j't}(p_{j't} - \Gamma^F_{j't} - c_{j't}) + \chi q_{ort}\Gamma_{ort}$$

where $\chi \in \{0, 1\}$ indicates whether the retailer internalizes cross-category effects. The first-order condition with respect to price p_{jt} is given by

$$\frac{\partial \Pi_{rt}}{\partial p_{jt}} = q_{jt} + \textstyle\sum_{j' \in \mathcal{J}_{rt}} \frac{\partial q_{j't}}{\partial p_{jt}}(p_{j't} - \Gamma^F_{j't} - c_{j't}) + \chi \frac{\partial q_{ort}}{\partial p_{jt}}\Gamma_{ort} = 0.$$

Dividing by the derivative of demand for product j with respect to its price, this can be rewritten:

$$\underbrace{p_{jt} + \frac{q_{jt}}{\frac{\partial q_{jt}}{\partial q_{jt}}}}_{\text{marginal revenue, } j} + \underbrace{\sum_{j' \in \mathcal{J}_{rt} \setminus \{j\}} \frac{\frac{\partial q_{j't}}{\partial q_{jt}}}{\frac{\partial q_{jt}}{\partial p_{jt}}}(p_{j't} - \Gamma^F_{j't} - c_{j't})}_{\text{marginal profit, other cereals at } r} = \underbrace{c_{jt} + \Gamma^F_{jt}}_{\substack{\text{perceived} \\ \text{marginal cost, } j}} - \underbrace{\chi \frac{\frac{\partial q_{ort}}{\partial p_{jt}}}{\frac{\partial q_{jt}}{\partial p_{jt}}}\Gamma_{ort}}_{\substack{\text{marginal} \\ \text{externality } (e_{jt})}}.$$

The first term on the right-hand side is the retailer's perceived marginal cost: it includes the retailer component of marginal cost c^R_j and the wholesale price. The

[36] This assumption, often referred to as "passive beliefs" and adopted by de Fontenay and Gans (2003), implies that if an agent receives a non-equilibrium offer, the terms of other contracts remain unchanged—i.e., deviations are unilateral. Horn and Wolinsky (1988) use a related equilibrium concept that each contract is optimal, taking all others as given. Although de Fontenay and Gans (2003) focus on quantity-forcing two-part tariffs, the result generalizes to two-part tariffs with marginal wholesale prices and fixed transfers, as in our model. See Lee et al. (2021) for a discussion.

second term on the right-hand side is the product of a diversion ratio and markup. The diversion ratio is the marginal change in quantity q_{or} of other categories purchased from retailer r to the marginal change in cereal quantity q_{kr} following a price increase. Its sign is theoretically ambiguous: it is negative when cereals and other categories are substitutes and positive when they are complements. Complementarity may arise due to shopping costs, for example, if some of those who stop purchasing a unit of j at retailer r also switch to alternative retailers for other categories (see Thomassen et al. 2017). The size of this effect may vary over time as the quantity of other goods q_{or} purchased jointly with cereals changes.

To capture these cross-category effects in retailer incentives, we define *effective marginal costs* as:

$$\bar{c}_{jt} = c_{jt} - \chi e_{jt}.$$

This reflects the retailer's marginal opportunity cost of supplying an additional unit of breakfast cereal j, accounting for potential gains (or losses) in other categories.

Retailer adjusted markups are then $\tilde{\boldsymbol{\Gamma}}_t^R = \boldsymbol{p}_t - \boldsymbol{\Gamma}_t^F - \tilde{\boldsymbol{c}}_t$. In matrix form this becomes

$$\bar{\boldsymbol{c}}_t + \boldsymbol{\Gamma}_t^F = \boldsymbol{p}_t - \boldsymbol{\Delta}_t(\boldsymbol{p}_t)\boldsymbol{q}_t.$$

Under the bargaining model, we have $\boldsymbol{\Gamma}_t^F = \rho_{n(j)}\tilde{\ell}_{jt}$ where $\tilde{\ell}_{jt}$ is defined in equation (4.6), except that the gains from trade to the retailers use adjusted markups $\tilde{\boldsymbol{\Gamma}}_t^R = \boldsymbol{p}_t - \boldsymbol{\Gamma}_t^F - \tilde{\boldsymbol{c}}_t$ and therefore account for cross-category externalities of stocking a product. With estimates of $\boldsymbol{\Delta}_t(\boldsymbol{p}_t)$ from first-stage demand estimation, the second-stage regression is:

$$[p_{jt} - \tilde{\Gamma}_{jt}^R] = \rho_{n(j)}\tilde{\ell}_{jt} + \underbrace{\boldsymbol{\gamma}\boldsymbol{x}_{jt}^s + \omega_{jt}}_{\tilde{c}_{jt}}$$

While this specification identifies the effective marginal cost $\tilde{c}_{jt}$, separate identification of c_{jt} and e_{jt} requires further assumptions beyond the scope of the paper.

Retailer pricing The retailer pricing model is nested in the bargaining model for the case where $\rho_n = 0$ for all n, which implies $\boldsymbol{\Gamma}_t^F = 0$. Therefore it is given by the derivation for the bargaining model setting $\rho_n = 0$ and $\boldsymbol{\Gamma}_t^F = 0$ throughout.

Counterfactuals The in-store counterfactual, and the overall counterfactual, restores adjusted marginal costs to their values in the corresponding quarter of 2002. This is equivalent to returning the cross-category effects back to their levels in that period and so that the counterfactual captures any consumer gains from changes to discounter cross-category effects that may have occurred over time.

F Moments

In this appendix we detail the market-level BLP instruments used in demand estimation. We also specify three sets of micro moments that we use in Section (4.1).

F.1 BLP Instruments

We construct BLP instruments using the following observed product characteristics: indicators for private-label budget, private-label not budget, wheat, rice, oats, bran, multigrain, granola, contains chocolate, nuts, fruit and honey, as well as pack size, and pack size squared. The instruments are based on two alternative ways of summing the observed characteristics; for the lth characteristic these sums are

$$|\mathcal{J}_{rt}|^{-1}\left(\sum_{j'\in\mathcal{J}_{rt}} x^l_{j't}\right) - x^l_{jt} \qquad \text{and} \qquad |\mathcal{J}_t \setminus \mathcal{J}_{rt}|^{-1}\left(\sum_{j'\in\mathcal{J}_t\setminus\mathcal{J}_{rt}} x^l_{j't}\right) - x^l_{jt},$$

for observation (j,t), where r is the retailer for option j. Intuitively, these instruments measure how close option j is to the average of other options sold, (i) in the same retailer and (ii) in competitor retailers, across each dimension of characteristic space, and therefore capture the intensity of competition for the option and are likely to drive to what extent the retailer can set price above marginal cost (see Berry et al. (1995) and Gandhi and Houde (2019) for a discussion).

F.2 Micro Moments

We use three sets of micro moments. For each set we specify the moments at the household level. These are averaged over households as described in equation (4.1).

F.2.1 Cross-Period Moments

The first set of moments comprise cross-period moments for each of four choice attributes. Let $\mathcal{P}_2(I'_h)$ denote the set of (unordered) pairs of household-weeks from the set $I'_h \in \{I_h, I^*_h\}$ of household-weeks belonging to household h. For choice attribute l, we label the corresponding moment $m(l)$. For household h, the predicted component of the moment is given by

$$y^{m(l)}_h(\boldsymbol{\theta}) = \frac{1}{|\mathcal{P}_2(I^*_h)|}\sum_{(i,i')\in\mathcal{P}_2(I^*_h)} (x^l_i(\boldsymbol{\theta}) - \bar{x}(\boldsymbol{\theta})^l)(x^l_{i'}(\boldsymbol{\theta}) - \bar{x}^l(\boldsymbol{\theta})),$$

where

$$\bar{x}^l(\boldsymbol{\theta}) = \frac{1}{|I^*_h|}\sum_{i\in I^*_h} x^l_i(\boldsymbol{\theta}), \qquad x^l_i(\boldsymbol{\theta}) = \frac{\sum_{j\in J^l_{t(i)}} s_{ij}(\boldsymbol{\theta})x^l_{jt}}{\sum_{j\in J^l_{t(i)}} s_{ij}(\boldsymbol{\theta})}$$

and

$$I^*_h = \{i \in I^* | h(i) = h\}.$$

The observed component is

$$Y^{m(l)}_h = \frac{1}{|\mathcal{P}_2(I_h)|}\sum_{(i,i')\in\mathcal{P}_2(I_h)} (x^l_i - \bar{x}^l)(x^l_{i'} - \bar{x}^l),$$

where

$$\bar{x}^l = \frac{1}{|I_h|}\sum_{i\in I_h} x^l_i, \qquad x^l_i = \sum_{j\in J^l_{t(i)}} 1_{[i \text{ chooses } j]} x^l_{jt}$$

and

$$I_h = \{i \in I | h(i) = h, \sum_{j \in J^l_{t(i)}} 1_{[i \text{ chooses } j]} = 1\}.$$

J^l_t denotes the set of options for which characteristic l is defined. The observed and predicted moments have the same conditioning on choice of an options in this set. There are four characteristics l as follows.

1. *Price* ($l = 1$): $x^l_{jt} = p_{jt}$ and $J^l_t = J_t$.
2. *Inside good* ($l = 2$): $x^l_{jt} = 1_{j>0}$ and $J^l_t = J_t \cup \{0\}$.
3. *Retailer* ($l = 3$): $x^l_{jt} = 1_{r(j)=r}$ and $J^l_t = J_t$. This generates a moment for each retailer r. We aggregate over r to generate a single moment, i.e., labeling the r-specific moments Y^r_h, we aggregate to the single moment $Y^l_h = \sum_{r \in \mathcal{R}} Y^r_h$ where $\mathcal{R}$ is the set of retailers.
4. *Cereal base* ($l = 4$): $x^l_{jt} = 1_{b(j)=b}$ and and $J^l_t = J_t$. This generates a moment for each cereal base b. We aggregate over b to generate a single moment, i.e., labeling the b-specific moments Y^b_h, we aggregate to the single moment is $Y^l_h = \sum_{b \in \mathcal{B}} Y^b_h$ where $\mathcal{B}$ is the set of cereal bases.

These are centered moments. We use these rather than uncentered moments for the following reason. With substantial (time-persistent) heterogeneity across households in the coefficient on x^l_i, some households will consistently have high values of x^l, while others will consistently have low values. For a *given* cross-household mean of x^l_i, this persistence will inflate the average (across households) value of the corresponding uncentered moment, $x^l_i x^l_{i'}$, compared to a case with little heterogeneity. However, the heterogeneity parameter may also have a mean-shifting effect—i.e., it may change the mean (across households) value of x^l_i. In this case, the magnitude of the uncentered moment reflects both by changes in the mean and changes in the persistence. We use *centred* moments to strip out this mean-shifting component, focusing instead on whether some households persistently have above-average and others below-average, values of x^l_i.

F.2.2 Moments Based on Household-Option Interactions

The second set of moments is based on variables that vary at the household-option level. Let x^l_{ij} denote such a variable, labeled l. Let the corresponding moment be denoted $m(l)$. The predicted moment is

$$y^{m(l)}_h(\boldsymbol{\theta}) = \frac{1}{|I^*_h|} \sum_{i \in I^*_h} x^l_{ij}(\boldsymbol{\theta}) \qquad \text{where} \qquad x^l_i(\boldsymbol{\theta}) = \frac{\sum_{j \in J^l_{t(i)}} s_{ij}(\boldsymbol{\theta}) x^l_{ij}}{\sum_{j \in J^l_{t(i)}} s_{ij}(\boldsymbol{\theta})}$$

and

$$I^*_h = \{i \in I^* | h(i) = h\}.$$

The observed moment is

$$Y^{m(l)}_h = \tfrac{1}{|I^*_h|} \sum_{i \in I^*_h} x^l_i \qquad \text{where} \qquad x^l_i = \sum_{j \in J^l_{t(i)}} 1_{[i \text{ chooses } j]} x^l_{ij}$$

and

$$I_h = \{i \in I | h(i) = h, \sum_{j \in J^l_{t(i)}} 1_{[i \text{ chooses } j]} = 1\}.$$

$I' \in \{I_h, I^*_h\}$ is defined in Section 4.1 and the set J^l_t contains options for which characteristic l is defined. The predicted and observed moments have the same conditioning on choice of an option in this set. There are two characteristics l as follows.

1. *Price-income interaction* ($l = 1$): $x^l_{ij} = (p_{jt} \times y_i)$ and $J^l_t = J_t$.
2. *Distance* ($l = 2$): $x^l_{ij} = \ln(\text{dist}_{ij})$ and $J^l_t = \{j | j \in J_t, r(j) \neq \text{Other}\}$. We do not define a distance variable for the retailers in the group Other, which is why it is excluded from J^l_t.

F.2.3 Choice Set and Inside Good Covariance Moments

See Section 4.1.

G Details of Estimator

The estimator for the demand model is

$$\hat{\boldsymbol{\theta}} = \arg\min_{\boldsymbol{\theta}} \begin{bmatrix} \mathbf{g}_A(\boldsymbol{\theta}) \\ \mathbf{g}_M(\boldsymbol{\theta}) \end{bmatrix}' \begin{bmatrix} \boldsymbol{W}_A & \mathbf{0} \\ \mathbf{0} & \boldsymbol{W}_M \end{bmatrix} \begin{bmatrix} \mathbf{g}_A(\boldsymbol{\theta}) \\ \mathbf{g}_M(\boldsymbol{\theta}) \end{bmatrix}$$

The micro moments $\mathbf{g}_M(\boldsymbol{\theta})$ is a 10×1 vector that stacks the moments described in Appendix F. The BLP moments $\mathbf{g}_A(\boldsymbol{\theta})$ are

$$\mathbf{g}_A(\boldsymbol{\theta}) = N_A^{-1} \boldsymbol{Z}' \boldsymbol{\xi}(\boldsymbol{\theta})$$

where N_A is the number of jt observations, $\boldsymbol{Z}$ is a matrix of instruments, and

$$\boldsymbol{\xi}(\boldsymbol{\theta}) = \boldsymbol{\delta}(\boldsymbol{\theta}_1) - \boldsymbol{X}\boldsymbol{\theta}_2$$

and where the vector $\boldsymbol{\delta}(\boldsymbol{\theta}_1)$ is the value of $\boldsymbol{\delta}$ that, given $\boldsymbol{\theta}_1$, matches observed and predicted market shares, and is found by iterating on the BLP contraction. Here $\boldsymbol{\theta}_1$ are the nonlinear parameters and $\boldsymbol{\theta}_2$ are the linear parameters.

The matrix $\boldsymbol{X}$'s columns are a constant, dummies for all except one market, dummies for all except one retailer, dummies for all except one product. The matrix $\boldsymbol{Z}$ consists of the columns of $\boldsymbol{X}$, plus a set of instruments for price (cost-shifter and BLP instruments).

The vectors $\boldsymbol{\theta}_1$ and $\boldsymbol{\theta}_2$ represent a decomposition of the parameter vector $\boldsymbol{\theta}$ into its nonlinear ($\boldsymbol{\theta}_1$) and linear ($\boldsymbol{\theta}_2$) components. For each trial value $\boldsymbol{\theta}_1$ during numerical minimization, we concentrate out the linear parameters as

$$\hat{\boldsymbol{\theta}}_2(\boldsymbol{\theta}_1) = (\boldsymbol{X}'\boldsymbol{Z}\boldsymbol{W}_A\boldsymbol{Z}'\boldsymbol{X})^{-1}\boldsymbol{X}'\boldsymbol{Z}\boldsymbol{W}_A\boldsymbol{Z}'\boldsymbol{\delta}(\boldsymbol{\theta}_1). \tag{G.1}$$

Rewriting the parameters as $\boldsymbol{\theta} = (\boldsymbol{\theta}_1, \hat{\boldsymbol{\theta}}_2(\boldsymbol{\theta}_1))$, where $\hat{\boldsymbol{\theta}}_2(\boldsymbol{\theta}_1)$ is given by equation (G.1), the estimator is

$$\hat{\boldsymbol{\theta}}_1 = \arg\min_{\theta_1} \begin{bmatrix} \mathbf{g}_A(\boldsymbol{\theta}_1, \hat{\boldsymbol{\theta}}_2(\boldsymbol{\theta}_1)) \\ \mathbf{g}_M(\boldsymbol{\theta}_1, \hat{\boldsymbol{\theta}}_2(\boldsymbol{\theta}_1)) \end{bmatrix}' \begin{bmatrix} \boldsymbol{W}_A & \mathbf{0} \\ \mathbf{0} & \boldsymbol{W}_M \end{bmatrix} \begin{bmatrix} \mathbf{g}_A(\boldsymbol{\theta}_1, \hat{\boldsymbol{\theta}}_2(\boldsymbol{\theta}_1)) \\ \mathbf{g}_M(\boldsymbol{\theta}_1, \hat{\boldsymbol{\theta}}_2(\boldsymbol{\theta}_1)) \end{bmatrix}$$

$$\hat{\boldsymbol{\theta}}_2 = \hat{\boldsymbol{\theta}}_2(\hat{\boldsymbol{\theta}}_1).$$

The weighting matrix $\boldsymbol{W}$ is block diagonal, i.e., $\boldsymbol{W} = \text{diag}(\boldsymbol{W}_A, \boldsymbol{W}_M)$, reflecting that the BLP and micro moments arise from separate sampling processes and are therefore uncorrelated. The matrix $\boldsymbol{W}_A$, corresponding to the BLP moments, is given by $(\mathbf{Z}'\mathbf{Z}/N_A)^{-1}$, where N_A is the total number of market-option observations, and $\mathbf{Z}$ is the matrix of instruments. The matrix $\mathbf{W}_M$, corresponding to the micro moments, is diagonal, with the entry for moment m equal to the reciprocal of the square of the predicted component of that moment: $1/(\bar{Y}^m)^2$, where $\bar{Y}^m$ is defined in equation (4.1). This normalization put the micro moments—which are not measured in the same units—on a common (units-free) scale as percentage deviation between predicted and observed contributions (see Low and Meghir 2017).

H Standard errors

Standard errors correspond to the square roots of the diagonal of the GMM asymptotic covariance estimator

$$(\mathbf{G}'\mathbf{W}\mathbf{G})^{-1}\mathbf{G}'\mathbf{W}\boldsymbol{\Omega}\mathbf{W}\mathbf{G})(\mathbf{G}'\mathbf{W}\mathbf{G})^{-1}$$

where

$$\mathbf{W} = \begin{bmatrix} \mathbf{W}_A & \mathbf{0} \\ \mathbf{0} & \mathbf{W}_M \end{bmatrix}$$
$$\mathbf{G} = \begin{bmatrix} \nabla \mathbf{g}_A(\boldsymbol{\theta}) \\ \nabla \mathbf{g}_M(\boldsymbol{\theta}) \end{bmatrix}$$
$$\boldsymbol{\Omega} = \begin{bmatrix} \boldsymbol{\Omega}_A & \mathbf{0} \\ \mathbf{0} & \boldsymbol{\Omega}_M \end{bmatrix}.$$

Here the covariance of the moments, $\boldsymbol{\Omega}$, is block diagonal since the household-level moments and product-level moments are independent processes. The covariance of the market level moments is

$$\boldsymbol{\Omega}_{\boldsymbol{A}} = \frac{1}{|N_A|} \sum_{(j,t)\in N_A} \left[\boldsymbol{Z}'_{jt}\boldsymbol{\xi}_{jt}(\hat{\boldsymbol{\theta}})\right] \left[\boldsymbol{Z}'_{jt}\boldsymbol{\xi}_{jt}(\hat{\boldsymbol{\theta}})\right]'.$$

The covariance of the micro moments (see O'Connell et al. (2025) for a derivation), is given by

$$
\begin{aligned}
\boldsymbol{\Omega}_M &= k\hat{\boldsymbol{\Sigma}}_Y + \hat{\boldsymbol{\Sigma}}_y - k(\hat{\boldsymbol{\Sigma}}_{Yy} + \hat{\boldsymbol{\Sigma}}'_{Yy}) \\
\hat{\boldsymbol{\Sigma}}_Y &= \frac{1}{|N_H|}\sum_{h\in N_H}[\mathbf{Y}_h - \bar{\mathbf{Y}}][\mathbf{Y}_h - \bar{\mathbf{Y}}]' \\
\hat{\boldsymbol{\Sigma}}_y &= \frac{1}{|N_H^*|}\sum_{h\in N_H^*}[\mathbf{y}_h(\hat{\boldsymbol{\theta}}) - \bar{\mathbf{y}}(\hat{\boldsymbol{\theta}})][\mathbf{y}_h(\hat{\boldsymbol{\theta}}) - \bar{\mathbf{y}}(\hat{\boldsymbol{\theta}})]' \\
\hat{\boldsymbol{\Sigma}}_{Yy} &= \frac{1}{|N_H^*|}\sum_{h\in N_H^*}[\mathbf{Y}_h - \bar{\mathbf{Y}}][\mathbf{y}_h(\hat{\boldsymbol{\theta}}) - \bar{\mathbf{y}}(\hat{\boldsymbol{\theta}})]'
\end{aligned}
$$

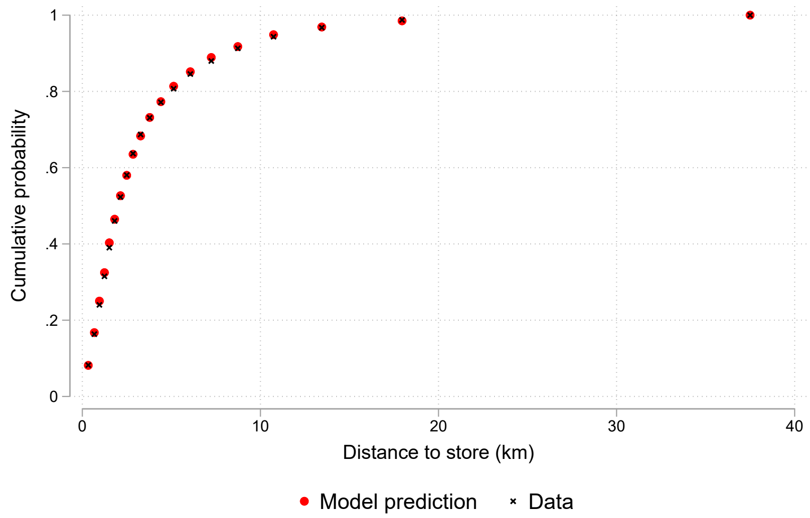
and where N_H^* and N_H are the small and large samples, respectively, $k = |N_H^*|/|N_H|$ is the ratio of the two sample sizes (assumed fixed as $n \to \infty$). The vectors $\mathbf{Y}_h$ and $\mathbf{y}_h(\boldsymbol{\theta})$ represent the observed and predicted components of the moment for household h. The vector $\bar{\mathbf{Y}}$ contains the sample means of $\mathbf{Y}_h$ across households in the large sample, while $\bar{\mathbf{y}}(\hat{\boldsymbol{\theta}})$ is the vector of means of $\mathbf{y}_h(\boldsymbol{\theta})$ across households in the small sample. This covariance structure allows for arbitrary within-household correlation of prediction errors across household-weeks i, i.e., standard errors are clustered at the household level h.

The derivative of the micro and product-level moments with respect to the nonlinear parameters $\boldsymbol{\theta}_1$ is computed using a forward finite-difference approximation with step size $|\hat{\boldsymbol{\theta}}_{1k}| \cdot 1e^{-5}$ for entry k of $\hat{\boldsymbol{\theta}}_1$. The derivatives of the micro moments $\mathbf{g}_M(\boldsymbol{\theta})$ with respect to the linear parameters $\boldsymbol{\theta}_2$ are zero, since the micro moments do not depend on the value of $\boldsymbol{\theta}_2$. The block of $\nabla\mathbf{g}_A(\boldsymbol{\theta})$ corresponding to the derivatives of the market-level moments $\mathbf{g}_A(\boldsymbol{\theta})$ with respect to $\boldsymbol{\theta}_2$ is given by $-\mathbf{Z}'\mathbf{X}/|N_A|$.

I Model Fit

In Section 4.1, we report the fit of the micro moments. In Figure I.1 we show that model-predicted relationship between the average cumulative probability of a household choosing an option and the travel distance to the nearest store selling that option closely matches the corresponding pattern in the data. In other words, the model successfully recovers the how purchase probabilities vary spatial with travel distances.

Figure I.1: *Impact of distance on choice probabilities*



Notes: Each marker shows the cumulative probability of a household choosing an option within the distance indicated on the horizontal axis from their home. Probabilities are conditional on choosing an inside option. Red markers show predictions from our model and black markers are probabilities computed with the data.

J Counterfactual Algorithm

We perform counterfactuals market-by-market. Here, we suppress market subscripts t. Morrow and Skerlos (2011) propose reformulating the standard BLP supply side (equation (3.3)) as

$$\mathbf{p} - \tilde{\mathbf{c}} = \boldsymbol{\zeta}(\mathbf{p}),$$

where $\tilde{\mathbf{c}}$ is the marginal cost that the retailer optimizes against,

$$\boldsymbol{\zeta}(\mathbf{p}) = \boldsymbol{\Lambda}(\mathbf{p})^{-1}\boldsymbol{\Gamma}(\mathbf{p})'(\mathbf{p} - \tilde{\mathbf{c}}) - \boldsymbol{\Lambda}(\mathbf{p})^{-1}\mathbf{s}(\mathbf{p}),$$

$\boldsymbol{\Lambda}$ is a $J \times J$ diagonal matrix with entries

$$\Lambda_{jj} = \textstyle\sum_{i \in I^*} s_{ij} \frac{\partial U_{ij}}{\partial p_j}$$

and $\boldsymbol{\Gamma}$ is a $J \times J$ matrix with entries

$$\boldsymbol{\Gamma}_{jj'} = \begin{cases} \sum_{i \in I} s_{ij} s_{ij'} \frac{\partial U_{ij'}}{\partial p_{j'}} & \text{if } j \text{ and } j' \text{ are co-owned} \\ 0 & \text{otherwise.} \end{cases}$$

Morrow and Skerlos (2011) show that the mapping $p \leftarrow \tilde{\mathbf{c}} + \boldsymbol{\zeta}(\mathbf{p})$ is a contraction.

Let $\boldsymbol{\gamma}^R$ be the per-pack (i.e. not per-kilogram) retailer markup and $\tilde{\mathbf{c}}$ the (wholesale price inclusive) retail marginal costs (also per pack), so that $\mathbf{p} \equiv \boldsymbol{\gamma}^R + \tilde{\mathbf{c}}$. We can write the contraction with $\boldsymbol{\gamma}^R$ as an argument instead:

$$\boldsymbol{\gamma}^R \leftarrow \boldsymbol{\zeta}(\boldsymbol{\gamma}^R + \tilde{\boldsymbol{c}}). \tag{J.1}$$

Let kg_j be the pack size in kilograms for option j. Then the per-pack retailer markup $\boldsymbol{\gamma}^R$ relates to the per-kilo retailer markup $\boldsymbol{\Gamma}^R$ as $\Gamma_j^R = \gamma_j^R / \text{kg}_j$, and similarly for prices and costs.

In per-kilogram terms, the manufacturer markup $\boldsymbol{\Gamma}^F$ (see equation (4.6)) can be written as

$$\begin{aligned} \boldsymbol{\Gamma}^F &= \rho \boldsymbol{\chi} \boldsymbol{B}(\boldsymbol{p})^{-1} \boldsymbol{A}(\boldsymbol{p}) \boldsymbol{\Gamma}^R && \text{(J.2)} \\ &= \boldsymbol{\varphi}(\boldsymbol{\Gamma}^R). && \text{(J.3)} \end{aligned}$$

To solve for counterfactual prices we take the following steps.

1. (Step 0). Start with guesses of per-pack retail prices $\mathbf{p}_s$ and per-pack manufacturer markup $\boldsymbol{\gamma}_s^F$, for iteration counter $s = 0$, as well as known total vertical per-pack marginal costs $\boldsymbol{c}$ (which remain fixed throughout this exercise).

2. (Step 1). With $\tilde{\boldsymbol{c}}_s = \boldsymbol{\gamma}_s^F + \boldsymbol{c}$, update retailer markup as $\boldsymbol{\gamma}_{s+1}^R = \boldsymbol{\zeta}(\boldsymbol{p}_s)$, using equation (J.1).

3. (Step 2). Transform $\boldsymbol{\gamma}_{s+1}^R$ to per-kilogram terms, $\boldsymbol{\Gamma}_{s+1}^R$. Use the updated matrices $\boldsymbol{A}(\boldsymbol{p}_s)$ and $\boldsymbol{B}(\boldsymbol{p}_s)$ and equation (J.3), with $\boldsymbol{\Gamma}^R = \boldsymbol{\Gamma}_{s+1}^R$ to calculate $\boldsymbol{\Gamma}_{s+1}^F$, and transform to per-pack terms: $\boldsymbol{\gamma}_{s+1}^F$ (by multiplying each element j of $\boldsymbol{\Gamma}_{s+1}^F$ by the corresponding pack size kg_j).

4. (Step 3). Update retail prices (in per-pack terms) as $\boldsymbol{p}_{s+1} = \boldsymbol{c} + \boldsymbol{\gamma}_{s+1}^R + \boldsymbol{\gamma}_{s+1}^F$.

5. Iterate on steps 1-3 until convergence defined as $\|\boldsymbol{p}_{s+1} - \boldsymbol{p}_s\| < 10^{-8}$.

The foregoing discussion is for the baseline bargaining model. For the alternative two-part tariff (or retailer pricing) model the algorithm is identical except that we fix $\boldsymbol{\Gamma}^F = \boldsymbol{\varphi}(\boldsymbol{\Gamma}^R) = 0$ in equation (J.3). We can then skip Step 2. In Step 1, $\tilde{\boldsymbol{c}} = \boldsymbol{c}$, and in Step 3, $\boldsymbol{p}_{s+1} = \boldsymbol{c} + \boldsymbol{\gamma}_{s+1}^R$.

K Decomposition of Cereal and Non-cereal Utility Effects

The mean utility of option $j = (k, r)$—i.e., product k at retailer r—in market t is given by:

$$\delta_{jt} = \theta_k + \theta_r + \xi_{jt}.$$

We decompose the time-varying component ξ_{jt} into: $\xi_{jt} = \xi_{jt}^* + \psi_{rt}$, where ξ_{jt}^* captures factors intrinsic to the breakfast cereal product, and ψ_{rt} reflects retailer-level effects not specific to breakfast cereals (e.g., changes in the quality of the shopping experience or improvements in other product categories purchased alongside cereals).

To separately identify ξ^*_{jt} and ψ_{rt}, we exploit continuing options—specific cereals k sold by retailer r in consecutive periods. Let $\mathcal{J}^{\text{cont}}_{rt}$ be the set of such options for (r,t). We assume the change over time in the intrinsic cereal-specific utility component is mean zero:

$$\mathbb{E}(\xi^*_{jt} - \xi^*_{jt-1}) = \mathbb{E}([\xi_{jt} - \xi_{jt-1}] - [\psi_{rt} - \psi_{rt-1}]) = 0, \quad \forall j \in \mathcal{J}^{cont}_{rt},$$

for each (r,t). This assumption is motivated by the fact that the characteristics for continuing options do not change, so that any shift in option-level mean utility must stem from evolving non-cereal effects ψ_{rt}. The sample analogue implies, for all (r,t),

$$\psi_{rt} - \psi_{rt-1} = -\left|\mathcal{J}^{cont}_{rt}\right|^{-1} \textstyle\sum_{j\in\mathcal{J}^{cont}_{rt}} [\xi_{jt} - \xi_{jt-}].$$

and normalizing $\psi_{r1} = 0$, yields ψ_{rt} for all $t > 1$.

In equation (6.2), we re-write mean utility:

$$\delta_{jt} = \theta_k + \theta_r + \xi_{rt} + \Delta\xi^*_{jt}.$$

where:

$$\xi_{rt} \equiv -\left|\mathcal{J}_{rt}\right|^{-1} \sum_{j\in\mathcal{J}_{rt}} \xi_{jt}, \quad \Delta\xi^*_{jt} \equiv \xi_{jt} - \xi_{rt}$$

Noting that:

$$\xi_{rt} = -\left|\mathcal{J}_{rt}\right|^{-1} \sum_{j\in\mathcal{J}_{rt}} \xi^*_{jt} + \psi_{rt} \equiv \xi^*_{rt} + \psi_{rt}$$

we obtain:

$$\delta_{jt} = \theta_k + \theta_r + \psi_{rt} + \xi^*_{rt} + \Delta\xi^*_{jt},$$

where ξ^*_{rt} and $\Delta\xi^*_{jt}$ capture retailer–market-level and idiosyncratic intrinsic cereal effects, and ψ_{rt} captures retailer–market-level non-cereal effects.

L Consumer Surplus

We write the utility of option $j > 0$ for consumer-week i as $U_{ijt} = \delta_{jt} + \mu_{ij} + \epsilon_{ij}$, which includes the heterogeneous taste term μ_{ij}, as specified in equation (3.9). We write $\mu_{ij} = \mu_j(\tilde{p}_{jt}, \boldsymbol{\nu}_i, \text{dist}_{ir(j)})$ to make explicit its dependence on equilibrium price $\tilde{p}_{jt(i)}$, the random taste shock vector $\boldsymbol{\nu}_i$, and distance $\text{dist}_{ir(j)}$. Note that distances in quarter-year t depend on the set $\mathcal{S}_t$ of store locations. Let $F(\mu_i|\tilde{p}_t, \mathcal{S}_t)$ be the distribution function of the vector $\mu_i = (\mu_{ij})_{j\in J}$. For a given realization $(\boldsymbol{\epsilon}_i, \mu_i)$, let the optimal choice be denoted

$$j(\boldsymbol{\epsilon}_i, \mu_i, \mathcal{J}_t) \quad \equiv \quad \arg\max_{j \in \mathcal{J}_t} \{\delta_{jt} + \mu_{ij} + \epsilon_{ij} | j \in \mathcal{J}_t \cup 0\}$$

where $\mu_{i0} = 0$. The compensating variation of a consumer in market t being offered options $\mathcal{J}_t$ with mean utilities $\boldsymbol{\delta}_t = \{\delta_{jt}\}_{j \in J_t}$, is

$$\begin{aligned} \mathrm{CS}_t &= \int_{\mu_i} \frac{1}{\alpha_i} \left[\mathbb{E}_{\boldsymbol{\epsilon_i}} \left(\delta_{j't} + \mu_{ij'} + \epsilon_{ij'} | j' = j(\boldsymbol{\epsilon_i}, \mu_i, \mathcal{J}_t) \right) \right] dF(\mu_i | \mathcal{S}_t) \\ &= \int_{\mu_i} \frac{1}{\alpha_i} \left[\ln \left(1 + \sum_{j \in \mathcal{J}_t} \exp(\delta_{jt} + \mu_{ij}) \right) \right] dF(\mu_i | \mathcal{S}_t). \end{aligned}$$

The consumer's expected travel cost T_t and the expected contribution Z_t from time-varying non-cereal utility effects $\psi_{r(j)t}$ are respectively given by

$$\begin{aligned} T_t &= -\tau \int_{\mu_i} \frac{1}{\alpha_i} \textstyle\sum_{j \in J_t} \left\{ \mathrm{dist}_{ij} s_{ijt}(\mu_i) \right\} dF(\mu_i | \mathcal{S}_t), \text{ and} \\ Z_t &= \int_{\mu_i} \frac{1}{\alpha_i} \textstyle\sum_{j \in J_t} \left\{ \psi_{r(j)t} s_{ijt}(\mu_i) \right\} dF(\mu_i | \mathcal{S}_t). \end{aligned}$$

See below for the steps in this derivation. Since these effects are additive in utility, the utility B_t from breakfast cereal products net of transport costs and non-cereal retailer choice effects is

$$B_t = \mathrm{Y}_t - T_t - Z_t.$$

Aggregate surplus To compute aggregate consumer surplus we use the full counterfactual consumer surplus change $\Delta_{CF3}\mathrm{CS}$. In addition, we compute corresponding changes for transport costs and other category effects, i.e.,

$$\Delta_{CF3}\mathrm{T}_t = \mathrm{T}(\mathcal{S}_t, \mathcal{J}_t, \mathbf{c}_t, \boldsymbol{\delta}_t) - \mathrm{T}(\mathcal{S}'_t, \mathcal{J}'_t, \mathbf{c}'_t, \boldsymbol{\delta}'_t)$$

and

$$\Delta_{CF3}\mathrm{Z}_t = \mathrm{Z}(\mathcal{S}_t, \mathcal{J}_t, \mathbf{c}_t, \boldsymbol{\delta}_t) - \mathrm{Z}(\mathcal{S}'_t, \mathcal{J}'_t, \mathbf{c}'_t, \boldsymbol{\delta}'_t),$$

giving

$$\Delta_{CF3}\mathrm{B}_t = \Delta_{CF3}\mathrm{CS}_t - \Delta_{CF3}\mathrm{T}_t - \Delta_{CF3}\mathrm{Z}_t.$$

The implied aggregate consumer surplus change is $\Delta_{CF3}\mathrm{B}_t \times SC_B + \Delta_{CF3} \times SC_T$ where SC_B is the scale-up factor for the breakfast cereal component (1/revenue share of breakfast cereals) and SC_T is the scale-up factor for transport costs (1/trip share of breakfast cereals).

Derivation of expected surplus components.

$$
\begin{aligned}
T_t &= -\tau \int_{\mu_i} \frac{1}{\alpha_{\mu_i}} \mathbb{E}_{\boldsymbol{\epsilon_i}}\left[\text{dist}_{ij(\boldsymbol{\epsilon_i},\mu_i)}\right] dF(\mu_i|\mathcal{S}_t) \\
&= -\tau \int_{\mu_i} \frac{1}{\alpha_i} \int_{\boldsymbol{\epsilon_i}} \text{dist}_{ij(\boldsymbol{\epsilon_i},\mu_i)} dF_\epsilon(\boldsymbol{\epsilon_i}) dF(\mu_i|\mathcal{S}_t) \\
&= -\tau \int_{\mu_i} \frac{1}{\alpha_i} \int_{\boldsymbol{\epsilon_i}} \textstyle\sum_{j\in J_t} \Big\{ \text{dist}_{ij} 1\big[j = j(\boldsymbol{\epsilon_i},\mu_i)\big] \Big\} dF_\epsilon(\boldsymbol{\epsilon_i}) dF(\mu_i|\mathcal{S}_t) \\
&= -\tau \int_{\mu_i} \frac{1}{\alpha_i} \textstyle\sum_{j\in J_t} \Big\{ \text{dist}_{ij} \displaystyle\int_{\boldsymbol{\epsilon_i}} 1\big[j = j(\boldsymbol{\epsilon_i},\mu_i)\big] \Big\} dF_\epsilon(\boldsymbol{\epsilon_i}) dF(\mu_i|\mathcal{S}_t) \\
&= -\tau \int_{\mu_i} \frac{1}{\alpha_i} \textstyle\sum_{j\in J_t} \Big\{ \text{dist}_{ij} s_{ijt}(\mu_i) \Big\} dF(\mu_i|\mathcal{S}_t)
\end{aligned}
$$

The Z_t term can be derived analogously.

M Results under Alternative Supply Models

M.1 Retailer pricing

Table M.1: *Average elasticities, cost and markups*

		Traditional retailers		Discounters		All options
		Branded	Private-label	Branded	Private-label	
2002	Marginal cost c (£/kg)	3.47	2.05	3.27	1.83	3.08
	Total margin γ (£/kg)	1.52	1.22	0.81	0.91	1.45
	Lerner index ($\frac{\gamma}{p}$)	0.31	0.39	0.19	0.34	0.33
2011	Marginal cost c (£/kg)	3.58	1.71	2.56	1.79	3.09
	Total margin γ (£/kg)	1.70	1.37	1.02	0.97	1.56
	Lerner index ($\frac{\gamma}{p}$)	0.33	0.46	0.29	0.36	0.35
2021	Marginal cost c (£/kg)	3.20	1.21	2.70	1.08	2.52
	Total margin γ (£/kg)	1.49	1.26	1.16	1.08	1.41
	Lerner index ($\frac{\gamma}{p}$)	0.32	0.54	0.30	0.54	0.39

Notes: Table reports average own-price elasticities, total vertical marginal costs and Lerner indexes in 2002, 2012 and 2021. Retailer share is average share of total margins accruing to retailers. For private-label products this is 100%. Marginal costs and margins are expressed in 2021 £s.

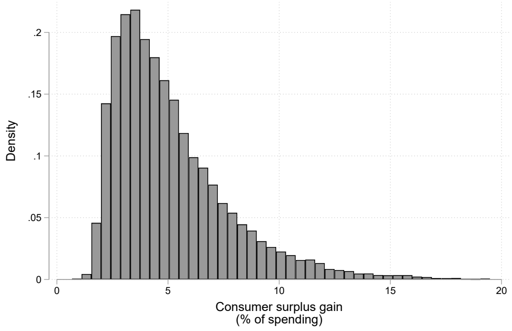
Table M.2: *Counterfactual analysis*

	Observed equilibrium	Counterfactual equilibrium: Store (CF1)	In-store (CF2)	Full (CF3)
A) Discounter primitives				
Marginal cost (£/kg)				
All options	1.34	-	1.11	1.11
Overlapping options	0.75	-	0.91	0.91
B) Market equilibrium				
Concentration (HHI)				
Retail	1942	2108	2110	2222
Manufacturer	2073	2234	2233	2335
Average market price (£/kg)				
Unweighted	3.93	3.97	4.10	4.14
Sales-weighted	3.24	3.41	3.25	3.43
Discounter margins (£/kg)				
All options	1.09	1.02	0.93	0.87
Overlapping options				
Branded				
Retail component	0.58	0.49	0.54	0.46
Manufacturer component	-	-	-	-
Private-label	1.03	0.98	0.92	0.88
Traditional retailer margins (£/kg)				
Branded				
Retail component	1.51	1.57	1.55	1.59
Manufacturer component	-	-	-	-
Private-label	1.26	1.32	1.30	1.35
C) Δ annual market surplus (£m)				
Consumer surplus	-	-62.3	-56.5	-97.9
% of spending		*(-4.31%)*	*(-3.91%)*	*(-6.78%)*
Producer surplus				
Traditional retailers	-	59.8	51.0	95.7
% change		*(12.73%)*	*(10.85%)*	*(20.36%)*
Discounters	-	-41.2	-41.8	-66.5
% change		*(-44.16%)*	*(-44.75%)*	*(-71.23%)*
Total surplus	-	-43.7	-47.3	-68.7
% of spending		*(-3.02%)*	*(-3.28%)*	*(-4.76%)*

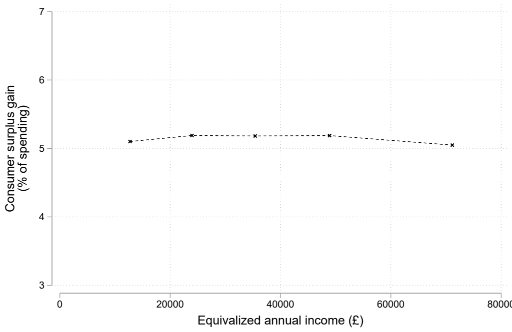
NNotes: Table compares average outcomes in the 2021 observed and counterfactual equilibrium. Panel (A) summarizes the change to market primitives in each counterfactual scenario. Panels (B) and (C) summarize the change in endogenous market outcomes. Marginal costs, prices, margins and surplus are expressed in 2021 £s.

Figure M.1: *Distributional impact*

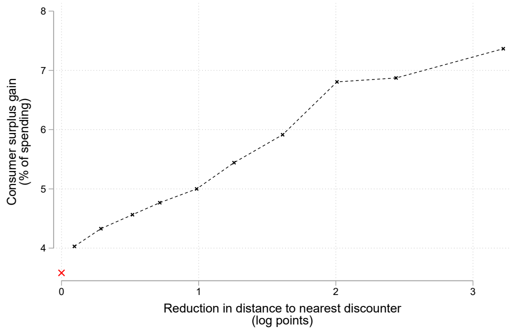
(a) Distribution across households



(b) Impact by income quintiles



(c) Impact by travel distance reduction



Notes: Figures show the difference in consumer surplus, expressed as a fraction of total expenditure, between the observed and full counterfactual equilibria for the year 2021. Panel (a) reports the distribution of consumer changes across households. Panel (b) shows the average change for each household income quintile. Panel (c) presents the average change by the reduction in travel distance to the nearest discounter store.

M.2 Manufacturer pricing

Table M.3: *Average elasticities, cost and markups*

		Traditional retailers		Discounters		All options
		Branded	Private-label	Branded	Private-label	
2002	Marginal cost c (£/kg)	4.09	2.71	3.40	1.87	3.69
	Total margin γ (£/kg)	0.90	0.56	0.69	0.87	0.84
	Lerner index ($\frac{\gamma}{p}$)	0.18	0.18	0.17	0.32	0.19
2011	Marginal cost c (£/kg)	4.39	2.40	2.93	1.81	3.80
	Total margin γ (£/kg)	0.89	0.67	0.66	0.95	0.85
	Lerner index ($\frac{\gamma}{p}$)	0.17	0.22	0.18	0.35	0.19
2021	Marginal cost c (£/kg)	3.81	1.70	3.12	1.11	3.04
	Total margin γ (£/kg)	0.88	0.77	0.73	1.06	0.89
	Lerner index ($\frac{\gamma}{p}$)	0.19	0.33	0.19	0.52	0.26

Notes: Table reports average own-price elasticities, total vertical marginal costs and Lerner indexes in 2002, 2012 and 2021. Retailer share is average share of total margins accruing to retailers. For private-label products this is 100%. Marginal costs and margins are expressed in 2021 £s.

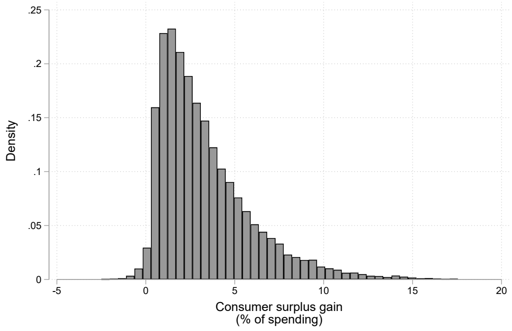
Table M.4: *Counterfactual analysis*

	Observed equilibrium	Counterfactual equilibrium: Store (CF1)	In-store (CF2)	Full (CF3)
A) Discounter primitives				
Marginal cost (£/kg)				
All options	1.43	-	0.92	0.92
Overlapping options	0.77	-	0.70	0.70
B) Market equilibrium				
Concentration (HHI)				
Retail	1942	2123	2111	2237
Manufacturer	2073	2226	2235	2328
Average market price (£/kg)				
Unweighted	3.93	3.93	4.06	4.06
Sales-weighted	3.24	3.38	3.09	3.28
Discounter margins (£/kg)				
All options	1.00	0.94	0.95	0.89
Overlapping options				
Branded				
Retail component	-	-	-	-
Manufacturer component	0.53	0.44	0.50	0.42
Private-label	1.01	0.96	0.97	0.91
Traditional retailer margins (£/kg)				
Branded				
Retail component	-	-	-	-
Manufacturer component	0.90	0.90	0.90	0.91
Private-label	0.77	0.79	0.78	0.79
C) Δ annual market surplus (£m)				
Consumer surplus	-	-46.0	-29.3	-62.3
% of spending		*(-3.18%)*	*(-2.03%)*	*(-4.31%)*
Producer surplus				
Trad. retailer private-label	-	11.8	5.6	15.5
% change		*(12.98%)*	*(6.21%)*	*(17.07%)*
Discounter private-label	-	-40.2	-22.7	-54.0
% change		*(-45.84%)*	*(-25.84%)*	*(-61.65%)*
Branded	-	17.4	9.2	23.2
% change		*(8.79%)*	*(4.68%)*	*(11.72%)*
Total surplus	-	-57.0	-37.1	-77.7
% of spending		*(-3.95%)*	*(-2.57%)*	*(-5.37%)*

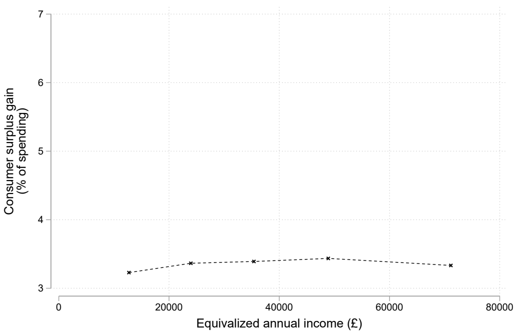
Notes: Table compares average outcomes in the 2021 observed and counterfactual equilibrium. Panel (A) summarizes the change to market primitives in each counterfactual scenario. Panels (B) and (C) summarize the change in endogenous market outcomes. Marginal costs, prices, margins and surplus are expressed in 2021 £s.

Figure M.2: *Distributional impact*

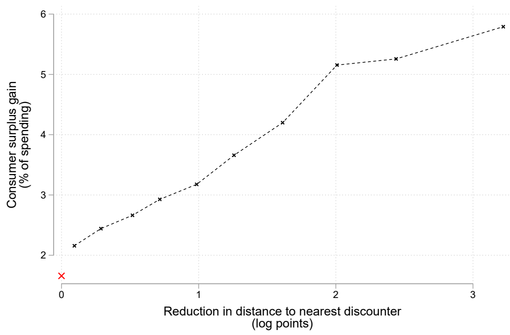
(a) Distribution across households



(b) Impact by income quintiles



(c) Impact by travel distance reduction



Notes: Figures show the difference in consumer surplus, expressed as a fraction of total expenditure, between the observed and full counterfactual equilibria for the year 2021. Panel (a) reports the distribution of consumer changes across households. Panel (b) shows the average change for each household income quintile. Panel (c) presents the average change by the reduction in travel distance to the nearest discounter store.

N Product categories

Table N.1: *Product categories (1)*

Category	Spending share (%)	Category	Spending share (%)
Ambient Cakes&Pastries	1.61	Pork	0.78
Morning Goods	1.52	Sausages	0.76
Total Bread	1.84	Chilled Cooking Sauces	0.10
Chilled Breads	0.16	Chilled Desserts	0.77
Chilled Cakes	0.36	Chilled Pate&Paste&Spread	0.11
Butter	0.74	Chilled Prepared Salad	0.34
Cheddar	1.55	Chilled Ready Meals	2.81
Eggs	0.78	Chilled Rice	0.03
Fresh Cream	0.34	Chilled Vegetarian	0.09
Margarine And Lard	0.72	Cooked Meats	2.41
Milk	2.98	Fresh Meat&Veg&Pastry	1.21
Non Cheedar Cheese	0.78	Fresh Pasta	0.16
Processed Cheese	0.44	Fresh Soup	0.12
Total Soft White	0.24	Fresh&Chilled Pastry	0.05
Yoghurt	1.81	Other Chilled Convenience	0.28
Yoghurt Drinks And Juices	0.33	Sandwich Fillers	0.14
Apples	0.79	Frozen Bread	0.04
Bananas	0.65	Frozen Meat Products	0.24
Brassicas	0.59	Frozen Pizzas	0.55
Chilled Prepared Frt&Veg	0.96	Frozen Potato Products	0.79
Citrus	0.72	Frozen Processed Poultry	0.48
Legumes	0.22	Frozen Ready Meals	0.84
Nuts - Fruit	0.14	Frozen Savoury Bakery	0.22
Other Vegetables	0.83	Frozen Vegetables	0.57
Pears	0.21	Frozen Vegetarian Prods	0.20
Potatoes	1.16	Other Frozen Foods	0.15
Root Crops	0.81	Ambient Slimming Products	0.03
Salads	1.76	Ambient Soup	0.35
Soft Fruit	1.94	Baked Bean	0.39
Tropical Fruits	0.43	Canned Fish	0.53
Chilled Prepared Fish	0.26	Canned Meats	0.34
Shellfish	0.21	Canned Puddings	0.05
Wet&Smoked Fish	0.85	Canned Rice&Pasta	0.14
Chilled Processed Poultry	0.40	Canned Vegetables	0.16
Cooked Poultry	0.47	Prepared Peas&Beans	0.15
Fresh Poultry	2.20	Tinned Fruit	0.19
Frozen Fish	0.93	Tomato Products	0.24
Frozen Poultry	0.33	Food Drinks	0.19
Bacon	1.39	Herbal Tea	0.08
Beef	2.04	Instant Coffee	0.85
Chilled Burgers&Grills	0.22	Liquid&Grnd Coffee&Beans	0.29
Chld Frnkfurter&Cont Ssgs	0.12	Tea	0.57
Flavoured Meats	0.15	Ambient Pastes&Spreads	0.09
Lamb	0.56	Breakfast Cereals	1.66
Other Meat & Offal	0.13	Honey	0.10

Table N.2: *Product categories (2)*

Category	Spending share (%)	Category	Spending share (%)
Peanut Butter	0.07	Savoury Biscuits	0.34
Porridge Oats	0.20	Cereal&Fruit Bars	0.26
Preserves	0.19	Childrens Biscuits	0.13
Toaster Pastries	0.03	Chocolate Biscuit Bars	0.46
Ambient Condiments	0.09	Confect. & Other Exclusions	0.16
Dips	0.21	Healthier Biscuits	0.26
Olives	0.08	Savoury Biscuits	0.13
Pickles Chutneys&Relish	0.10	Sweet Biscuits	1.00
Salad Accompanimet	0.27	Frozen Confectionery	0.36
Sour&Speciality Pickles	0.13	Total Ice Cream	1.00
Table Sauces	0.31	Chocolate Confectionery	2.25
Ambient Rice&Svry Noodles	0.48	Gum Confectionery	0.09
Cous Cous	0.02	Ice Cream Cone	0.01
Dry Pasta	0.24	Sugar Confectionery	0.60
Dry Pulses&Cereal	0.06	Crisps	0.94
Dry Food	0.03	Nuts - Savoury	0.25
Instant Hot Snacks	0.12	Popcorn	0.06
Packet Soup	0.12	Savoury Snacks	0.87
Ambient Cooking Sauces	0.85	Colas	1.01
Cooking Oils	0.33	Flavoured Milk	1.34
Ethnic Ingredients	0.22	Lemonade	0.15
Flour	0.12	Mineral Water	0.40
Herbs&Spices	0.18	One Shot Drinks	0.43
Meat Extract	0.37	Other Soft Drinks	0.65
Pizza&Bases	0.53	Shandy, Ginger Ale	0.05
Salt	0.03	Tonic, Soda Water	0.11
Stuffing	0.05	Total Fruit Squash	0.61
Sweet&Savoury Mixes	0.10	Beer&Lager	1.74
Vinegar	0.05	Cider	0.43
Ambient Sponge Puddings	0.02	Fortifed Wine,Fabs	0.42
Artificial Sweeteners	0.08	Sparkling Wine	0.44
Defined Milk&Cream Prd(B)	0.09	Spirits	2.35
Home Baking	0.42	Wine	3.37
Instant Milk	0.02	Bar Soap	0.05
Lemon&Lime Juices	0.01	Bath&Shower Products	0.31
Milkshake Mixes	0.03	Body Sprays	0.38
Mincemeat	0.01	Liquid Soap	0.13
Nuts - Sweet	0.06	Shaving	0.07
Powd Desserts&Custard(B)	0.09	Skincare	0.33
R.T.S. Custard	0.06	Sun Care	0.05
Rts Desserts Long Life	0.08	Talcum Powder	0.01
Ready To Use Icing	0.03	Hair Colourants	0.10
Sugar	0.31	Hair Conditioners	0.15
Syrup & Treacle	0.03	Hair Styling	0.11
Table&Quick Set Jellies	0.03	Shampoo	0.26

Table N.3: *Product categories (3)*

Category	Spending share (%)	Category	Spending share (%)
Analgesics	0.18	Firelighters&Log	0.01
Cold Sore Treatment	0.00	Household Cleaners	0.41
Cold Treatments	0.16	Household Food Wraps	0.21
Contact Lens Cleaners	0.01	Household Insecticides	0.01
Eye Care	0.01	Kitchen Towels	0.36
First Aid Dressings	0.02	Lmscle Rmvrs&Water Softener	0.04
Foot Preparations	0.03	Machine Wash Products	1.00
Hayfever Remedies	0.03	Shoe Care Products	0.01
Oral Lesion&Teething Mrkt	0.01	Toilet Tissues	1.18
Sleeping Aids	0.01	Wash Additives	0.11
Smoking Cessation	0.04	Washing Up Products	0.49
Spray Insecticide	0.00	Dental Cleaners	0.35
Stomach Treatments	0.11	Mouthwashes	0.12
Topical Antiseptics	0.02	Total Toothbrushes	0.15
Vitamins.Minerals&Splmnts	0.18	Cotton Wool	0.04
Air Fresheners	0.33	Feminine Care	0.28
Batteries	0.18	Moist Wipes	0.20
Bin Liners	0.15	Razor Blades	0.17
Bleaches&Lavatory Clnrs	0.26	Cat Litter	0.11
Carpet Clnrs&Stain Rmvers	0.06	Cat&Dog Treats	0.36
Cleaning Accessories	0.13	Dog Food	0.63
Electric Light Bulbs	0.06	Fish Foods	0.01
Fabric Conditioners	0.37	Total Cat Food Inc.Bulk	1.35
Facial Tissues	0.24		

Notes: Based on authors' calculations using Kantar's Worldpanel Take Home Panel, 2002-2021. Reported spending shares are means across years.

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