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Price Differentials among Brands in Retail Distribution: Product Quality and Service Quality*

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Abstract. A theoretical model is proposed to disentangle the contribution of brand quality and retailer service quality in explaining brand price differentials across retailers. Two testable hypotheses emerge: i) for each brand type, price differences across retailers are independent of brand quality differentials, and ii) at a given retailer, price differences between different brand qualities are independent of service quality differentials. Our empirical analysis, for a sample of UK grocery retailer prices, discloses that retailers that offer higher service quality sell same quality brands at higher prices. In particular, service quality premia amount to 6% for national brands and are in the range of 9-15% for low-quality store brands. Besides, at a given retailer, the price premia paid for the national brand are very large: around 150% between national brands and low-quality store brands, and around 40% between national brands and high-quality store brands. Also, the price differential between the national brand and the low-quality store brand does not increase with service quality.

JEL Classification: C70, L13, L20, J50, J52

Key words: Store Brands, Brand Quality, Service Quality.

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1 Introduction

The selling of simple products like food and household goods is becoming a very complex matter. Traditional grocery retailers, like supermarkets, face the competition from discounters that fight for customers who are increasingly more concerned about price and quality. National brands receive vigorous competition from private label products and the service level at various retailer types is fairly different. As a result, prices of similar products vary considerably across retailers. The comparative quality of national brands and private labels can explain a portion of the price gap between them; another portion can be explained by the higher service level under the supermarket format. This paper develops a model of retail competition that accounts for both sources of quality and then measures their contribution in explaining (the observed) price differentials for a sample of UK grocery retailers.

The U.K. grocery market was worth £177.5 billion in March 2015. Groceries account for 9 percent of total household spending in the U.K., making it the third largest area of expenditure, following housing and transport. Four supermarket chains dominate UK food retailing, accounting for 71.7 % of the market. Tesco is the market leader, with 27.7 % market share, followed by Sainsbury's with 16.6 %, Asda/Wal-Mart with 16.4 % and Morrisons with 10.8 %. The combined market share of discounters Aldi (5.6%) and Lidl (4.4%) reached, at the end of 2015, 10 % of the British grocery market for the first time. [1] There are substantial differences in the scale, strategy and product offering of the different firms.

Grocery retailers are competing within a relatively mature market. Stable population limits growth of food consumption. Food expenditure (other than eating out) accounts for a declining share of household budgets. This has driven multiple retailers to fiercely compete for market share through multifold strategies such as price, range and service; retailers have shifted to premium products, diversified into non-grocery products and services, enlarged existing stores and opened high-street convenience stores. That is, retailers' strategies include three relevant dimensions: 1) price, 2) brand quality competition, and 3) retailer differentiation. Many retailer businesses have introduced private labels in a large number of product categories. Private labels or store brands make their packaging, sizes and labelling extremely similar to those of the national brand - feature or horizontal differentiation. In contrast, vertical differentiation is quality-driven, where private labels are usually perceived as a lower quality substitute to the corresponding national brands. Thus one expects price differences as a response to brand quality differences; differently, when consumers view both brand types as highly substitutable (because the quality gap closes) the retailer can effectively increase

[1] Source: Kantar Worldpanel, market share summary, 12 weeks to Nov 8, 2015.

the store brand prices, keep the price differential low, and still maintain healthy sales. Additionally, many grocery retailers have adopted a two-tier store brand strategy. Premium store brands are positioned in terms of quality to compete with the highest-quality national brands. Therefore, we envision higher price differentials regarding standard low-quality store brands relative to premium high-quality store brands in retailers' efforts to appeal to price sensitive consumers.

However, customers not only weigh up quality of product but also service against the money involved in buying groceries. In a broad sense, retailers' differentiation strategies regarding the level of service quality encompass location, the assortment of brands[2] and any characteristics related with the store format (such as shop ambience, aisle space, easy navigation, size of parking areas, queuing times, opening hours, number of credit and debit cards accepted and helpfulness of staff). The conventional supermarket format provides a higher service quality level than the discounter format, where there is a limited selection of items, stores are relatively small and few services are offered to consumers.[3] Given the vertical differentiation feature of service levels, prices at discounters are very low and we therefore expect price differentials across retailers that are partly attributable to service quality differentials.

We offer a fairly general setting for multiproduct retail competition and develop a linear case in the spirit of Choi and Coughlan (2006). Our purpose is to establish the relevance of vertical differentiation features in explaining brand price differentials. The analysis combines two different sources of quality differentiation, one coming from the brand characteristics and name and another coming from the level of consumer service offered by the seller; this allows us to find how the demand interactions among differently valued brands can explain price differences within and across multi-product retailers. Equilibrium prices are compared. Thus, the service quality premium enjoyed by high service quality retailers should not be dependent on brand quality differences. Similarly, provided that store brands tend to imitate national brands, the price premium between brands at a given retailer is expected to be independent of service quality when in-store competition is strong. These two theoretical predictions are

[2]Responses to the consultation on the Office Fair Trade's Proposed Decision, particularly from individuals, made clear that access to a range of products of different stores (including independents) is valued by a significant number of consumers.

[3]In particular, focusing in the differences between supermarkets chains and discounters, it is common to observe that discounters concentrate on the so called value items, i.e. low price and simple packaged goods. They offer less products and less service quality than the supermarket chains. Davies and Brito (2004) report that many discounters operate with as few as four full time equivalent staff per store compared with the 200 or more in a superstore. And also that a supermarket chain may offer 20,000 product lines while a discounter only 1,500.

then checked empirically.

The price data are obtained from two supermarkets (Tesco and Sainsbury's) and a discounter (Kwik Save); the former offer two store brand qualities whereas the latter just one. We find empirical support of the two testable implications of our theoretical model. First, for a given product, we find that on average supermarkets charge higher prices than discounters, providing evidence in favour of the existence of service quality premium. Second, our results confirm the existence (both at supermarket and discounters) of meaningful brand quality premia that are independent of service quality. Further, we find evidence suggesting that supermarkets do not price high-quality store brands symmetrically with respect to national brands and low-quality store brands, since the price premium of high-quality store brands over low-quality store brands is much higher than that of national brands over high-quality store brands.

1.1 Related literature

Given the significance of the retail industry and the notable changes witnessed in the last decades, regarding store brands in particular, there has been considerable research, both theoretical and empirical, devoted to study why retailers introduce store brands, what determines their profitability, their effect on retailers' bargaining power, and product positioning, among other issues (see Dobson and Waterson (1999), Steiner (2004), Bergès-Sennou et al. (2004)). Sethuraman (2009) provides an excellent survey that consistently presents the analytical results from theoretical models and assesses their empirical validity.

Retailer competition has combined at least two strategies: the introduction of one or more store brands and the provision of different services to consumers. Regarding the former, the development of store brands has relevant strategic implications. Store brands are created and controlled by retailers who must consider two layers of competition. On the one hand, they compete with national brands; on the other, store brands help retailers to differentiate themselves from the competition (see Corstjens and Lal (2000), Sayman et al. (2002), Sayman and Raju (2004), Scott Morton and Zettelmeyer (2004), Choi and Coughlan (2006) and Groznik and Heese (2010) from a theoretical perspective; see also Cotterill and Putsis (2000), Ward et al. (2002) and Bontemps et al. (2008), among others, for empirical evidence that the increase in private label market share is consistent with an increase in the price of national brands).

Regarding service strategies, they can certainly give retailers a competitive advantage. Retailers of the same format, like supermarkets, target a similar consumer segment with

similar marketing policies. However, supermarkets and discounters provide different types of consumer benefits. Recent contributions that analyse this fact include Gonzalez-Benito et al. (2005), Gijsbrechts et al. (2008) and Cleeren et al. (2010), among others. These empirical analyses reveal that store characteristics, related to service level, determine consumer shopping patterns and the competitive structure within the sector, thus emphasizing an important stance in retail price competition. Therefore, it is reasonable to assume that both sources or retailer competition will affect brand price differentials, as a consequence understanding brand price differentials becomes fundamental since they are key for store brand performance (Dhar and Hoch (1997)).[4] In a related paper Davies and Brito (2004) empirically study price and quality competition across brands. Their approach differs from ours in several respects. They adopt the value system perspective in their analysis[5]. Then, their goal is to explain the price differences that arise among competing value systems on a selected number of category products in the UK grocery industry. In contrast with us, they focus on data on the transfer prices of goods and services from one value chain member to another and on the costs added within each value chain by different elements such as production, marketing and logistics. As noted above, our purpose is to decompose retailer price differences into that part coming from brand quality differences and that owing to service quality differences.

The next section sets out the theoretical model and delivers the results. Section 3 deals with the econometric model and the description of the data set, and the estimation. Section 4 concludes and Section 5 contains managerial implications and directions for further research.

2 A model of retail competition

We wish to specify a model of multiproduct retail competition. Consider an oligopoly with K price-setting retailers and N substitute products in a certain category. Each retailer k

[4]Testing the effect of quality on price differentials in the banana market, Wiggins and Raboy (1996) find that price premia associated with containerization (as a quality attribute) are quite robust and explain the bulk of inter-company price differences, whereas brand-name does not. Also, see Shepard (1991) for the gasoline retail market in Eastern Massachusetts. She finds price differentials consistent with the price discrimination hypothesis and inconsistent with cost-driven differentials. On average, the price differential at multiproduct stations is 9 to 11 cents higher than the differential across single-product stations. The higher differential comes largely from higher full-service prices. Finally, Delgado and Waterson (2003) find price differentials among retailers for tyres, basically a homogeneous product, on the basis of the scope of vertical integration.

[5]When a firm belongs to a superior form of organization, its competitive advantage is explained not only by its own value to the chain but also by how it is within the organization. The relevant actor is the full organization not each member (see Porter (1985)).

sells a subset I_k of products, $I_k \subseteq N$. The demand function of product i at retailer k is denoted by $D^{ik}(\sigma, \mu, p, \varepsilon)$, where p is the vector of all prices, ε the vector of all own and cross effects between products,[6] σ is an exogenous vector of parameters that indicate the service level provided by each retailer k, and similarly μ is an exogenous vector of parameters that indicates the quality level of each product. The demand function $D^{ik}(\sigma, \mu, p_{ik}, p_{-ik}, \varepsilon)$ is differentiable and continuous, downward sloping in own price, p_{ik}, and upward sloping in all other product prices, p_{-ik}. Besides, the demand function D^{ik} is positively related with the service level of retailer k, σ_k, as well as with the quality of product i, μ_i. Retailers need not carry the same products and may thus have different product lines; this presentation is general enough to allow for retailer differentiation. Finally, a retailer may carry its own store brand. The mere definition of store brand implies it is exclusively sold by a particular retailer and hence that product cannot form part of any other retailer's product line.

Each retailer is assumed to use product-line pricing as part of category management. If c_i denotes the unit cost[7] of supplying product i, the profit function of retailer k that sells I_k products in a given category can be written as follows:

$$\Pi^k = \sum_{i \in I_k} (p_{ik} - c_i) D^{ik}(\sigma, \mu, p, \varepsilon) \tag{1}$$

Retailers maximize category profits and simultaneously set prices in a one-shot game. The market equilibrium, p^*, is determined by the solution to the system of first-order conditions for all retailers, $\frac{\partial \Pi^k}{\partial p_{ik}} = 0, \ \forall i \in I_k, \ \forall k \in K$.

Assume that all the regularity conditions are satisfied so that the equilibrium exists, is a maximum and is unique. The equilibrium prices will be a function of σ, μ, ε and c the vector of all unit costs. In particular, and because own effects dominate cross-effects, the equilibrium price of product i sold at retailer k will be positively related with retailer k service level as well as with product $i's$ quality level. We thus expect price differences, between products sold at the same retailer, and between the same product sold at different retailers, to be a function both of service quality levels and product quality levels. In principle, and since a retailer will normally deliver the same service in its store to all products, on the one hand we hypothesize that the price premia between products sold at a given retailer should mainly be explained

[6] It is assumed that own effects dominate cross effects.

[7] The unit costs can be interpreted as wholesale prices paid by retailers to manufacturer producers. Then, linear contracts are implicitly assumed. Non-linear contracts could be introduced in the model. The analysis of contracts is beyond the scope of the present formulation; yet the properties of equilibrium prices we wish to note are not affected by this. For the sake of the exposition, any other type of costs are disregarded.

by product quality differences, and hence be independent of service level. On the other, if a product of a given quality is sold at different prices between retailers then those price premia should mainly be attributable to differences in the service levels provided.

The next subsection develops a linear setting where the general model applies to specifically note the hypotheses that will be tested.

2.1 A linear setting

Let us take three products and two retailers. Retailer 1 carries product 1, a national brand, and its own store brand, product 2, whereas retailer 2 just carries product 3, its own store brand. Quantities are denoted by q_i for $i = 1, 2, 3$. Further assume that retailer 1 offers better service quality than retailer 2. Consider then a representative consumer[8] utility function of the form (Dixit and Stiglitz (1977), Singh and Vives (1984)) and employed in Choi and Coughlan (2006):

$$U(q_1, q_2, q_3) = \sum_{i=1,2,3} \alpha_i q_i - \frac{1}{2}\left(\sum_{i=1,2,3} q_i^2 + 2\beta q_1 q_2 + 2\gamma q_1 q_3 + 2\delta q_2 q_3\right) \tag{2}$$

Maximization of U subject to the budget constraint results in the following system of inverse demands:

$$p_1 = \alpha_1 - q_1 - \beta q_2 - \gamma q_3 \tag{3}$$

$$p_2 = \alpha_2 - q_2 - \beta q_1 - \delta q_3 \tag{4}$$

$$p_3 = \alpha_3 - q_3 - \gamma q_1 - \delta q_2 \tag{5}$$

Parameter β measures the degree of substitution between products 1 and 2 (i.e. between the national brand and own store brand); parameter γ represents how substitutable are products 1 and 3 (i.e. the national brand and the competitor's store brand); and finally, δ measures the degree of substitution between products 2 and 3 (i.e. between the store brands). Alternatively, β can be thought of as a measure of in-store competition; γ as a "typical" inter-brand competition parameter; and δ as capturing intra-brand competition when store brands are positioned close together. Further note that α_i represents the intrinsic value of product i or its quality. Therefore differences between any pair of $\alpha's$ correspond to a vertical differentiation measure between any two products. We suppose that quality stems from two sources. In particular, we consider $\alpha_1 = \sigma_1 + n$, $\alpha_2 = \sigma_1 + s$ and $\alpha_3 = \sigma_2 + s$, where n stands for the quality of the

[8]Evidence provided in Choi and Coughlan (2006) indicates that consumers routinely buy and hold both national brands and private labels in quite a number of product categories. Such preference for variety is captured by the proposed utility-maximizing framework.

national brand and s for the quality of the store brand, where it is implicitly assumed that store brands are of equal quality, and $n > s$. Besides, σ_k stands for service quality at retailer k, with $\sigma_1 > \sigma_2$. These elements, σ_k, n and s are vertical differentiation features. The different coefficients that go with the prices reflect horizontal differentiation features.[9]

The system formed by (3)-(4)-(5) can be inverted to obtain

$$q_1 = \frac{1}{A}\left((\alpha_1 - p_1)(1-\delta^2) - (\alpha_2 - p_2)(\beta - \gamma\delta) - (\alpha_3 - p_3)(\gamma - \beta\delta)\right) \quad (6)$$

$$q_2 = \frac{1}{A}\left(-(\alpha_1 - p_1)(\beta - \gamma\delta) + (\alpha_2 - p_2)(1-\gamma^2) - (\alpha_3 - p_3)(\delta - \beta\gamma)\right) \quad (7)$$

$$q_3 = \frac{1}{A}\left(-(\alpha_1 - p_1)(\gamma - \beta\delta) - (\alpha_2 - p_2)(\delta - \beta\gamma) + (\alpha_3 - p_3)(1-\beta^2)\right) \quad (8)$$

where $A = 1 - \beta^2 - \gamma^2 + 2\beta\gamma\delta - \delta^2$ that must be positive for a concave matrix of own and cross effects and own effects dominate cross effects. We thus have a system of demand functions that satisfy the properties specified for D_{ik} above.

We may now pose the profit-maximizing problem of retailers as follows

$$\max_{p_1, p_2} \Pi_1 = (p_1 - c_1)q_1 + (p_2 - c_2)q_2 \quad (9)$$

$$\max_{p_3} \Pi_2 = (p_3 - c_3)q_3 \quad (10)$$

Solving $\partial\Pi_1/\partial p_1 = 0, \partial\Pi_1/\partial p_2 = 0$, and $\partial\Pi_2/\partial p_3 = 0$ – and checking that the s.o.c. hold – yields equilibrium prices p_1^*, p_2^* and p_3^* as a function of all parameters. Store brands usually have the same features and, although they are differentiated from national brands, they tend not to be differentiated (see Choi and Coughlan (2006)). This can be easily incorporated in the analysis by assuming that $\delta \longrightarrow 1$ and that $\gamma \longrightarrow \beta$. Consistent with this argument let $c_2 = c_3 = c$.

The price difference between brands 2 and 3, that is, within the same type of brand between retailers is given by,

$$\Delta_{23} = \frac{2(\sigma_1 - \sigma_2)}{3} \quad (11)$$

which means that the price premium is just a function of the service quality differential and therefore,

Hypothesis 1: *The service quality price premium across retailers is independent of brand quality differences and unit costs.*

[9] A model with product line competition between sellers that considers these type of competition can be found in Dobson and Waterson (1996); yet their analysis does not include differences in brand quality.

Likewise we can construct the price difference between brands 1 and 2, that is, between the national brand and the store brand sold at retailer 1. The difference boils down to

$$\Delta_{12} = \frac{1}{6}((1-\beta)(\sigma_1 + 2\sigma_2) + 3n - 3\beta s + 3c_1 - 3c(2-\beta)) \tag{12}$$

and we can conclude that, if in-store competition is strong ($\beta \longrightarrow 1$), then the price premium of the national brand over the store brand is basically a function of the difference between brand qualities and unit costs, that is,

Hypothesis 2: *The price premium of higher quality brands at a given retailer is independent of the service quality differential.*

The model can also be used with assuming Cournot competition. Using (3)-(4)-(5) in the profit maximization problem yields equilibrium quantities. Once these are substituted in (3)-(4)-(5) we can calculate the price differentials as above, superscript C. The price difference between the store brands turns out to be $\Delta_{23}^C = (\sigma_1 - \sigma_2)$. Finally, under the same assumptions as above, we have that

$$\Delta_{12}^C = \frac{1}{3}((1-\beta)(\sigma_2 - \sigma_1) + 3n - (2+\beta)s - c(1-\beta)) \tag{13}$$

Just as happens with Bertrand competition, if in-store competition is strong then the price premium is basically a function of the difference between brand qualities, and it is independent of the service quality differential, thus reaching the same conclusions as above.[10]

3 The econometric model and the data

3.1 Database description

The data used to test the above stated hypotheses are prices directly collected by the authors in three stores in the south of Coventry (United Kingdom). Two of them, Tesco and Sainsbury's, belong to the two supermarket chains with the largest market shares in the UK and the third

[10]The same sort of analysis can be carried out with five products. Retailer 1 carries three products and retailer 2 only two. One way to interpret such asymmetric product lines is that retailer 1 has two tiers of store brands, one of a higher quality than another, in addition to selling a national brand. Retailer 2 carries a national brand plus its store brand in that product category. We have to adapt the utility function to account for five products and the corresponding own and cross-effects. The same qualitative conclusions are obtained which confirms the findings with three products. Computations are available upon request.

belongs to Kwik Save, the largest discounter chain (at the time of data collection). Tesco and Kwik Save stores considered are located in Cannon Park shopping center and Sainsbury's is located approximately one and a half miles away.[11]

The data set is composed of 27 price observations for the leading national brands, the high-quality and the low-quality store-brand variants of 46 products taken from November 1995 to March 1997 on a fortnightly basis (but for the Christmas periods).

The criteria used to select the products for the sample are the following: (i) they should be present in the grocery basket of the representative UK consumer; and (ii) they should be available in three stores considered in the sample. Usually low-quality store brands are available in only one size and this is the size that we use for the analysis. The list of products used in the analysis can be found in Appendix A.

Our data, although twenty-years old, have some salient features that allow drawing sound conclusions on retailer pricing strategies that should be valid for the analysis of the current state of competition. First, both today and at the moment of data collection different service quality retailers compete in UK food retailing. In our sample we consider two high-service quality retailers (Tesco and Sainsbury's) and a low-quality one (Kwik Save). Nowadays, high-service quality supermarkets such as Tesco, Sainsbury's and Asda compete with low-service quality discounters such as Lidl or Aldi. At this point, we should acknowledge discounters' increasing market share in the last years could influence supermarkets' strategic pricing, an issue that our data does not capture. Second, in our data we consider the existence of food-retailers offering different product lines; whereas Tesco and Sainsbury's sold national brands and high and low-quality store brands, Kwik Save sold only national brands and low-quality store brands. At the moment the situation is similar, main supermarket chains keep the same three-tier structure, and Lidl and Aldi sell low-quality store brands together with a reduced number of store brands.

3.2 Characterising supermarkets and discounters

The supermarket outlets considered in our analysis (belonging to the Tesco and Sainsbury's chains) belong to the superstore format. With a floor space over 25,000 square feet and located out of town, these superstores sell a large range of food and non-food products. The discounter outlets with a floor space between 6,000 and 12,000 square feet sell also a range of food and non-food products but more limited in size than the supermarket range.

[11] Cannon Park Shopping Centre included a few small shops, a pharmacy from a national chain, Tesco and Kwik Save.

Supermarkets and discounters differ in the level of service quality they offer. The first element determining this difference in service quality is the shopping environment. Supermarkets offer a nice shopping atmosphere with wide aisles, tidy shelves and big number of check-out lines to assure short queuing times and convenience. In contrast, in Kwik Save aisles are narrower, products are just piled up on the shelves, the number of check-outs is small, queues are frequent, etc. Supermarkets accept all major debit and credit cards whilst Kwik Save only accepts some of them. Supermarkets offer loyalty cards with accumulative points that later on will be transformed in monetary discounts, and the possibility of using them in the own supermarket petrol station. Supermarkets also offer banking services and the possibility of home shopping via internet. Supermarkets offer wider opening hours. Finally and more importantly, supermarkets offer a larger range of products making possible the desired one-stop shopping and reducing in this way the cost of shopping in terms of time. Therefore, service quality is higher for supermarkets than for discounters.

Supermarkets and discounters also differ in the rank of quality variants sold. Large UK supermarkets chains, such as Tesco and Sainsbury's, sell three quality variants for most of the products they sell. From higher to lower quality they are national brands (manufacturer-branded products), high-quality store brands, and low-quality store brands.[12] Discounters such as Kwik Save only sell national brands and low-quality store brands, i.e. they do not sell the intermediate quality.

The national brands sold under the manufacturer's brand name are marketed under intense manufacturer advertising and product development, and are provided with identical specifications to all the retailers (e.g. Heinz Baked Beans). Therefore, we assume the quality for a national brand to be the same for all the retailers considered.

UK supermarkets introduced high-quality store brands more than 30 years ago to compete directly with the national brands. These products are located on shelves very close to the national brands and tend to mimic very closely their packaging and presentation (Corstjens and Corstjens, 1995). They are sold under each supermarket brand name: Tesco and Sainsbury's (for example, Tesco Baked Beans and so on).

The low-quality store brand products (the lowest quality variant) were introduced in UK supermarkets from 1993 onward. Their development was a reaction to the arrival in the UK of Continental discounters that offered a limited range of tertiary brand products sold at very reduced prices. The products of this quality variant can be characterized as basic products of

[12]This two-tier store brand strategy is not unique to UK supermarkets, Steiner (2004) also identifies it for Wal-Mart in the US.

manifestly lower quality that are sold at very low prices. Supermarkets have tried to avoid sales cannibalization between the two store brand variants by means of differentiation. Specifically, the two supermarkets sell high and low-quality store brands under different brand names and with completely different packaging. Whereas the high-quality store brands are sold just under the supermarket brand name, the low-quality store-brands combine the supermarket denomination with another word that suggests their basic characteristics: Tesco Value or Sainsbury Essentials. In addition, whilst high-quality store brand products packaging mimics that of the manufacturers' branded products, the packaging of the low-quality store brands reflects the "value-for-money" approach that supermarkets pursue with them. The very nature of this quality variant precludes any possibility of outlet differentiation attached to brand quality. Consequently, we assume that high-quality and low-quality store brands in different retailers are assumed of equal quality.

3.3 Analysis of service-quality and brand-quality price premia

3.3.1 Introduction

To test price premia we use the following reduced form equation:

$$p^r_{j,it} = \beta_0 + \beta_1 D_T + \beta_2 D_S + \beta_3 D_T \times D_H + \beta_4 D_S \times D_H + \beta_5 D_N + \beta_6 D_T \times D_N + \beta_7 D_S \times D_N + \gamma_i + \varepsilon_{it} \quad (14)$$

where, $p^r_{j,it} = \frac{P^r_{j,\ it}}{P^{KwikSave}_{L,\ it}}$, i.e. all prices are expressed as a ratio with respect to the price of the low-quality store brand in the low service quality retailer (Kwik Save). r denotes retailer: Tesco (T), Sainsbury's (S), Kwik Save (K); j denotes quality variant: (national-brand (N), high-quality store brand (H), low-quality store brand (L)); $i = 1, \ldots, 46$ denotes products, and $t = 1, \ldots, 27$ denotes fortnights.

As for the variable definition, D_T is a dummy variable that takes value 1 if the price observation corresponds to Tesco and 0 otherwise; D_S is a dummy variable that takes value 1 if the price observation corresponds to Sainsbury's and 0 otherwise; D_H is a dummy variable that takes value 1 if the price observation corresponds to a high-quality store brand; D_N is a dummy variable that takes value 1 if the price observation corresponds to a national brand; and where γ_i are the individual effects that are considered as random effects, and ε_{it} is the error term. See Appendix B for estimation results.

By construction, $\beta_0 + \beta_1$ is the mean relative price of Tesco low-quality store brands, $\beta_0 + \beta_2$ is the mean relative price of Sainsbury low-quality store brands.[13] Analogously, $\beta_0 + \beta_1 + \beta_3$

[13]By construction β_0, the mean relative price of Kwik Save low-quality store-brands is equal to 1 as the

is the mean relative price of Tesco high-quality store brands and $\beta_0 + \beta_2 + \beta_4$ is the mean relative price of Sainsbury high-quality store brands. Finally, $\beta_0 + \beta_5$ is the mean relative price of Kwik Save national brands , $\beta_0 + \beta_1 + \beta_5 + \beta_6$ is the mean relative price of national brands sold by Tesco, and $\beta_0 + \beta_2 + \beta_5 + \beta_7$ is the mean relative price of national brands sold by Sainsbury's. Further, we can calculate mean price differentials among retailers for each of three brand qualities, and mean price differentials between brand qualities for each of the retailers. Table 1 shows the expressions used to calculate these differentials.

Table 1: Price differentials.

Between retailers for each brand quality (service quality)			
	National brands	High-quality Store brand	Low-quality Store brand
T-K	$\Delta_N^{T-K} = \beta_1 + \beta_6$		$\Delta_L^{T-K} = \beta_1$
S-K	$\Delta_N^{S-K} = \beta_2 + \beta_7$		$\Delta_L^{S-K} = \beta_2$
S-T	$\Delta_N^{S-T} = \beta_2 + \beta_7 - (\beta_1 + \beta_6)$	$\Delta_H^{S-T} = \beta_2 + \beta_4 - (\beta_1 + \beta_3)$	$\Delta_L^{S-T} = \beta_2 - \beta_1$

Between quality brands for each retailer (brand quality)			
	Kwik-Save	Tesco	Sainsbury's
N-L	$\Delta_{N-L}^{K} = \beta_5$	$\Delta_{N-L}^{T} = \beta_5 + \beta_6$	$\Delta_{N-L}^{S} = \beta_5 + \beta_7$
N-H		$\Delta_{N-H}^{T} = \beta_5 + \beta_6 - \beta_3$	$\Delta_{N-H}^{S} = \beta_5 + \beta_7 - \beta_4$
H-L		$\Delta_{H-L}^{T} = \beta_3$	$\Delta_{H-L}^{S} = \beta_4$

3.3.2 Service quality premium: hypothesis 1 test

In order to test Hypothesis 1 we proceed in two steps. First, we estimate the service quality premium of supermarket r over Kwik Save for brand quality j ($\hat{\Delta}_j^{r-K}$) as the ratio of the mean price differential between supermarket r and Kwik Save over the mean price at Kwik Save (for $r = T, S$ and $j = N, L$). Table 2 shows the estimates of these service quality premia. Our

reference price is always the price of Kwik Save low-quality store brand.

estimations suggest that the service quality premium enjoyed by Tesco and Sainsbury's (over Kwik Save) for national brands is about 6% ($\hat{\Delta}_j^{T-K} = 0.058$ and $\hat{\Delta}_j^{S-K} = 0.060$, and both are significant). All the tests use delta-method for calculation of the standard errors. As for low-quality store brands, the second column in Table 2 shows that the high-service quality retailers enjoy positive and significant service quality premia. These service quality premia are 9.2% and 15.4% for Tesco and Sainsbury's, respectively.[14] Second, we test whether, as established in Hypothesis 1, service premium is brand-quality independent. This implies to test the null that there are no differences between the service quality premium of national brands and low-quality store brands at Tesco and Sainsbury's. Thus, we estimate the following *differentials-in-premium*: $\widehat{dip^{T-K}} = \hat{\Delta}_N^{T-K} - \hat{\Delta}_L^{T-K} = \frac{\hat{\beta}_1+\hat{\beta}_6}{\hat{\beta}_0+\hat{\beta}_5} - \frac{\hat{\beta}_1}{\hat{\beta}_0}, \widehat{dip^{S-K}} = \hat{\Delta}_N^{S-K} - \hat{\Delta}_L^{S-K} = \frac{\hat{\beta}_2+\hat{\beta}_7}{\hat{\beta}_0+\hat{\beta}_5} - \frac{\hat{\beta}_2}{\hat{\beta}_0}$; and, test whether they are significantly different from zero. Our estimates confirm the brand-quality independence of the service quality premium for Tesco but not for Sainsbury's. Whereas $\widehat{dip^{T-K}}$ is not significantly different from zero, for Sainsbury's the service-quality premium associated to the low-quality store brands is 9% higher than that associated to national brands ($\widehat{dip^{S-K}} = -0.095$ with p-value=0.007). All in all, our estimations confirm a positive and sizeable service quality premia both for national brands and low-quality store brands. However, they only provide partial support for our Hypothesis 1: while for Tesco, as established in Hypothesis 1, the estimated service-quality premia associated to national brands and low quality store brands do not differ, for Sainsbury's it is not the case.

3.3.3 Brand quality premium: hypothesis 2 test

We also follow a two step procedure to test hypothesis 2. First, for each retailer r we estimate the brand quality premium of brand quality j over brand quality k ($\hat{\Delta}_{j-k}^r$) as the ratio between the mean price differential between brand qualities j and k over the price of brand quality k (for $j = N,\ H$ and $k = H,\ L$ and $j \neq k$; $r = T,\ S,\ K$). Table 3 shows the estimates of the brand quality premia for Kwik Save, Tesco and Sainsbury's in columns 1, 2 and 3, respectively. Consistently with the formal derivation in Section 2 we focus first on the two brand qualities that are sold by the three retailers (national brands and low-quality store brands). Our estimates suggest that the average premium of national brands over low-quality store brands

[14]For a matter of completeness, we test for differences between Tesco and Sainsbury's price premia both for national brands and low-quality store brands. Since we have assumed that both supermarkets offer similar service quality we expect these premia to be non-significant. Thus, we test whether $\hat{\Delta}_J^{S-T}$ for $j = N, L$ is significantly different from zero. It is shown in Table 2 that $\hat{\Delta}_N^{S-T}$ and $\hat{\Delta}_L^{S-T}$ are not significant at a conventional 5% level.

Table 2: Estimates for service quality premia

	National brands		Low-quality store brands	
T-K	$\hat{\Delta}_N^{T-K} = \frac{\hat{\beta}_1+\hat{\beta}_6}{\hat{\beta}_0+\hat{\beta}_5}$	0.058	$\hat{\Delta}_L^{T-K} = \frac{\hat{\beta}_1}{\hat{\beta}_0}$	0.092
		(0.000)		(0.004)
S-K	$\hat{\Delta}_N^{S-K} = \frac{\hat{\beta}_2+\hat{\beta}_7}{\hat{\beta}_0+\hat{\beta}_5}$	0.060	$\hat{\Delta}_L^{S-K} = \frac{\hat{\beta}_2}{\hat{\beta}_0}$	0.154
		(0.000)		(0.000)
S-T	$\hat{\Delta}_N^{S-T} = \frac{\hat{\beta}_2+\hat{\beta}_7-\left(\hat{\beta}_1+\hat{\beta}_6\right)}{\hat{\beta}_0+\hat{\beta}_1+\hat{\beta}_5+\hat{\beta}_6}$	0.002	$\hat{\Delta}_L^{S-T} = \frac{\hat{\beta}_2-\hat{\beta}_1}{\hat{\beta}_0+\hat{\beta}_1}$	0.058
		(0.868)		(0.058)

p-values between brackets.

ranges from 148% to 171% (e.g. at Sainsbury' s on average prices of national brands are 148% higher than those of low-quality store brands).[15] Second, we pairwise compare the average premium of national brands over low-quality store brands across retailers. If Hypothesis 2 holds, we should not find significant difference across retailers. These pairwise comparisons reveal that the average premium of national-brands over low-quality store brands is not service quality dependent. This is so since average premium is higher at Tesco and Kwik Save (two retailers with different levels of service quality) than at Sainsbury's ($\hat{\Delta}_{N-L}^T - \hat{\Delta}_{N-L}^S = 0.138$ with p-value 0.080; $\hat{\Delta}_{N-L}^T - \hat{\Delta}_{N-L}^K = -0.084$ with p-value 0.324; $\hat{\Delta}_{N-L}^K - \hat{\Delta}_{N-L}^S = 0.222$ and with p-value 0.004). Since we have data on the second-tier of store brands the analysis is also carried out to study price premia involving high-quality store brands. Thus, the estimated average premium of national brands over high-quality store ranges from 38% at Sainsbury' s to 40% at Tesco, and there is no significant difference between average premia across these retailers $\hat{\Delta}_{N-H}^T - \hat{\Delta}_{N-H}^S = 0.021$ with p-value 0.432). Finally, the estimated average premium of high-quality store brands over low-quality store brands ranges from 80.4% at Sainsbury's to 87.6% at Tesco. Again, the difference between these average premia at Tesco and Sainsbury's is not statistically significant $\hat{\Delta}_{H-L}^T - \hat{\Delta}_{H-L}^S = 0.072$ with p-value 0.234). A final observation is that our results indicate that differences between national and high-quality brands are smaller than the differences between the high-quality and low- quality store brands. This seems to be in accordance with the advanced explanation of the initial role of store brands as an instrument

[15]Dhar and Hoch (1997) report a price advantage for own brands that ranged from 24 to 44%. Also Davies and Brito (2004) find on average a 42.6% price premium paid for national brands when compared with the store-brands sold by supermarkets. The source of this price premium being the internal costs of brand manufactures, in particular, marketing costs (i.e. consumer advertising and trade marketing), employment costs and R& D expenses.

Table 3: Estimates for brand quality premia.

	K		T		S	
$N-L$	$\hat{\Delta}^K_{N-L}=\frac{\hat{\beta}_5}{\hat{\beta}_0}$	1.708	$\hat{\Delta}^T_{N-L}=\frac{\hat{\beta}_5+\hat{\beta}_6}{\hat{\beta}_0+\hat{\beta}_1}$	1.624	$\hat{\Delta}^S_{N-L}=\frac{\hat{\beta}_5+\hat{\beta}_7}{\hat{\beta}_0+\hat{\beta}_2}$	1.485
		(0.000)		(0.000)		(0.000)
$N-H$			$\hat{\Delta}^T_{N-H}=\frac{\hat{\beta}_5+\hat{\beta}_6-\hat{\beta}_3}{\hat{\beta}_0+\hat{\beta}_1+\hat{\beta}_3}$	0.398	$\hat{\Delta}^S_{N-H}=\frac{\hat{\beta}_5+\hat{\beta}_7-\hat{\beta}_4}{\hat{\beta}_0+\hat{\beta}_2+\hat{\beta}_4}$	0.377
				(0.000)		(0.000)
$H-L$			$\hat{\Delta}^T_{H-L}=\frac{\hat{\beta}_3}{\hat{\beta}_0+\hat{\beta}_1}$	0.876	$\hat{\Delta}^S_{H-L}=\frac{\hat{\beta}_4}{\hat{\beta}_0+\hat{\beta}_2}$	0.804
				(0.000)		(0.000)

p-values between brackets.

to target national brand competition. Summing up, our estimations confirm the theoretical model prediction of positive premia of higher quality brands. Further, they also suggest that the quality premium of national brands over high-quality store brands is not service quality dependent (confirming Hypothesis 2).

4 Conclusions and managerial implications

Different varieties of products are sold in different stores. Consumers have, therefore, several alternatives to satisfy their needs. Depending on their tastes they will be willing to buy either leading branded products (i.e. national brands) or low-quality store brands and they might also have a different willingness to pay for those products when purchased at retailers that offer high-quality service. As a consequence a plethora of prices can be found for the "same" good. Our paper is a contribution to the study of price dispersion not only among national brands themselves and store brands themselves but also between them; specially focusing on the role of quality and service. We have developed a theoretical model of retail competition that incorporates two sources of quality, one inherently linked to brand characteristics and the other linked to the retailer level of service. Then we have measured their contribution in explaining brand price differentials for a sample of U.K. grocery retailer prices. We find that at equilibrium the retailers that offer a higher quality service sell same quality brands at higher prices. We find econometric evidence that they amount to 6% for national brands and to a range between 9% and 15% for low-quality store brands. These price premia are explained solely by differences in service quality levels. Besides, at a given store, the price premia paid for the national brand is positive. These differentials are very large: around 150%

between national brands and low-quality store brands, around 40% between national brands and high-quality store brands. Also, the price differential between the national brand and the low-quality store brand for retailers with broader product range does not increase with its service quality.

Our findings suggest interesting interpretations and implications. The range of brand price differentials is quite wide. In particular, the service quality premia are low (between 6% and 15%) whereas the brand quality premia of national brands are much larger (around 150% with respect to low quality store brands and around 40% with respect to high quality store brands). These results are suggestive for retailers' strategies in their efforts to enhance performance. First, although offering a high service quality modestly contributes to price premia, these have been found to be more important for store brands. In other words, service differentials have a greater impact on low quality store brands price premia. Second, the price differentials between national brands and low-quality store brands are much higher at discounters, and this is not related to service. One could possibly attribute this premium to differences in the product line width, which implies less in-store competition between national brands and store brands at discounters, or maybe it is due to higher marginal retailer costs for national brands in discounters as compared to supermarkets attributable to unobserved differences in bargaining power. Third, provided that supermarkets offer similar service quality, the price premia happen to be greater between the two tiers of store brands. These pricing observations seem consistent with retailer strategies where high-quality store brands target the national brands whereas low-quality ones are meant to combat competition from discounters.

At the retailer level this is the simplest model structure that captures the interactions between different brands at a given retailer and same brand types across retailers. Some limitations of our study also suggest promising extensions. We have neither examined how much of an increase in the quality gap between brands, or in the service quality gap between retailers, is passed through to final prices nor how that may affect retailer profits. Another limitation is related with not having given a role to upstream producers. These have a say in positioning strategies of national brands as well as in fixing the terms of payment to downstream retailers.

Further research should inquire into the contribution of particular items associated with service quality. More detailed information would allow us to identify which attributes are more valued by customers, which would eventually help retailers in the design of their marketing strategies regarding price and building loyalty. Another fruitful line of research is to explore how the bargaining power of upstream manufacturers and downstream supermarkets finally determine prices and consequently their profit margins.

Appendix A: List of products

Baked Beans in Tomato Sauce 425grs	Orange Juice 1 litre
Beer 330ml	Oven Chips 1810grs
Bleach 2 litres	Pasta Sauce 475grs
Canned Peas 400grs	Pasta Sauce 475grs
Canned Spaghetti 200grs	Peach Halves in Syrup 415grs
Canned Sweet Corn 340grs	Salad Dressing 285grs
Canned Tomatoes 400grs	Salted Crisps (Multipack. 6 packs)
Cat Food 400grs can	Sanitary Towels (16 units)
Cola 2 litres	Shower Gel 500ml
Conditioner 2 litres	Smoked Back (8 slices)
Cornflakes 500grs	Soap 250grs
Deodorant 150ml	Spaghetti 500grs
Dog Food 400grs can	Strawberry Jam 454 grs
Fish Fingers (10 units)	Strawberry Yogurt 200grs
Flour 1.5kg	Tea 250grs
Frozen Peas 340grs can	Tissues (90 units)
Hair Shampoo 400grs	Toilet Roll 4 rolls pack
Instant Coffee 200grs	Toothpaste 100ml
Ketchup 340grs	Tuna in Oil 200grs can
Kitchen Foil 450mm x 5m	Vanilla Ice Cream 750grs
Kitchen Towel (2 rolls pack)	Washing Powder 2kgs
Long Grain Rice 1kg	Washing Up Liquid 500ml
Margarine 500grs	White Bread 800grs
Mayonnaise 400grs	

Appendix B: Estimation Results

Table 4: Estimation Results

	Coefficient	p-value
Constant	1	0.000
D_T	0.092	0.004
D_S	0.155	0.000
$D_T \times D_H$	0.957	0.000
$D_S \times D_H$	0.929	0.000
D_N	1.708	0.000
$D_T \times D_N$	0.065	0.153
$D_S \times D_N$		0.866
Number of observations		9936
R^2		0.348

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