How Do National Brands And Store Brands Compete?

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Abstract

This paper considers the nature of competition between national brands and store brands (otherwise known as *private label* or *own label* goods). We expound an analytical framework that allows for both price and non-price (quality) competition and use this to see how these different forms of rivalry interact in a setting where a leading retailer offering a store brand acts as both a customer *and* competitor to a national brand producer. This relationship thus entails both vertical and horizontal competition. We show that generally the retailer will seek to position its store brand as closely as possible to the national brand, by seeking to minimise the quality gap, but price the two goods very differently, with a wide price gap, as a means to segment consumers. Store brand introduction can lead to overall higher prices, so be against consumers' interest, unless there is intense head-to-head rivalry for value-conscious consumers. Intense rivalry is more likely to happen if the national brand producer can exercise some control over its own product's retail price (e.g. by being allowed to use maximum resale price maintenance) and has protection against copycat (lookalike) store brands ensuring a degree of differentiation between the competing products. Accordingly, we suggest that there are horizontal competition benefits on top of the usual vertical (alleviating double marginalisation) and intellectual property (to encourage brand investments) reasons to support respectively a more lenient policy stance towards RPM and a tougher stance against parasitic copycatting. The mix of horizontal and vertical aspects has important implications for undertaking market definition analysis in CPG markets, and specifically testing whether store brands and national brands are in the same product market. We highlight the considerable care needed in applying and interpreting the usual price and demand elasticity analysis used in market definition tests because of how segmentation and item-by-item retail pricing can distort demand and sales patterns.

Key words: Store brands, national brands, private label, competition, quality gap, price gap, segmentation

J.E.L. codes: K21; L13; L14; L40

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1. Introduction

Store brands – also known as *private label* or *own label* goods – are ubiquitous. They are an important feature of most sectors of modern retailing, ranging from apparel to home furnishing, DIY to electrical appliances, books to jewellery, pharmacy to financial services (Kumar and Steenkamp 2007). Indeed, they feature in almost every domain where retail store chains have become the dominant means of retail distribution and where consumers have built up a relationship to the extent that the retailers are viewed as brands in their own right, enabling them to commission and market products bearing their own store name or a registered exclusive brand name to compete alongside established producer-managed *national brands*.

The success and prevalence of store brands is nowhere more apparent than in the consumer packaged goods (CPG) sector – or otherwise called the fast moving consumer goods (FMCG) sector – with frequently purchased, low involvement, low cost food and non-food goods sold through supermarkets, mass merchandisers, discounters and drug stores. In the US, store brands sales through such outlets amounted to $112bn in 2013, representing 17.5% of sales in these channels (PLMA 2014a). In Europe, though, the market shares held by such store brands are typically much higher; over 40% by value in Switzerland, Spain and the UK, and averaging over 30% across EU countries (PLMA 2014b). Globally, store brands' market share has been increasing over time and represents around 15% of CPG sales (Nielsen 2011; Tristram 2014).

The emergence of store brands as an important feature of most consumer goods markets might appear as an obvious welcome development, not least for value-conscious consumers seeking an alternative to branded goods and for new suppliers able to compete without the normal risks and capital associated with having to develop and market producer brands. However, the overall impact on market outcomes from the increasing presence of store brands is not clear cut. For consumers, if store brands add to (rather than replace) existing products and thus increase product choice then this might generally be welcomed, but this does not necessarily entail lower prices and does not necessarily mean that the goods that they would ideally like are available, e.g. if their favourite brands are replaced by store brands or producers are less willing to make investments in improving quality or develop new products. Much depends on how competition is affected within the supply chain and whether store brands stimulate competition in a positive way or they lessen and/or distort competition in a detrimental way. This requires a careful understanding of how national brands and store brands compete, which is the focus of this paper.

With modern supply chains characterised by consolidation and concentration amongst both producers and retailers, driven by the need for efficiency and the growth of more successful businesses at the expense of weaker ones, it is possible that markets which have both strong national brands and strong store brands might offer the best of both worlds. Steiner (2004) argues that such a "mixed regimen" situation is where competition is at its most intense as brand producers fight to maintain their market positions through investing in product developments, innovation and marketing while having to be competitive on their supply prices as store brands try to compete through price and seeking to match quality. However, Steiner accepts this can be a delicate balance and it might tip one way, where one side ends up dominating, or the firms find ways to avoid intense competition (with the suggestion that information sharing and influence through category captaincy could facilitate collusion).

Nevertheless, we should not assume that effective competition simply relies on the dynamic of horizontal competitive pressure between a producer-controlled national brand and a retailer-controlled store brand, each vying for increasing their respective market share at the other's expense, just as with any other competitive relationship. Producer competition here necessarily involves trading with a distributor (as their customer) to reach final consumers. In this case, though, it is the very same retailer commissioning and controlling the store brand that is also retailing it and equally the same retailer buying and then reselling the national brand. The complexity of the relationship is because there is both a *horizontal* element to competition at the product level (and the battle for *market share*) and a *vertical* element to competition in trading between successive stages of the supply chain (and the battle for *profit share*).

These twin elements can give a retailer considerable power over a national brand producer when it holds both a gatekeeper position as an essential route for the producer to go through to reach final consumers and as the controller of the selling environment in which products are retailed to consumers. In this case, the retailer has all the in-store marketing levers at its disposal in determining which products to stock, how much shelf space to allocate to them, where precisely to position them, how much in-store promotion and attention to give them (including banners and shelf talkers), and how they are priced (in both a relative and absolute sense). The retailer will clearly adjust these levers to suit its own interests, and that could well mean favouring its store brands over national brands. However, it would only do so if such action were profitable and it had some degree of discretion, e.g. because retail competitors were behaving in a similar

way in trying to promote higher-margin store brands and consumers were willing to accept or not notice such behaviour (perhaps of a more subtle rather blatant nature).

By contrast, and without the retailer's in-store promotional support, the national brand producer can only exert indirect influence over consumers by how attractive it makes its products and how well it advertises and promotes them (e.g. with coupons) to arouse consumers' interest and create demand. In many instances, pioneering national brands have opened up and created whole new product categories, only for others including store brands to follow later. However, the worry for national brand producers in undertaking such innovation is that they will not be able to fully reap the rewards of their risky investments when store brands can simply mimic them and replace them. This is particularly the fear with "lookalikes" which go beyond me-too similar products to being blatant copycats plagiarising the brand's trade dress and then potentially misleading or even deceiving consumers.[1] Yet, there is a more general concern that store brands are often followers, using a second-mover advantage to free-ride on national brands' product design and marketing investments and then favoured in-store by retailers as their owners at the expense of national brands.[2] Moreover, these concerns are not just a matter for intellectual property law but they are intrinsically a competition law matter because of the way rivalry may be restricted or distorted in the marketplace to have an adverse impact on consumers.

Even so, national brands continue to perform well and typically outsell store brands in a wide range of product categories. While store brand share is generally increasing across countries its penetration rate varies quite significantly across product categories and types of retailers. The categories where store brands tend to hold high market shares are for commodity-type products which have little differentiation such as fresh food (fruit, vegetables, meat and fish), food staples (like eggs, milk and related dairy produce) and non-food commodities (like bleach), or where retail service is important such as freshly baked bread or delicatessen goods served by sales assistants. However, store brands' shares tend to be low where strong national brands predominate in categories when there is considerable scope for differentiation and distinctiveness (e.g. alcoholic and non-alcoholic beverages), where product trust and reliability is

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[1] Public policy to deal suitably with this matter remains under debate. For instance, the UK government is currently reviewing the enforcement provisions of the Consumer Protection from Unfair Trading Regulations 2008 in respect of copycat packaging (https://www.gov.uk/government/consultations/consumer-protection-copycat-packaging-call-for-evidence).

[2] Dobson and Chakraborty (2009) provide examples and illustrations of these aspects and discuss the different roles that national brands and store brands can play in supporting or hindering consumers' choice and welfare.

vital (e.g. baby food, diapers and tampons), or where product quality, formulation or design is not easy to match (e.g. cola, instant coffee and razor blades). Also, there is quite wide variation in the extent and emphasis that different retailers place on their store brand portfolios. Some retailers operate almost entirely relying on store brands (e.g. Aldi and Marks & Spencer) but most retailers operate with a mix of store brands and national brands, with some evenly split and others pushing in this direction.[3]

Over time, consumer acceptance of CPG store brands has increased and store brand ranges have spread across all main product categories. Moreover, the quality gap with national brands appears to have closed quite significantly in terms of performance (e.g. as tested by consumer bodies) as well as in terms of perception, as the negative stigma about store brands as cheap inferior alternatives has given way to an appreciation that they can offer a genuine quality-equivalent alternative as well as being innovative in their own right (e.g. with premium and gourmet store brands).[4] Nevertheless, there continues to be a marked price gap with national brands generally carrying a significantly higher retail price than corresponding store brands. This price gap averages around 20% in the US and 30% in Europe (slightly lower in countries like the UK, Netherlands and Italy, while higher in the likes of Germany, France and Greece). The price gap also varies across product categories, tending to be lower in categories like chilled and fresh food, ambient food and frozen food while higher for alcoholic and non-alcoholic drinks, confectionery and personal care, and more mixed for household and pet food (IRI 2013).

Accordingly, we observe quite a mixed picture, where store brand penetration rates vary according to the country, category, and retailer and while store brand quality is seemingly close to that of national brands a wide price gap generally persists.[5] Nevertheless, the march of store brands appears relentless. Retailers have over time expanded their ranges and moved into operating multiple tiers of store brands, such as providing consumers with a three-tier choice of "economy-standard-premium" marketed as "good-better-best", as well as other variants targeted

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[3] For instance, the big six UK supermarket chains (i.e. Tesco, Asda, Sainsbury's, Morrisons, Waitrose and the Co-operative) operate with a generally close to even split in the range 42-53% (Spary 2014). In the US, with the exception of Aldi and its subsidiary Trader Joe's, retailers' store brand shares tend to be lower but growing (Peckenpaugh 2013; Hale 2014).

[4] Boyle and Lathrop (2013) provide a review and synthesis of the US evidence on increasing store brand quality. *Consumer Reports* magazine scores private label and national brands on their performance (e.g. http://www.consumerreports.org/cro/magazine/2013/10/best-store-brands/index.htm). In the UK, *Which?* provides a similar service. However, for a very extensive range of assessments of the quality of UK store brands compared to national brands, see http://www.supermarketownbrandguide.co.uk.

[5] Sethuraman and Gielens (2014) provide a review of the different factors affecting store brand share.

at different consumer segments (e.g. "healthy", "organic", and "free from"). These sub-categories are expected to grow, but most sales will still be through mainstream standard me-too store brands.[6] However, the growth of store brands is expected to increasingly squeeze secondary ("B") brands rather than the market leading ("A") national brands. Inevitably, this will lead to categories becoming increasingly polarised with consumers' options restricted to a dichotomous choice between the leading national brand or a store brand (Rabobank 2011).

Given the enormous size of the CPG sector affecting essentially every consumer, how competition plays out in the sector is critically important for consumer and societal welfare. Ideally, there should be vigorous competition that provides the range and quality of products to satisfy consumers' needs and at keen prices. But with increasingly polarised consumer choice and high degrees of concentration at both producer and retailer levels, how sure can we be that competition will deliver such benefits?

This paper explores this issue through analytical modelling to provide insights on how national brands and store brands compete and then to consider the implications for industry participants and the consumers they serve as well as for the regulators and policymakers who oversee and promote competition in the sector. We model this competition at its most core level by considering the dual cooperative-yet-competitive relationship between a single leading national brand producer and a single leading retailer, dominant in their respective markets. We take account of the above described features of such markets, which allow for different consumer segments and different individual preferences supporting the presence of both a national brand and a store brand. In particular, we are interested to see how price and non-price competition interact, and particularly how store brand quality is determined relative to that of national brand quality and the consequences for resulting prices in the market. Will the store brand seek to position itself differently or the same as the national brand in terms of quality? Which is better for consumers?

In addressing these questions, we are particularly concerned about the robustness of any findings so we allow for different degrees of channel control and influence over price setting, ranging from this being national brand producer-led to retailer-led as well as more balanced control. However,

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[6] Multi-tier and multi-variant store brand portfolios are most advanced in the UK, but even here standard-level store brands continue to account for over three-quarters of all store brand sales amongst the leading grocery retailers (Spary 2014). In other countries, standard store brands remain dominant over subcategories (e.g. IGD 2013).

a general finding emerges across the range of scenarios considered. We find that the retailer will seek to position its store brand as closely as possible to match the quality of the national brand but that a large price gap may still prevail between the two products. This occurs because the retailer prefers to use the two products to achieve self-targeted consumer segmentation, by pricing the national brand high so it appeals and sells only to brand loyal consumers while pitching the store brand at a sufficient discount to capture consumers prepared to switch into buying the seemingly better value store brand. There are exceptions, such as when the retailer is restricted in its ability to match national brand quality or where the brand loyal segment is so small that the national brand is encouraged to fight for value-sensitive consumers. However, the segmentation outcome generally prevails for most market conditions examined. Furthermore, this is not necessarily a beneficial outcome for consumers and can lead to overall higher prices.

At the heart of the analysis lies the question of what a retailer can gain from developing a store brand to compete with the national brand. In essence, what advantage does the store brand provide the retailer? As we show, it can be an instrument to curb a national brand producer's channel power, obliging it to offer lower supply prices to the retailer. However, it can also provide the retailer with a tool to price discriminate with consumers self-targeting through their product selection, taking advantage of differences in consumers when some are prejudiced against store brands while others are not. In this sense, the retailer is very much in the ilk of Salop's (1977) "noisy monopolist" using the quality-equivalent store brand and spurious differentiation as a means to price discriminate between brand loyal and brand switcher consumers by selling the national branded product at a high price to brand loyal consumers and the store brand at a low price to switcher consumers, compared to selling only the branded product at an intermediate price to both consumer types.[7]

Does this mean that national brands and store brands do *not* actually compete? No, they still compete in both non-price (quality) and price terms, but it is important to understand how each constrains the other when it is the retailer that sets the prices of both products (and so controls the price gap) and it sets the store brand's quality relative to that of the national brand (and so controls the quality gap). The retailer's objective here is to maximise its own profit so it will set prices and relative quality in a way that suits its own interests, even if this gives rise to channel conflict with the national brand producer, which can suffer from its demand being choked off by

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[7] This argument and related analysis also features in Ward et al (2002), Perloff et al (2006; 2012) and Gabrielsen et al (2006), while Soberman and Parker (2004; 2006) reach similar conclusions.

its high retail price and losing sales to a copycat store brand pitched at a lower price. In this case, it might be better from a societal perspective to let the national brand producer be able to dictate or at least cap its own retail price. Prevailing policy has been very much against allowing producers to practice resale price maintenance (RPM), but we consider whether in this setting competition authorities might want to take a more lenient approach. We also consider whether public policy to restrict store brands copycatting national brands might also encourage more direct price competition.

Beyond these two policy matters, our analysis also raises other important questions for competition authorities, notably in respect of market definition analysis, which could be important in merger cases or industry inquiries. In other market contexts, where independent competitors each set their own prices and non-price variables, examining price gaps and price correlations, as well as demand patterns and diversion ratios, can be quite telling about the extent to which products are substitutes and whether they are in the same or different economic markets. However, given that prices are not independently set here and corresponding non-price decisions made in a manner that could intentionally segment consumers, the application of standard market definition analysis should be undertaken with considerable care. We discuss this matter and highlight where difficulties might arise and why incorrect conclusions might be drawn, particularly in considering store brands as being in separate economic markets to national brands.
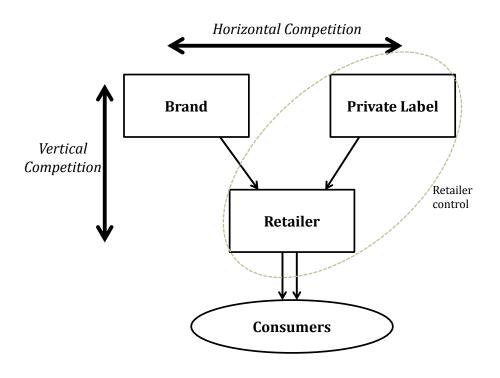
In all of this analysis and discussion, we are conscious that this is a complex subject and that no simple model can do full justice to the intricacies and multifaceted nature of competition in modern CPG markets. In explaining and developing our model, we carefully consider the assumptions being made and discuss their implications and alternatives. In this way, we hope that we are being as transparent as possible about the model and the interpretation and applicability of the findings, but also we are seeking to be helpful in suggesting where extensions and further lines of enquiry could be developed. This is a particularly rich topic and we hope that the present paper stimulates further analytical work as well as a deeper consideration and appreciation of the public policy issues. While the empirical work is large in this field and analytical work is flourishing, we are conscious that much more work is needed on public policy aspects as well as providing guidance for regulators and competition authorities and we hope that the present paper fills part of this void.
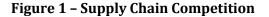
The rest of the paper is organised as follows. In the next section we set out our analytical framework, relating this to the existing research literature and picking up the key themes in the subsequent analysis, while setting out the model's assumption on consumer demand, firms' revenues and costs, and the structure and timing of decisions. In Section 3, we examine the market outcomes in the absence of a store brand, where only a national brand is available to cater for consumers' needs. In Section 4, we examine outcomes where the retailer introduces a store brand to compete with the national brand, distinguishing between the situation where there is market segmentation with the national brand targeted to brand loyal customers and the store brand targeted at brand switcher consumers and the situation where both products compete head-to-head for switcher consumers. In Section 5, we derive the equilibrium market outcomes, determining the store brand quality that the retailer will want to set relative to that of the national brand and the resulting equilibrium prices. In Section 6, we discuss the implications of our findings for industry participants, consumers, regulators, policymakers and competition authorities. Section 7 concludes the paper with a summary of the findings and suggestions for further areas of research.

2. Model Set-Up

2.1 Literature context [8]

Our interest centres on the relationship and interaction between a leading national brand producer and a leading retailer where there is a tension between the need to *cooperate* for the sake of their complementary roles as a producer and a distributor to create value by supplying goods to consumers and yet *compete* for how this value (i.e. profit) is shared. This tension is present in any supply chain trading relationship. However, the added element of tension with the presence of a retailer-controlled store brand is that the retailer is not only a competitor for a national brand producer in a *vertical* sense over profits as a *customer* (i.e. at successive stages of the supply chain) but also as a competitor in a *horizontal* sense as a direct *rival supplier* (i.e. at the same stage of the supply chain), so affording the retailer a *double agent* role (Bell et al 1997; Dobson 1998, 2005). This relationship is illustrated in Figure 1.

Figure 1 – Supply Chain Competition

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[8] This section has benefited by being able to draw on a number of very useful survey articles, including Bergès-Sennou et al (2004), Sayman and Raju (2007), Pauwels and Srinivasan (2009), Sethuraman (2009), Hyman et al (2010), Sethuraman and Raju (2012) and Sethuraman and Gielens (2014), which helpfully summarise and put into context what has now become a large literature on theoretical and empirical analysis of store brands and private labels.

How this tension and rivalry plays out is of interest not just in terms of how it affects the division of profits but how it affects outcomes for the supply chain and the market as a whole, and not least for consumers. Potentially, consumers have much to gain from the presence of store brands by adding to their choice set and spurring increased producer price competition (e.g. Mills 1995), but not necessarily if the benefits simply flow to the retailer and provide it with greater means of control over consumers, such as enhancing its ability to price discriminate (e.g. Soberman and Parker 2006). Indeed, the empirical evidence on the effect of the presence of store brands on overall prices is mixed.[9] More generally, what is even less well understood is how the combination of price and non-price competition is affected by these mixed vertical-horizontal relationships, which is the key theme of this paper.

Our aim here is to try to provide some clarity or at least general insights on the precise nature of the competitive relationship between national brands and store brands. This is necessarily a complex subject matter and our model does not seek to cover all aspects and angles. Notably, we couch our analysis in a very simple market structure which focuses on just a single national brand producer and a single retailer, so abstracts from the strategic considerations of other players like rival brand producers and rival retailers. Much recent research has focused on more complex market structures, and this has produced many fresh insights.[10] However, at issue here is to try to gain a more robust perspective on the one-to-one relationship between a leading brand producer and a leading brand retailer by considering a wide range of pricing arrangements, allowing for different extremes that might conceivably characterise how market prices are set at the wholesale and retail level.

In particular, as evident from Sethuraman's (2009) examination of the validity of analytical results from national brand and store brand competition models, the *decision structure* in these models is invariably of one type, namely Stackelberg leadership with sequential producer-then-retailer pricing, where producers make take-it-or-leave-it offers or negotiate wholesale prices

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[9] Some studies find brand prices increasing in response to store brand new entry, e.g. Kim and Parker (1999), Pauwels and Srinivasan (2004), and Ward et al (2002). For a review, see Sethuraman (2009).

[10] For instance, competition amongst different brand manufacturers allows for consideration of which national brand the store brand might seek to replace (e.g. Scott Morten and Zettelmeyer 2004; Sachon and de Albeniz 2009) or mimic (e.g. Sayman et al 2002). In addition, competition amongst different retailers allows for consideration of how store brands might be used to build store loyalty and soften competition through lack of direct price comparability (e.g. Corstjens and Lal 2000).

and then retailers unilaterally set retail prices.[11] There are few models which employ different timings of moves, whether simultaneous or retailer-then-producer price setting,[12] but at real issue is who has control in the trading relationship and the extent to which a party has influence over the other party's own price. Specifically, we will be considering situations ranging from the two opposite extremes where the brand producer has full control not just of its own NB wholesale price but also the brand's retail price, against the other extreme where the retailer has complete control over not just the brand's retail price but also its wholesale price, as well as the intermediate situation where each party independently controls its own price. As will be seen, this allows for consideration of an unusually wide set of market outcomes, but of particular pertinence will be the common findings in providing some assurance about their broad applicability and generality.

As well as accommodating the need for a wide array of different pricing arrangements in the market, the central purpose of the paper is to give consideration to the interaction of price and non-price competition between national brands and store brands. In particular, our main focus will be on a retailer's strategic positioning of a store brand in quality terms relative to a national brand and how this affects prices and choice in the market. To this end, we are mindful of the need to adopt a consumer demand set-up that can readily account for the joint presence of both a national brand and a store brand but is sufficiently versatile in allowing for considerable modelling flexibility with a simple parameterised structure. In this regard, our characterisation of consumer demand adopts the neat and intuitive formulation by Gabrielsen and Sørgard (2007), which marries together the notion of two distinct consumer segments with one brand loyal and the other prepared to switch products (e.g. Narasinham and Wilcox 1998; Corstjens and Lal 2000; Soberman and Parker 2004, 2006; Perloff et al 2012) and consumers differing in their individual willingness to trade off price against quality when making value-for-money product selections (e.g. Mills 1995, 1999; Bontems et al 1999; Bergès-Sennou and Waterson 2005; Heese 2010; Groznik and Heese 2010a; Fousekis 2010). However, our focus is very different to theirs as we address both product quality and pricing decisions to analyse a wide set of conceivable vertical and horizontal customer/competitor interactions. In particular, our emphasis is on actual and not just potential direct competition between a national brand and a store brand so that, rather

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[11] However, there are models which allow for greater scope than simple linear (wholesale-price-only) contracts to consider non-linear (e.g. two-part tariff or share of profits) contracts and other negotiated terms. For a recent example with comments on the extant literature, see Johansen (2012).

[12] A notable exception is Choi and Fredj (2013) examining a range of different timing sequences, but their focus is solely on price competition and they do not examine non-price competition addressed here.

than giving consideration to contracts that exclude competition, we are primarily interested in how vertical and horizontal competition may manifest itself between a national brand and a store brand and the strategic role that product quality and pricing decisions play in determining market outcomes.

In modelling consumer demand, we utilise an address model approach (i.e. which explicitly models consumers preferences in product characteristics space) in terms of discrete choices (buy one unit of a good or buy nothing) made by a spectrum of individual consumers differing in terms of their individual taste preferences for product quality, i.e. a vertical differentiation set-up in the tradition of Mussa and Rosen (1978), Gabszewicz and Thisse (1979) and Shaked and Sutton (1982). This framework suits our context where we are looking at consumers making a purchase decision in a single product category, where the products are sold in indivisible units (e.g. a 500g packet or 1lt bottle) and where consumers share the same view on the products' quality ranking but can differ in their willingness to pay for quality and where they are only looking to purchase one unit of one good. Nevertheless, the literature on store brands and private labels has used other approaches, including address models built on horizontal differentiation where consumers hold different views over quality rankings which might be suitable for when competing products are very different in their features, e.g. Soberman and Parker 2006 and Richards et al 2010, or a combination of horizontal and vertical differentiation when allowing for retail competition, e.g. Groznik and Heese 2010b and Liao and Yano 2013. In addition, yet other papers take a non-address approach (where product characteristics are left unspecified) looking at aggregate demand or where a representative consumer purchases a bundle of imperfectly substitutable goods which can be useful for an aggregate or sector-wide perspective, e.g. Raju et al 1995, Cotterill and Putsis 2000, Sayman et al 2002, Choi and Coughlan 2006, and Choi and Fredj 2013.

Much of the relevant literature treats the store brand's position as exogenously given, leaving the focus to be primarily about price competition. However, there are a number of papers like ours which provide formal modelling of how the store brand might be best positioned for the retailer's benefit. The findings generally point to the retailer best positioning the store brand close to the national brand. Four key reasons emerge. First, competitively supplied store brands offer the retailer higher margins so it is inclined to try to shift sales towards the store brands and away from the national brands, and so gain higher profits in the process, e.g. Raju et al (1995).[13] Second,

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[13] There are a large number of studies showing that percentage margins tend to be higher on private label goods, e.g. Hoch and Banerji (1993), Narasimhan and Wilcox (1998), Raju et al. (1995), Barsky et al. (2001),

closer competition makes the national brand less indispensable for generating high channel profits and so weakens its bargaining position vis-à-vis the retailer, e.g. Mills 1995 and Scott-Morten and Zettelmeyer (2004).[14] Third, high quality store brands help build customer store loyalty so soften retail competition, e.g. Corstjens and Lal (2000).[15] Fourth, creating high quality store brands in one product category could offer revenue synergies through a reputational benefit encouraging trial and store brand acceptance in other categories, e.g. Sayman and Raju (2004).[16] As we limit our attention to a single product category and a single retailer, our primary interest will be in the first two of these reasons.

Nevertheless, and despite these good reasons for positioning the store brand close to the national brand, there are also reasons why the retailer might prefer a more differentiated position. First, differentiation might allow store brands to serve different (e.g. value-conscious) consumers more effectively compared to national brands focused on the needs of other (e.g. quality-conscious) consumers, thereby allowing the retailer greater opportunity to segment and price discriminate amongst consumer types (Soberman and Parker 2006). Second, the store brand might want to position away from national brands when they are largely undifferentiated and already in intense head-to-head competition amongst themselves or prepared to fight aggressively to serve their existing customer base, say by the store brand offering different product features (Choi and Coughlan 2006). Third, if it is costly to imitate the quality and features of national brands then taking a differentiated position for a store brand might be more cost-effective and offer higher profit margins (e.g. Bontems et al 1999). Fourth, positioning the store brand close to national brand might trigger a strategic response that either escalates costs or weakens category demand, e.g. a cost escalation with the national brand trying to keep its distance from the store brand by improving quality and adding further features (Heese 2010) or reduced brand investment effort

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Sayman et al (2002), Pauwel and Srinivasan (2004), and Steiner (2004, 2009), but the counter is that absolute (dollar/euro) margins can be lower, e.g. Corstjens and Lal (2000) and Ailawadi and Harlam (2004).

[14] Empirical evidence also supports this view showing the introduction or growing presence of private label can allow the retailer to obtain lower wholesale prices on brands, e.g. Narasimhan and Wilcox (1998), Sayman et al (2002), Ailawadi and Harlam (2004), or better trade deals from brand suppliers, e.g. Lal (1990).

[15] For supporting evidence, see Sudhir and Talukdar (2004) and Ailawadi et al (2008).

[16] Sayman and Raju (2004) find support for such an "umbrella" effect where the number and sales of private label products in other product categories increase the sales of the private label item in the target category. Consistent with this motive and retailers' attempts to maximize private label share at the category level, Chintagunta (2002) finds private label prices to be set lower than category profit-maximising prices. Similarly, Sudhir and Talukdar (2004) suggest that loyalty and differentiation benefits for the retailer arising from private label are linked to the breadth of the private label range.

in advertising and product improvements causing market demand to contract or not reach its full potential (Sethuraman 2004).[17] Our primary interest will again be in the first two of these reasons but we do consider the other two as well.

Accordingly, the analytical framework we have in mind is one that is tractable [and we are able here to derive straightforward exact (closed-form) solutions for ease of comparison rather than needing to rely on simulations] and yet allows for a broad consideration of the mix and interplay of price and non-price competition between a national brand and store brand serving heterogeneous consumers. In particular, we are conscious of the need to examine the robustness of findings by allowing for a wide range of different pricing scenarios representing different degrees of channel control because of their potential to have significant influence on the strength of competing tensions, like whether the store brand should be positioned closely or differently to the national brand, whether it should be priced aggressively or softly, and whether it should be targeted at the same or different consumers. Importantly, we do find consistent results and these are helpful in discussing the implications for firms, consumers and regulators.

2.2. Outline of Model

To fix ideas, we focus on a product category sold by a retailer which holds a leading market position in the downstream market, e.g. a local monopolist. There is a single leading brand producer which sells a national brand (NB) in this product category and the retailer has the option of distributing the national brand exclusively or can introduce its own store brand (SB) to compete for sales with the national brand. Competition arises for the NB producer by the threat or actual presence of the store brand, which is assumed to be supplied by a third party under perfectly competitive conditions and so supplied to the retailer at its marginal cost of production. The retailer does not face direct retailer competition but does so indirectly by virtue of its customers having a maximum willingness to pay (i.e. reservation price) before they go elsewhere to buy their goods. This outside option for consumers can be thought of in terms of there being an alternative distribution channel which normally would not compete for same type of shoppers (e.g. a choice of perfectly competitive independent convenience stores serving consumers' *top-*

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[17] As Dobson and Chakraborty (2009) discuss, how a brand producer responds to store brands mimicking its position will depend on its ability to maintain its distance and the extent to which it can appropriate its brand investments to limit the extent to which store brands simply free-ride on these investments. For a range of possible brand producer responses to the threat of store brands, see Mills (1999), Du et al (2005), Kumar and Steenkamp (2007), and Nasser et al (2013).

up-shopping needs as compared to a dominant hypermarket chain store operator serving consumers' *one-stop-shopping* needs). In this way we abstract from the strategic consideration of other players in the supply chain to focus solely on the interaction between the two key trading parties. Clearly, we are cognisant that this simple structure loses some of the sophistication of more complex competitive settings, involving multiple interacting brand producers and retailers, and so narrows the set of issues that can be addressed, but as will become apparent it still allows for a rich set of considerations.

To this stripped-down market structure we add two key ingredients that appear as important features of NB and SB interaction and explain why product categories typically cater for the presence of both types of goods, but which also provide different analytical ways to conceive product substitutability. First, both goods serve the same general function for consumers and share the same general defining product characteristics (e.g. cornflakes, tomato ketchup or razor blades) but the two goods can be distinguished in vertical differentiation terms by their perceived quality, where we will assume an unambiguous quality ranking with the NB ranked as better or at least as good as the SB by all consumers. To be clear, we are viewing here the SB as a "me-too" "standard" store brand or private label seeking to emulate the NB and not as a distinctive "premium" store brand, in which case a horizontal differentiation framework might be more appropriate, where consumers differ over their quality ranking according their individual own tastes and preferences. Thus, all other things being equal, we would expect the SB price to be less than or at most equal to the NB price as otherwise no-one would buy the me-too SB.[18] Of central importance to the paper will be the retailer's quality choice of the SB, which we take as an endogenous choice variable rather than exogenously given. Thus the model accounts for NB and SB competition in both price and non-price (quality) dimensions.

The second critical ingredient we add is that the retailer's customers differ fundamentally in their preferences for the NB and SB and form two distinct consumer segments (e.g. Narasinham and Wilcox (1998), Gabrielsen and Sørgard (2007), Perloff et al (2012), *inter alia*). One segment is made up of consumers who will only consider buying the NB and on no account would ever contemplate buying the SB, which in their eyes is an unacceptably inferior product. These consumers are termed "Loyals", because of their unstinting brand loyalty towards the NB which means that even if the NB is over-priced to the point of exceeding their reservation price or if it is

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[18] In contrast, prices for premium store brands can often exceed those for national brands. For examples, see Kumar and Steenkamp (2007, chapter 3).

not stocked and delisted by the retailer then they would simply go elsewhere to buy the NB (i.e. exercise their outside option). The other segment is made of consumers who will consider buying either the NB or the SB but make their choice based on a careful consideration of their respective product qualities and the prices offered, selecting the one that offers them the better value for money for their own individual preference in trading off price against quality. These consumers are termed "Switchers", because of their willingness to switch products based on what offers them personally the better value. Of importance to our analysis will be the relative sizes of these two segments and the range of preferences amongst the Switchers in terms of their individual value-for-money and willingness-to-pay preferences ranging from low-end budget conscious consumers to high-end quality conscious consumers.

With these two ingredients, we can see why the retailer will desire to stock and sell the NB, because of its superior quality perception and because some consumers will simply not buy an alternative product. Equally we can see why the retailer would be interested to introduce and sell an SB because it can appeal to value-conscious Switchers and give the retailer some leverage in its dealings with the NB producer where otherwise it would be faced with a monopoly supplier. Similarly, we can observe the challenge for the NB producer that it will want to maintain its leading position in terms of sales in the category but it will not want to be drawn into a profit-destroying fight with the SB for the sake of maintaining sales if this simply results in diminished profit and instead it might want to fall back on the comfort of serving its secure base of brand loyal customers. For the retailer contemplating its choice of SB quality, it will have to think through how its decision will affect pricing behaviour in the market and whether it is desirable to provoke or avoid the prospect of intense head-to-head competition between the NB and SB. As will become apparent, much will depend on how retail prices are set.

With the framework outlined, we next set out the specifics on consumer demand, the costs faced by the industry players, and the structure and timing of decisions and degree of channel control.

2.3 Consumer demand

In terms of formalising consumer demand, we assume that the shoppers at the retailer are a mix of Loyals and Switchers. Each shopper buys at most one unit of an item in the product category, selecting between the NB and the SB (if it is available and at an acceptable quality) or buying nothing which offers zero utility. Switchers are prepared to consider all three options (i.e. buy

the NB, buy the SB or buy nothing), and will select between the NB and SB based on which offers the better value subject to it meeting their individual reservation price for the given product quality. In contrast, Loyals will only consider buying the NB and will do so as long as its price does not exceed their reservation price.

Let p_i denote the retail price of product i = 1, 2, where "1" indicates the national brand and "2" indicates the store brand and let $s_i \in [0,1]$ serve as a quality index for each of the two goods.

In respect of the demand from Switchers, we assume a conventional vertical differentiation set-up with a continuum of such consumers indexed by θ, uniformly distributed in the interval $[\underline{\theta}, \overline{\theta}]$ with unit density, $\overline{\theta} - \underline{\theta} = 1$, and $\overline{\theta} > \underline{\theta} > 0$. The taste parameter θ represents marginal willingness to pay for quality and the utility of a switching consumer of type θ buying quality s_i at price p_i is

$$V(\theta, s_i) = \theta s_i - p_i \quad \text{s.t. } \theta \sim U[\underline{\theta}, \overline{\theta}], \ \underline{\theta} > 0, \ \overline{\theta} = \underline{\theta} + 1$$

As we allow for the possibility of uncovered demand (i.e. some consumers opting not to buy anything from the retailer), we assume that $\overline{\theta}$ is close to unity and so $\underline{\theta}$ is just over zero and that way their ratio (i.e. $\overline{\theta}/\underline{\theta}$) is high, representing a wide spread of individual tastes (Choi and Shin 1992; Wauthy 1996; Liao 2008).[19]

In contrast, there are μ Loyals, where $\mu \lesseqgtr 1$. Loyals share a high willingness to pay for the NB, which we assume is the same taste parameter $\overline{\theta}$, such that their number can be increased by adding consumers at the top of the taste distribution for quality. The utility of a Loyal consumer buying the national brand is

$$V(\overline{\theta}, s_1) = \overline{\theta} s_1 - p_1$$

To reduce the notation, we normalise the NB quality to unity ($s_1 = 1$), and we denote $s_2 = s$ as the SB quality. We assume $s \leq 1$, so that SB quality cannot exceed that of the NB, but generally we will be considering the situation where the SB is a lower quality than the NB, i.e. $s < 1$, but look to see what happens as the quality gap, $1 - s$, narrows and in the limit the SB becomes an exact match in quality terms to the NB, i.e. $s \to 1$. Accordingly, the NB is the benchmark in quality terms, positioned at the highest feasible quality level, for which the SB has to measure itself against.

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[19] For instance, Wauthy (1996) shows that with no costs of quality – which we will be assuming – the uncovered demand outcomes are supported as sub-game perfect equilibrium outcomes when $\overline{\theta}/\underline{\theta} > 8.6581$. With fixed costs of quality, Liao (2008) finds the requirement to be $\overline{\theta}/\underline{\theta} > 4.7226$.

Implicitly we are assuming that for historical reasons the NB has moved first and committed to its quality level and then built its brand reputation around that quality level, leaving the SB as a second mover for the retailer to decide how close or distant it wants to position the SB quality relative to that of the NB. In such circumstances, and assuming that the costs associated with the quality choice have been already covered (i.e. past sunk costs rather than ongoing variable costs in nature), then the vertical differentiation set-up here lends itself to the first mover choosing the best available quality level (e.g. Choi and Shin 1992; Wauthy 1996).[20]

With the NB quality set at unity, the reservation price on the NB is $\overline{\theta}$, which represents maximum willingness to pay for both consumer types. If the NB price exceeds this level, and the SB does not represent any better and acceptable value, then consumers will not buying anything and instead exercise their outside option (which could be thought of as them leaving the retailer to buy a completely different brand from a completely different distribution channel).

Accordingly, a necessary and sufficient condition for Loyals to buy is that $p_1 \leq \overline{\theta}$, and if this condition is met then they will buy μ units regardless of how low is the price (i.e. their demand is fixed and being satiated they will pocket any consumer surplus, i.e. $(p_1 - \overline{\theta})\mu$). For Switchers, the necessary requirement to buy positive amounts is for $p_1 < \overline{\theta}$ or $p_2 < \overline{\theta}s_2$, but the actual amounts bought of each good will depend on whether only the NB is available (considered in section 3, where the requirement is $p_1 < \overline{\theta}$) or both the NB and SB are available (considered in section 4, where the requirement for positive quantities of both goods to be sold is $s/p_2 > 1/p_1 > 1/\overline{\theta}$). Unlike the binary nature of quantity bought by Loyals being either 0 or μ (i.e. rectangular demand with a flat demand curve at $p_1 = \overline{\theta}$ between 0 and μ units), quantity purchased by Switchers will increase the lower are the respective prices and the higher are the quality levels as more marginal consumers are brought into the market in a linear fashion, highlighting that total product demand from Switchers, denoted respectively for the NB and SB as $D_1(p_1, p_2, s)$ and $D_2(p_1, p_2, s)$, is both price and quality sensitive.

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[20] We have in mind the situation where the NB is well-established, having built its reputation and image around a specific quality level and formulation that is now trusted and accepted by consumers to such an extent that it is locked into this position at least for the short-term regardless of whether the retailer introduces an SB and at what price and quality level it selects for the SB. In line with Fousekis (2010), even with simultaneous setting of NB and SB quality then in our model the NB would position itself at the maximum possible level, leaving the SB to determine how close it would seek to position to the NB. However, for an alternative perspective that allows for NB producer to adapt its quality level and alter its market positioning in response to the position of an SB, see Heese (2010) and Nasser et al (2013).

The extent of overall product substitutability in the market is then captured both by how close is the SB quality relative to the NB quality and how small is the size of the segment of demand from Loyals relative to that of Switchers. The latter aspect is not just down to number of Loyals, measured by μ, but also relative to the maximum reservation price of $\overline{\theta}$. Accordingly, it will prove extremely useful to define the following term $\alpha \overset{\text{def}}{=} \mu/\overline{\theta}$ as a parameter measuring the relative number of Loyals to Switchers for a given $\overline{\theta}$, where a higher α means that the relative number of Loyals in the population increases. This term will feature extensively in our results.

2.4 Firms' revenues and costs

The NB producer and retailer each have the objective of maximising its own profit. Both parties have complete information in terms of understanding consumer demand, the decision structure for the timing and sequence of moves with product quality and availability determined before prices, and any costs in the industry. We assume that only one retail price applies for each product for all consumers, so ruling out *direct* price discrimination either through individual prices targeted to individual consumers (i.e. first degree price discrimination) or to different segments (i.e. third-degree price discrimination), but not necessarily ruling out *indirect* price discrimination where consumers segment themselves through their purchase choices in response to the prices offered and for their given quality preferences (i.e. self-targeted second-degree discrimination). Line revenue is then the price of the good, i.e. respectively p_1 and p_2, multiplied by the number of units sold, denoted respectively for the NB and SB as q_1 and q_2.

Even though the products have potentially different quality we work with the assumption of symmetric and constant unit supply costs, *c*, which for simplicity we normalize to zero. This assumption follows Gabrielsen and Sørgard (2007) but warrants further explanation.[21] We view product costs from the supplier as a combination of variable elements that make up the cost of production and distribution, e.g. ingredients, manufacturing, packaging, warehousing and physical distribution, as well as sunk investment costs that have gone into product design and marketing. As our interest is with products that serve fundamentally the same purpose and are essentially the same in their physical composition and appearance, then we take it that their

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[21] This assumption of constant and common unit costs is quite commonly used in such models as it aids mathematical tractability and supports the focus on gross category profits. For example, Sethuraman (2009) finds that 14 out of 22 papers reviewed use this assumption in their analytical models.

variable production and distribution costs will be broadly similar.[22] For example, while the national brand might have superior ingredients or be manufactured to a higher specification, this potential cost disadvantage compared to lower-quality smaller-volume retailer-specific store brands might be offset by superior efficiency associated with economies of scale (size advantages) and economies of experience (learning-by-doing advantages).

Apart from variable costs, quality differences in products can also relate to fixed costs which can come about through product invention, formulation and packaging design as well as initial marketing to support perceived quality differences, e.g. to build brand reputation and trust. We might expect the investment support to be high for a pioneering national brand, but we take such costs as fixed and sunk and past decisions (noting that we are assuming the NB is already at the top feasible quality position in the market with $s_1 = 1$). However, fixed costs for quality design might be considerably less for a re-engineered "me too" store brand not supported by marketing, and we take such fixed costs to be at a sufficiently low level that they do not impinge on the store brand quality level determined by the retailer, and without further loss of generality we discount them and set these fixed costs to be zero.

Nevertheless, even though the store brand might be able to replicate at minimal fixed cost the *physical* quality, performance and general appearance of the national brand by simple re-engineering, it might not be able to match its *perceived* quality at any reasonable cost when this is down to brand image and reputation built up over many years and especially if this is protected in respect of the national brand's trade mark, trade dress or other intellectual property rights. In this case, there might be an upper limit to the store brand's quality level in terms of how close it can go towards matching the national brand's quality. We allow for this possibility by contrasting the situation where the store brand is able to set any level it likes within the full quality spectrum, i.e. $s \in [0,1]$, against where it is constrained to a maximum level, $\bar{s} < 1$, with a restricted choice $s \in [0, \bar{s}]$.

Accordingly, in terms of product quality decisions the focus will be on the demand and revenue effects associated with competition rather than differences in costs. Nonetheless, as will become evident, our results would hold even with asymmetric variable or fixed costs as long as the cost

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[22] Clearly, this might not hold for very low quality store brands, like "budget" and "economy" private label ranges which use very cheap and inferior ingredients and packaging, but our interest is in what are essentially "me too" standard store brands which have to perform inline if not quite as good as their national brand equivalents. It is this type of store brands which still predominate in the market.

magnitudes and cost differences between the two goods were not too large. In addition, we capture cost obstacles restricting store brand quality through our examination of the effect of the retailer facing an upper limit to the quality level it can set and by consideration of the restrictiveness of the available quality range for the store brand.

For the retailer's costs, we assume that these comprise two variable elements covering cost of purchasing goods from suppliers to be resold and the associated retailing costs. We take the latter to be constant per unit and without loss of generality set this at zero.[23] For the former, we assume that the NB producer supplies the retailer at constant per unit wholesale price, denoted by w. As explained in the next sub-section we look at different scenarios as to how and when this wholesale price is set based on the extent to which one party has channel control. If in addition the retailer sells a store brand then this is assumed to be supplied on a perfectly competitive basis and at marginal production cost, which we have already assumed is zero.[24]

Summarising, there are two key demand parameters, $\overline{\theta}$ and μ (with the interactive term α), plus four variables, p_1, p_2, w and s, which determine market outcomes. The retailer's profit function when it commits to selling only the NB is $\pi_R(p_1, w) = (p_1 - w)q_1$ and the NB producer's profit function is $\pi_N(p_1, w) = wq_1$, while if the retailer sells both the NB and the SB then the two profit functions are respectively $\pi_R(p_1, p_1, w, s) = (p_1 - w)q_1 + p_1q_1$ and $\pi_N(p_1, p_2, w, s) = wq_1$.

For convenience and future reference, Table 1 provides a list and definitions for the mathematical notation used in the paper.

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[23] We ignore the retailer's fixed costs associated with operating stores while we are focusing on individual category decisions, but clearly any category-level profit made could contribute to the retailer's overall cost base.

[24] While it is commonly assumed that the wholesale price paid by a retailer on store brands are driven down to marginal cost levels by the retailer playing off desperately competitive suppliers against each other (e.g. by auctioning supply rights), in practice store brand suppliers can hold a degree of market power of their own when they are specialists in their field, provide unrivalled store brand product quality and build up a long-term relationship with the retailer. For example, see ter Braak et al (2013).

Table 1 – Mathematical Notation

Symbol	Values	Description
θ	$\theta \sim U[\underline{\theta}, \overline{\theta}]$	Taste parameter indexing Switcher consumers of unit density uniformly distributed between $\underline{\theta}$ and $\overline{\theta}$
$\overline{\theta}$	> 1	Maximum value of θ
$\underline{\theta}$	$= \overline{\theta} - 1 > 0$	Minimum value of θ
μ	$\lessgtr 1$	Mass of Loyal consumers (greater than, equal to, or less than unity, i.e. the density of Switcher consumers)
α	$\equiv \mu/\overline{\theta}$	The relative number of Loyals to Switchers for a given $\overline{\theta}$ (reflecting the relative number of Loyals in the total population)
s_1	$= 1$	National brand quality level (set at unity as a benchmark level)
$s \equiv s_2$	$\in [0,1]$	Store brand quality level (with feasible range from zero to unity)
$\overline{s}$	< 1	Maximum attainable level for constrained store brand quality
p_1		National brand retail price
p_2		Store brand retail price
$V(\theta, s_i)$	$= \theta s_i - p_i$	Utility function for a Switcher consumer of type θ buying good i (= 1, 2) at quality level s_i at retail price p_i
$V(\overline{\theta}, s_1)$	$= \overline{\theta} - p_1$	Utility function of a Loyal consumer prepared to pay up to $\overline{\theta}$ for the national brand (of quality s_1= 1)
q_1		National brand quantity sold
q_2		Store brand quantity sold
Q	$q_1 + q_2$	Total quantity of all goods sold
c	0	Unit production cost facing producers (set at zero)
$w \equiv w_1$	$\leq p_1$	National brand unit wholesale price
w_2	0	Store brand unit wholesale price (set at zero)
π_R	$= (p_1 - w)q_1 + p_2 q_2$	Retailer's profit as the product of the unit retail margin and the quantity sold for each available product
π_N	$= w q_1$	National brand producer's profit as the product of the unit price charged to the retailer and the quantity of the national brand sold
Π	$\pi_R + \pi_N$	Industry profit as the sum of the retailer's profit and national brand producer's profit
CS		Consumer surplus as the sum total of all individual consumer utility levels
TW	$\Pi + CS$	Total economic welfare as the sum of industry profit and consumer surplus

2.5 Decision structure and degree of channel control

We take the view that each firm's decision regarding product quality is a strategic variable involving longer-term commitment than prices, which are viewed as more flexible and more tactical in nature. This supports the use of a sequential decision structure where product quality

levels are determined first and then, in knowledge of which products are available and at which quality level, prices are determined. [25] With this sequential structure, we will be seeking to identify sub-game perfect equilibrium outcomes to characterise the set of equilibrium decisions and market outcomes.

In regard to product quality, as mentioned in section 2.3, we will be assuming that the NB producer has moved first and fixed its NB product quality at the maximum feasible level for a defined product in a given product category. We have in mind a standard manufactured consumer packaged food or non-food good with an established brand which operates with a consistent and recognised formulation and appearance and where all economic agents – industry participants and consumers alike – fully recognise the NB's top quality and image. Given this fixed and observable NB quality, the retailer then has the option to introduce a "me too" SB to rival the NB and decide on the SB quality relative to that of the NB. The SB quality choice is in respect of how consumers perceive the quality level when making purchase decisions, so it can extend beyond physical quality (which the SB might be more able to replicate) to less tangible aspects influenced by extrinsic cues such as the retailer's image (which can make it harder for the SB to match the NB).[26]

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[25] In contrast, Gabrielsen and Sørgard (2007) and Groznik and Heese (2010a) examine the situation where the NB producer can make a long-term commitment to the NB wholesale price and make this conditional on whether or not the retailer decides to offer a store brand, thus allowing for consideration of how the two parties could agree to NB exclusivity (i.e. a non-compete contract) that excludes the SB. This is an interesting line of enquiry and has potentially interesting applications but it does not match the setting we have in mind with longer-term product quality commitments and both wholesale and retail prices being somewhat more flexible, so they can be adjusted accordingly to realised demand conditions. We also have doubts about whether such exclusivity agreements would be enforceable in practice. First, the retailer will have an incentive to renege on such an agreement if it could promise exclusivity to obtain a lower NB wholesale price and then renege and introduce an SB and make more profit in the process (especially if there were a competitive threat from other retailers selling SBs). Second, it is not clear that either of the parties would want to go to court and suffer from the negative publicity by publicly admitting they agreed to a conspiratorial deal that would deny consumers choice of a cheaper alternative product. Thirdly, such an agreement might be viewed as anti-competitive in denying other (SB) producers access to the market so be challenged by competition authorities. Nevertheless, we accept that it is not impossible that such secret deals could exist and so, other than the cost of an SB being unusually high, they might explain why a retailer could be slow or reluctant to develop an SB in a product category.

[26] Accordingly here we are treating the NB's market positioning as being locked in by its image and reputation, which could have been established over many years or indeed decades, utilising a fixed formulation and appearance, whereas the SB is a later development and response to the NB's position. An alternative approach would be to look at where the NB has the opportunity to respond and re-position its product position in response to a SB challenge, e.g. Heese (2010) and Nasser et al (2013). Furthermore, we are assuming complete information so that consumers are aware of the NB and SB product quality before buying the good (e.g. based on their own prior experience or learning from other sources like reviews). An alternative approach is to consider SBs as experience goods, so that consumers need time to learn about SB product quality, e.g. Bergès-Sennou and Waterson (2005).

Following product qualities being set, there are three prices to be determined: the NB wholesale price (w), the NB retail price (p_1) and the SB retail price (p_2). As this is a market structure with successive dominant firms in the supply chain, it is not immediately clear whether one or other party would be able to dominate the other. In trying to keep the model straightforward and avoid a complicated bargaining analysis yet still allow for consideration of a wide set of possibilities, we consider three very different "Scenarios" regarding channel control. In all cases, we assume the retailer has unilateral control over the SB product quality and SB retail pricing decisions, but in the three scenarios we allow for very different perspectives on who controls the NB wholesale price and the NB retail price. The three Scenarios are as follows:

A. The producer has direct control over the NB retail price by de facto dictating the retail price to be set, as could be achieved by a contractual obligation like RPM,[27] as well as also dictating the NB wholesale price, i.e. a scenario with complete NB producer vertical control

B. The NB producer has no influence over the NB retail price or wholesale price and the retailer has full control and is unconstrained in simultaneously setting the NB price and NB wholesale price, i.e. a scenario with complete retailer vertical control

C. The producer has only indirect influence over the NB retail price by its ability to unilaterally dictate the NB wholesale price which the retailer takes as a cost and then in turn adds on its own margin in unilaterally determining the NB retail price, i.e. a scenario with separate and successive vertical control (where the producer can only indirectly influence the NB retail price by affecting the retailer's cost through the wholesale price level it sets in anticipation of the mark-up the retailer will subsequently add on).

To make these differences as explicit as possible, we assume unilateral decision making and contrast the extremes where under "Scenario A" the producer dictates both the retail and wholesale prices of the NB, which will entail setting them at the same level to extract all profits on the sales of the NB, while under "Scenario B" the retailer dictates both the retail and wholesale

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[27] To be precise, what is required is maximum RPM in the form of a produced-imposed price cap, e.g. contractually enforced as a condition of supply, but this might be achieved in other ways such as the NB products being supplied with printed price marks on the packaging or advertising the NB product price (so obliging the retailer to meet consumers' expectations). Analogously, but outside the scope of our model, it could be that the constraint on how high the NB price can be set is conditioned by retailer competition, e.g. where the retailer is constrained by wanting to match or beat the brand price that already exists in the market, i.e. already set by rival retailers, for example as part of a "price match" commitment or promise to its shoppers not to be beaten on brand prices, but necessary on store brands which are by their very nature not exact product matches. For instance, most of the leading UK supermarkets currently operate with such price promises on brand prices (King 2013).

prices of the NB, which will entail setting the wholesale price at the producer's marginal cost, here set at 0, to extract all profits on the sales of the NB. In practice, we might expect something less extreme, with bargaining over the wholesale price or over a lump sum fee in both scenarios as a means of dividing profits between the two parties. However, the key aspect that these two scenarios share in common is that they involve *efficient contracting*, in the sense that the transfer price does not impact on the retail price so joint profits are maximised from the trade, even if the allocation of these joint profits goes to opposite extremes, with the producer gaining all profits under Scenario A and the retailer gaining all profits under Scenario B. Nevertheless, it will become evident from our analysis that while there would be no difference between the NB producer or the retailer setting the NB retail price on the market outcomes for consumers when there is only the NB available, it could matter considerably when an SB is available to compete with the NB. This aspect goes to the heart of the double agency issue that we will be examining, as it alters the nature of the relationship between the NB producer and retailer in respect of the retailer acting both as customer and competitor for the NB producer and how this impacts consumers.[28]

Given these two scenarios are extreme alternatives, we also consider under "Scenario C" an intermediate case where both parties have a degree of market power, with the producer unilaterally setting the NB wholesale price and then the retailer unilaterally setting the NB retail price by marking up on the wholesale price. Specifically, we consider the commonly employed Stackelberg-type sequence of price setting, where the NB producer first sets a constant per unit wholesale price (independent of actual sales levels achieved) to maximise its own profit by

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[28] The contrast between Scenarios A and B really puts into perspective two very different situations that are not completely implausible. Scenario A focuses on the retailer's incentive to position and price the SB in a way that allows it to generate profits from a starting position of zero if it just sells the NB. Here, one could think of a situation where the retailer is obliged to retail the NB as it represents a "must-stock item", such that if it did not stock the product it would lose a significant number of its customers to rival retailers and in the process lose profits that it would make on sales in other product categories. In marked contrast, in Scenario B with the retailer calling all the shots, it is as if it owns or controls the NB with exclusive rights and so the product is really just an exclusive "premium" store brand but happens to carry a producer brand name rather than the store name, then leaving the retailer to contemplate whether to also offer a "standard" store brand as a cheaper alternative. The retailer could then control their positioning in tandem, for example pricing the premium SB for its special appeal to brand-conscious consumers and the standard SB serving less discerning value-conscious consumers.

anticipating the retail price that the retailer subsequently determines when taking this wholesale price as a cost and adding a mark-up to that level to maximise its own profit.[29]

This is a useful intermediate scenario to consider since it allows for the possibility of both parties making profits, which seems natural in such bilateral monopoly situations, without the need for formal bargaining analysis. However, its use comes with two caveats to bear in mind. First, it generally entails a first-mover advantage (because of *strategic substitutability* arising from the complementary demand relationship of the parties' respective services and with price rather than quantity being the choice variable), which *ceteris paribus* benefits the producer over the retailer. Second, it can result in *inefficient contracting* in the sense that joint profits might not be maximised when *double marginalisation* arises from the successive unilateral pricing decisions not internalising all externality effects, with the upshot that from a jointly optimising perspective the retail price can be set too high resulting in sub-optimal sales (and so in common parlance this leaves "money on the table" which more efficient contracting could extract). This is not just bad for the parties in forgoing profits. It is also bad for consumers when it entails them paying higher prices than they would otherwise do with more efficient contracting, so potentially a lose/lose situation; which can explain why competition authorities might be prepared to allow RPM under Scenario A, when it effectively acts as maximum RPM in imposing a ceiling on the retail price to avoid this kind of double marginalisation problem.[30]

Taking these three scenarios together, we should expect contrasting outcomes for the individual parties in terms of the profits they each achieve but what will also be interesting to see is what effect these will have on market outcomes for consumers, and so the breadth of these scenarios allow us to address several pertinent questions to see how consistent are the findings. For example, will the basis of how the NB retail price is determined make it more or less likely that an SB will be introduced? Will it influence the decision the retailer makes about the choice of

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[29] For example, Sethuraman's (2009) review of analytical models finds that 12 out of 22 papers used this Stackelberg wholesale-then-retail pricing set-up, and this trend has continued with a number of recent theoretical papers continuing to employ this form of price setting.

[30] To be clear, what the NB producer requires is maximum RPM to set a price cap so that the retailer can always set a lower price but cannot raise the NB price above the set threshold and thereby choke off NB demand, either to raise the retailer's own profit margin or favour SB sales. Competition authorities tend to take a more lenient view of maximum RPM of this nature, recognising its benefits in limiting prices while allowing retailers freedom to undercut each other if they so wish, rather than fixed or minimum RPM which prevents such intrabrand price competition.

quality of the SB relative to the quality of the NB? How will consumer prices and overall consumer welfare be affected by the choices made?

In proceeding with the analysis, we examine first (in Section 3), as a benchmark case, the situation where the NB is the only product available. We then move on to consider (in Section 4) the outcomes and nature of competition when there is a SB available to compete with the NB. We then compare the results (in Section 5) to determine the sub-game perfect equilibrium outcomes in respect of the product choices that are made available to consumers and their quality and the resulting market outcomes in terms of price and quantities and their net effect on profits for the different parties and consumer welfare (measured in terms of consumer surplus). Afterwards, we discuss (in Section 6) the implications of these results for the industry participants, consumers and regulators.

3. National Brand Monopoly

As a base case and reference point, consider the situation where the NB is the only product available. For the party determining the NB retail price, the choice is to serve just Loyals or both consumer segments. We consider these two choices in turn, comparing the outcomes under each of the three different scenarios for how the NB retail price is determined. For convenience and ease of comparison, all the results discussed in this section are summarised in Table 2.

3.1 Pricing the NB to sell only to Loyals

By pricing in a manner which targets Loyals but seeks to exclude Switchers, then regardless of whether the NB price is set under Scenario A, B or C (as characterised in section 2.5 above), the relevant profit function will be maximised by setting the retail price at the reservation price of the Loyal consumers, i.e. $p_1 = \overline{\theta}$. This puts Loyals in a position where they find it just worthwhile to buy the product but leaves them with no consumer surplus while the price level is such that it cuts off all sales to Switchers. Any higher level and all sales are lost. Any lower level and surplus is given away with no benefit of extra sales from Loyals who will buy μ units regardless of whether the retail price is at or below their reservation price level. So if the decision is to only target Loyals then price is set at $p_1 = \overline{\theta}$ and the resulting quantity sold is $q_1 = \mu$ and total profit generated is $\Pi = p_1 q_1 = \mu\overline{\theta} = \alpha\overline{\theta}^2$.

While in this case it makes no difference to consumers as to who sets the retail price, there will be clear differences in the division of total profit depending on who sets the NB retail price under Scenarios A, B and C. For Scenario A, the NB producer captures all the profits by setting both the retail and wholesale price at the same level, i.e. $p_1 = w = \overline{\theta}$ and so $\pi_N = wq_1 = pq_1 = \mu\overline{\theta}$. For Scenario B, the retailer captures all the profits by setting the wholesale price at zero, i.e. $\pi_R = (p_1 - w)q_1 = (\overline{\theta} - 0)\mu = \mu\overline{\theta}$. For Scenario C, and with just Loyals to be served, the NB producer, knowing that the retailer will be constrained in setting the retail price at the limit where Loyals will just be willing to buy, i.e. $p_1 = \overline{\theta}$, will set its wholesale price to extract all the profits, so set $w = \overline{\theta}$, thus earning $\pi_M = wq_1 = \mu\overline{\theta}$, but leaving the retailer with $\pi_R = (p_1 - w)q_1 = (\overline{\theta} - \overline{\theta})\mu = 0$.

3.2 Pricing the NB to sell to both Loyals and Switchers

When it comes to pricing at an affordable level to appeal to both segments, there is a balance to be struck in pitching the price at a level sufficiently low to attract a good number of Switcher consumers, who in addition to Loyal consumers result in increased sales, but not so low as to give away too much consumer surplus to the high-reservation-price inframarginal consumers, notably Loyal consumers, and in the process make less profits on sales to these consumers. With quantity demanded expressed as $q_1(p_1) = \mu + \overline{\theta} - p_1$, the available total profit is $\Pi = p_1 q_1(p_1) = p_1(\mu + \overline{\theta} - p_1)$. Under Scenario A, the NB producer would set the retail price to maximise this total profit. Likewise, the retailer would do the same under Scenario B. So in both scenarios the optimal price is $p_1 = \frac{1}{2}(\mu + \overline{\theta})$, resulting in sales of $q_1 = \frac{1}{2}(\mu + \overline{\theta})$ and total profit of $\Pi = \frac{1}{4}(\mu + \overline{\theta})^2 = \frac{1}{4}(1 + \alpha)^2 \overline{\theta}^2$. The difference is that all this profit would be captured by the NB producer under Scenario A and by the retailer under Scenario B.

While we can observe that the retail price, quantity and total profit are all increasing in both μ and $\overline{\theta}$, these levels are constrained by the retail price satisfying the requirement that it must be less than the upper threshold which chokes off all demand from Switchers. This is determined by the proportion of Loyals to Switchers for a given level of $\overline{\theta}$, represented by $\alpha \equiv \mu\overline{\theta}$, which if it exceeds a critical level then the retail price will be driven up so high as to cut off all demand by the Switchers. Specifically, in order for both segments to be served then $p_1 = \frac{1}{2}(\mu + \overline{\theta}) = \frac{1}{2}(1 + \alpha)\overline{\theta} < \overline{\theta}$, which can only hold if $\alpha < 1$. Comparing the two profits levels, we observe that the total profit is higher from serving just Loyals when $\alpha > 1$, and higher serving both segments when $\alpha < 1$.

Under Scenarios A and B, the efficient contracting between the retailer and NB producer ensures that the retail price is not influenced by any transfer price or wholesale price, so it does not matter if it is the NB producer or the retailer setting the NB retail price, as they would both choose the same level to maximise the available joint profits.

In contrast, under Scenario C, the combination of successive wholesale-then-retail price setting will result in double marginalisation when demand is variable. Here, the NB producer leads by first setting a constant per unit wholesale price, w, to maximise its own profit, and the retailer follows by taking this wholesale price as a cost and then seeking to add a mark-up to that level when unilaterally setting the retail price to maximise its own profit. Yet, serving both segments is only possible if $p_1 < \overline{\theta}$, which will mean in this Stackelberg-type leader-follower set-up that the

NB producer, in reasoning ahead as to the retail price that the retailer will subsequently set, will have to set the wholesale price with the restriction that $w < p_1(w) < \overline{\theta}$.

To see how much less the NB producer's wholesale price will need to be compared to the retail price set by the retailer, observe that the retailer's profit function is $\pi_R(p_1(w)) = (p_1(w) - w)q_1(p_1(w)) = (p_1 - w)(\mu + \overline{\theta} - p_1)$. Maximizing with respect to p_1 yields the retail price conditioned on the wholesale price as $p_1(w) = \frac{1}{2}(\mu + \overline{\theta} + w)$ and resulting quantity as $q_1(w) = \frac{1}{2}(\mu + \overline{\theta} - w)$. Anticipating this, the NB producer will set it wholesale price to maximise its own profit, taken as $\pi_N = wq_1(w) = \frac{1}{2}(\mu + \overline{\theta} - w)w$, and thus set $w = \frac{1}{2}(\mu + \overline{\theta})$, which in turn means once the retailer has added its mark-up the retail price will be set at $p_1 = \frac{3}{4}(\mu + \overline{\theta})$ and so generating sales of $q_1 = \frac{1}{4}(\mu + \overline{\theta})$, with the resulting profit for the NB producer at $\pi_N = \frac{1}{8}(\mu + \overline{\theta})^2 = \frac{1}{8}(1 + \alpha)^2\overline{\theta}^2$ and for the retailer at $\pi_R = \frac{1}{16}(\mu + \overline{\theta})^2 = \frac{1}{16}(1 + \alpha)^2\overline{\theta}^2$, with combined profits of $\Pi = \frac{3}{16}(\mu + \overline{\theta})^2 = \frac{3}{16}(1 + \alpha)^2\overline{\theta}^2$, which is less than would be earned under efficient contracting because of double marginalisation.

However, with the constraint on the retail price that $p_1 < \overline{\theta}$ then achieving these outcomes is only possible if $p_1 = \frac{3}{4}(\mu + \overline{\theta}) < \overline{\theta}$, which is satisfied only if $\alpha < \frac{1}{3}$ and this acts as a constraint on the circumstances under which both segments will be served. So, in contrast to outcomes under efficient contracting, inefficient contracting with double marginalisation provides less scope for serving both segments arising as an equilibrium outcome, requiring $\alpha < \frac{1}{3}$, as opposed to $\alpha < 1$ under efficient contracting.

In summary, when the proportion of Loyals to Switchers for a given level of $\overline{\theta}$, represented by $\alpha \equiv \mu\overline{\theta}$, exceeds a certain level then it is not in the firms' respective profit interests to serve both consumer segments but instead just target the NB at Loyals. The critical value of α depends on whether producer-retailer trading is characterised by efficient or inefficient contracting, in the sense of whether combined profits from the sale of the NB are optimised or not. With efficient contracting, under Scenarios A and B, and despite them being complete opposite extremes in terms of who controls the setting of the NB retail price and extracts all the generated profits, serving both consumer segments is profitable for a wider range of values of α, with the requirement that $\alpha < 1$, because efficient contracting allows for the retail price more effectively to be kept in check and not choke off demand to the Switchers. In contrast, the double marginalisation effect under Scenario C means that only low levels of α, precisely $\alpha < \frac{1}{3}$, will be

sufficient to ensure that the retail price is kept below the level that chokes off demand to the Switchers and for any higher levels of α then only Loyals will be served by the price being set exactly at their reservation price level.

Table 2 collects together all these results and shows the NB monopoly outcomes under each Scenario, with the first superscript denoting the Scenario (A, B and C) and the second superscript denoting the NB monopoly ("M") case, i.e. respectively superscripts AM, BM and CM. The conditions are shown for the values of α where only Loyals are served (i.e. with Switchers being effectively excluded from the market) and where both Loyals and Switchers are served (i.e. non-exclusion).

Table 2 – Outcomes with National Brand Monopoly

	Scenario A	Scenario B	Scenario C
NB wholesale price	$w^{AM} = \begin{cases} \overline{\theta} & \text{if } \alpha \geq 1 \\ \frac{1}{2}(\mu+\overline{\theta}) & \text{if } \alpha < 1 \end{cases}$	$w^{BM} = 0$	$w^{CM} = \begin{cases} \overline{\theta} & \text{if } \alpha \geq \frac{1}{3} \\ \frac{1}{2}(\mu+\overline{\theta}) & \text{if } \alpha < \frac{1}{3} \end{cases}$
NB retail price	$p_1^{AM} = \begin{cases} \overline{\theta} & \text{if } \alpha \geq 1 \\ \frac{1}{2}(\mu+\overline{\theta}) & \text{if } \alpha < 1 \end{cases}$	$p_1^{BM} = \begin{cases} \overline{\theta} & \text{if } \alpha \geq 1 \\ \frac{1}{2}(\mu+\overline{\theta}) & \text{if } \alpha < 1 \end{cases}$	$p_1^{CM} = \begin{cases} \overline{\theta} & \text{if } \alpha \geq \frac{1}{3} \\ \frac{3}{4}(\mu+\overline{\theta}) & \text{if } \alpha < \frac{1}{3} \end{cases}$
NB sales	$q_1^{AM} = \begin{cases} \mu & \text{if } \alpha \geq 1 \\ \frac{1}{2}(\mu+\overline{\theta}) & \text{if } \alpha < 1 \end{cases}$	$q_1^{BM} = \begin{cases} \mu & \text{if } \alpha \geq 1 \\ \frac{1}{2}(\mu+\overline{\theta}) & \text{if } \alpha < 1 \end{cases}$	$q_1^{CM} = \begin{cases} \mu & \text{if } \alpha \geq \frac{1}{3} \\ \frac{3}{4}(\mu+\overline{\theta}) & \text{if } \alpha < \frac{1}{3} \end{cases}$
NB producer profit	$\pi_N^{AM} = \begin{cases} \mu\overline{\theta} & \text{if } \alpha \geq 1 \\ \frac{1}{4}(\mu+\overline{\theta})^2 & \text{if } \alpha < 1 \end{cases}$	$\pi_N^{BM} = 0$	$\pi_N^{CM} = \begin{cases} \mu\overline{\theta} & \text{if } \alpha \geq \frac{1}{3} \\ \frac{1}{8}(\mu+\overline{\theta})^2 & \text{if } \alpha < \frac{1}{3} \end{cases}$
Retailer profit	$\pi_R^{AM} = 0$	$\pi_R^{BM} = \begin{cases} \mu\overline{\theta} & \text{if } \alpha \geq 1 \\ \frac{1}{4}(\mu+\overline{\theta})^2 & \text{if } \alpha < 1 \end{cases}$	$\pi_R^{CM} = \begin{cases} 0 & \text{if } \alpha \geq \frac{1}{3} \\ \frac{1}{16}(\mu+\overline{\theta})^2 & \text{if } \alpha < \frac{1}{3} \end{cases}$
Total profits	$\Pi^{AM} = \begin{cases} \mu\overline{\theta} & \text{if } \alpha \geq 1 \\ \frac{1}{4}(\mu+\overline{\theta})^2 & \text{if } \alpha < 1 \end{cases}$	$\Pi^{BM} = \begin{cases} \mu\overline{\theta} & \text{if } \alpha \geq 1 \\ \frac{1}{4}(\mu+\overline{\theta})^2 & \text{if } \alpha < 1 \end{cases}$	$\Pi^{CM} = \begin{cases} 0 & \text{if } \alpha \geq \frac{1}{3} \\ \frac{3}{16}(\mu+\overline{\theta})^2 & \text{if } \alpha < \frac{1}{3} \end{cases}$
Consumer Surplus (CS)	$CS^{AM} = \begin{cases} 0 & \text{if } \alpha \geq 1 \\ \frac{(\overline{\theta}-\mu)(\overline{\theta}+3\mu)}{8} & \text{if } \alpha < 1 \end{cases}$	$CS^{BM} = \begin{cases} 0 & \text{if } \alpha \geq 1 \\ \frac{(\overline{\theta}-\mu)(\overline{\theta}+3\mu)}{8} & \text{if } \alpha < 1 \end{cases}$	$CS^{CM} = \begin{cases} 0 & \text{if } \alpha \geq \frac{1}{3} \\ \frac{(\overline{\theta}-3\mu)(\overline{\theta}+5\mu)}{32} & \text{if } \alpha < \frac{1}{3} \end{cases}$
Total Welfare (TW)	$TW^{AM} = \begin{cases} \mu\overline{\theta} & \text{if } \alpha \geq 1 \\ \frac{3\overline{\theta}^2-\mu^2+6\overline{\theta}\mu}{8} & \text{if } \alpha < 1 \end{cases}$	$TW^{BM} = \begin{cases} \mu\overline{\theta} & \text{if } \alpha \geq 1 \\ \frac{3\overline{\theta}^2-\mu^2+6\overline{\theta}\mu}{8} & \text{if } \alpha < 1 \end{cases}$	$TW^{CM} = \begin{cases} \mu\overline{\theta} & \text{if } \alpha \geq \frac{1}{3} \\ \frac{7\overline{\theta}^2-9\mu^2+14\overline{\theta}\mu}{32} & \text{if } \alpha < \frac{1}{3} \end{cases}$

4. National Brand and Store Brand Duopoly

Having considered the situation where the NB was the only choice available for consumers, we now move on to consider the outcomes when the retailer develops a store brand (SB) and offers this alongside the national brand (NB). In principle, both products are available to all consumers when the retailer decides to offer both products. However, by assumption, the Loyals will ignore the SB and not buy it regardless of its price, but instead only consider buying the NB and indeed do so as long as the NB price does not exceed their reservation price, i.e. so long as $p_1 \leq \overline{\theta}$. So in this set-up, the SB can only appeal to Switchers and how many units they choose to buy will depend on the SB's absolute price but also its price relative to the NB price and the SB quality relative to the NB quality. In respect of the NB, this can also appeal to the Switchers as well, but likewise how many units Switchers will buy will depend on its absolute price and the relative prices and relative qualities between the NB and SB.

While it might be quite natural to consider the NB and SB competing head to head, fighting over the same set of customers, this is not only the possibility. In the present set-up, where Loyals are the natural focus of attention for the NB, it is not immediately obvious that it would be either in the NB producer's interest or the retailer's interest for both the NB and the SB to compete for Switchers. Specifically, if the NB were to compete for Switchers then the NB would have to be offered at a lower price than the Loyals' reservation price, so allowing Loyals to gain consumer surplus but at the cost to the firms of reduced profits made on these consumers. The lower the NB price to attract more Switchers, then the greater the foregone profits on Loyals but also the lower will have to be the price of the SB, and so the less profit that this product can make. Instead, profits might be higher if there were segmentation through self-selection by the respective consumer segments, with the NB priced in a manner to appeal just to Loyals and the SB offered at a lower price to attract Switchers.

However, whether targeted segmentation or direct head-to-head competition arises as an equilibrium outcome is likely to depend on who sets the NB price. Clearly the retailer will be inclined to give greater support to the SB over the NB if it helps to boost its own profits and undermines the NB producer's power, and segmentation might help to achieve this when the retailer can suitably manage both the NB and SB retail prices. In contrast, the NB producer might not wish to be limited to serving only Loyals but instead see benefits from obtaining higher sales volumes by attracting Switcher consumers, even if this means giving away some consumer

surplus to consumers with high reservation prices; though the ability of the NB producer to do this is likely to rest on how much it can control the NB price and prevent the retailer from choking off Switcher's NB demand by how it positions the SB. As we will see, it is not just NB and SB retail prices that matter but also the SB's quality relative to that of the NB, and the extent to which the retailer can affect the SB's perceived quality then the greater influence it will have to achieve the equilibrium outcome it desires.

We start by examining the more straightforward case where there is targeted segmentation with only Loyals buying the NB and the SB left to serve the Switchers. After considering this situation, we move on to consider the outcomes when there is competition over Switchers. We then compare the two situations to show the equilibrium choices and the market conditions that apply for each of them to hold. As in the previous section, all the results discussed in this section are tabled for convenience and ease of comparison and shown in Tables 3 and 4.

4.1 NB and SB indirect competition: Targeted segmentation with the NB aimed at Loyals and the SB aimed at Switchers

Given the nature of respective demand and differences in the willingness to pay between Loyals and Switchers, segmentation can arise in this set-up through how the two products are priced, with Loyals and Switchers self-selecting in respect of their product choice based on the NB and SB prices offered. In this situation, the two products are not directly competing against each other in the sense of chasing precisely the same set of customers, but are doing so *indirectly* because of the price thresholds on the demand for each product by the different consumer types. So, while Loyals are only interested in buying the NB, Switchers are open to considering buying either the NB or the SB, which means that their absolute and relative prices as well as relative qualities take on importance. However, the critical aspect here is the absolute price of the NB since if this is set at a level that exceeds the willingness to pay for Switchers while still appealing to Loyals, then this will leave the SB completely free to target Switchers as effectively the only product option. Thus, implicitly there is a sequence to the pricing decisions – even if only by reasoning rather than by action – with the NB price set first to exclude Switchers and then the SB price set to extract as much profit as possible from selling to Switchers.

With this in mind then we can see that regardless of the pricing Scenario, i.e. A, B or C, for setting the NB retail price, the optimal price is for the NB to be priced at $p_1 = \overline{\theta}$, which is the maximum price at which the Loyals will buy but at a level which is sufficiently high to prevent Switchers buying the NB. The difference in the price-setting scenarios is that all the profits on the sales of the NB (i.e. product "1") to the Loyals will be extracted by the producer under Scenarios A and C, which we denote as $\pi_{N1} = \mu\overline{\theta}$, and by the retailer under Scenario B, which we denote as $\pi_{R1} = \mu\overline{\theta}$, for the reasons discussed above in sub-section 3.1.

Then, with the NB priced in such a manner that it only appeals to Loyals and extracts all the consumer surplus from them, this leaves the retailer to target the SB at Switchers and seek to extract as much profit as possible from them while secure in the monopoly position that the SB holds over these particular consumers. Given that the utility of a switching consumer of type θ buying quality s at price p_2 is $U(\theta, s) = \theta s - p_2$ then the indifferent consumer is $\theta_0 = p_2/s$, so that the demand from Switchers for the SB for a given price and quality is $q_2(p_2, s) = \overline{\theta} - p_2/s$.

The retailer's profit function for sales made on the SB (i.e. product "2") to the Switchers is then $\pi_{R2}(p_2, s) = p_2(s)q_2(p_2, s) = p_2\left(\overline{\theta} - \frac{p_2}{s}\right)$. Maximising with respect to p_2 and solving shows the SB price set by the retailer as a function of the SB's quality is $p_2(s) = \frac{1}{2}\overline{\theta}s$, so the price chosen by the retailer is increasing in both the upper willingness to pay parameter, $\overline{\theta}$, and the SB's quality, s. In respect of the resulting level of SB sales achieved, this is $q_2 = \frac{1}{2}\overline{\theta}$, so always equal to half the upper taste parameter and independent of s, and the resulting retailer's profit on these sales to Switchers is $\pi_{R2}(s) = \frac{1}{4}\overline{\theta}^2 s$.

In comparing the prices set respectively to the Loyals and the Switchers, for a given $s \leq 1$, we can observe that the NB price set for the Loyals, $p_1 = \overline{\theta}$, is at least double that of the SB price set for the Switchers, $p_2(s) = \frac{1}{2}\overline{\theta}s$. Indeed, even if the SB quality were to exactly match that of the NB quality in the eyes of the Switchers, with $s = 1$, then the SB price would be *half* the NB price (which arises because even when the SB matches the product quality of the NB, the Switchers have lower reservation prices than the Loyals). Accordingly, in this segmented market arrangement, the Loyals really pay a high price for their blind loyalty to the NB, and the presence of the SB serves as no competitive restraint whatsoever on the NB price that the Loyals pay. Yet, the presence of the SB may be even worse for Loyals, since when NB was the only available product then it could also be priced low enough to appeal to Switchers, which would occur under NB pricing Scenarios A and B if $\alpha < 1$ and under Scenario C if $\alpha < \frac{1}{3}$, and in those circumstances

the Loyals would pay a higher price following the SB being introduced and then consumers being segmented by prices being targeted to appeal only to their specific consumer type.

However, for Switchers, they can gain by the presence of the SB. When only the NB is available, they are either excluded from purchasing the product, when the NB price is set at $p_1 = \overline{\theta}$ (which occurs under NB pricing Scenarios A and B if $\alpha \geq 1$, and under Scenario C if $\alpha \geq \frac{1}{3}$), or they face a high price based on the weighted average sum of their and the Loyals' willingness to pay, which is increasing in the proportion of Loyals to Switchers for a given maximum taste parameter $\overline{\theta}$, as represented by α. While segmentation prevents them affording the NB, the SB price they are offered represents better value for money, even accounting for product quality differences, than the NB monopoly price, and leads to higher sales levels from Switchers.

The overall effect on consumer welfare arising from the introduction of the SB in this segmented market arrangement depends on the trade-off between any loss of consumer surplus for Loyals against the gain in consumer surplus for the Switchers. Table 3 provides a summary of all the market outcomes with targeted segmentation, including showing the amount of consumer surplus generated at $CS = \frac{1}{8}\overline{\theta}^2 s$ which is more than under the NB monopoly for Scenarios A and B only when $s > 1 + 2\alpha - 3\alpha^2$, which even in the limit as $s \to 1$ will hold only if $\alpha < \frac{2}{3}$, while more than under the NB monopoly for Scenario C if $s > \frac{1}{4}(1 + 2\alpha - 15\alpha^2)$, which will necessarily hold if $s > \frac{4}{15} \approx 0.2\dot{6}\dot{6}$. Accordingly, consumers only gain in aggregate if the SB quality is high and/or the proportion of Loyals is small relative to Switchers.

So far, we have treated the SB quality as exogenous. However, we can observe that the profit which the SB generates for the retailer is directly increasing in s. If the retailer were freely and costlessly able to choose the SB's product quality then it would choose to set SB quality at its absolute conceivable maximum, i.e. $s = 1$. In other words, it would seek to exactly match the quality of the NB, at least as perceived by Switchers even if ignored by Loyals. Accordingly, rather than seek to stake out a differentiated position for the SB, the retailer would have exactly the opposite preference in facing a very strong profit motive to position the SB to exactly mimic the NB brand as a perfect substitute and clone.

This incentive to set the SB quality level exactly the same as the NB quality is a striking result since it goes against the usual notion in vertical differentiation models that it is better for rival firms to differentiate their products to avoid intense head-to-head price competition. However, we can note that in the market arrangement under consideration here involving complete

segmentation, the different product suppliers (i.e. the producer supplying the NB and the retailer supplying the SB) by definition avoid direct head-to-head competition over the same consumers, so it might not come as such a surprise. Whether this same striking result carries over to situations where the two products in principle compete for the same consumers is an aspect that we address next when we examine *direct* NB and SB competition.

Table 3 summarises this sub-section's results, showing the outcomes which are conditioned on the SB quality (which arise for exogenous values of s) and also showing the outcomes if the retailer were able to set SB quality at its preferred level to maximise its own profits, which in all three Scenarios is $s = 1$. Superscripts AI, BI and CI respectively denote the equilibrium outcomes under each for Scenario (<u>A</u>, <u>B</u> or <u>C</u>) for this situation of <u>i</u>ndirect competition ("I") with targeted segmentation of the NB for the Loyals and the SB for the Switchers.

Table 3 – Outcomes with *Indirect* Competition between NB and SB for Segmentation

	Scenario A	Scenario B	Scenario C
NB wholesale price	$w^{AI} = \bar{\theta}$	$w^{BI} = 0$	$w^{CI} = \bar{\theta}$
NB retail price	$p_1^{AI} = \bar{\theta}$	$p_1^{BI} = \bar{\theta}$	$p_1^{CI} = \bar{\theta}$
SB retail price	$p_2^{AI} = \begin{cases} \frac{1}{2}\bar{\theta}s \\ \frac{1}{2}\bar{\theta} \text{ for } s=1 \end{cases}$	$p_2^{BI} = \begin{cases} \frac{1}{2}\bar{\theta}s \\ \frac{1}{2}\bar{\theta} \text{ for } s\to1 \end{cases}$	$p_2^{CI} = \begin{cases} \frac{1}{2}\bar{\theta}s \\ \frac{1}{2}\bar{\theta} \text{ for } s\to1 \end{cases}$
NB sales	$q_1^{AI} = \mu$	$q_1^{BI} = \mu$	$q_1^{CI} = \mu$
SB sales	$q_2^{AI} = \frac{1}{2}\bar{\theta}$	$q_2^{BI} = \frac{1}{2}\bar{\theta}$	$q_2^{CI} = \frac{1}{2}\bar{\theta}$
NB producer profit	$\pi_N^{AI} = \mu\bar{\theta}$	$\pi_N^{BI} = 0$	$\pi_N^{CI} = \mu\bar{\theta}$
Retailer profit	$\pi_R^{AI} = \begin{cases} \frac{1}{4}\bar{\theta}^2 s \\ \frac{1}{4}\bar{\theta}^2 \text{ for } s=1 \end{cases}$	$\pi_R^{BI} = \begin{cases} \frac{1}{4}(4\mu\bar{\theta} + s\bar{\theta}^2) \\ \frac{1}{4}(4\mu\bar{\theta}+\bar{\theta}^2) \text{ for } s=1 \end{cases}$	$\pi_R^{CI} = \begin{cases} \frac{1}{4}\bar{\theta}^2 s \\ \frac{1}{4}\bar{\theta}^2 \text{ for } s\to1 \end{cases}$
Total profit	$\Pi^{AI} = \begin{cases} \frac{1}{4}(4\mu\bar{\theta} + s\bar{\theta}^2) \\ \frac{1}{4}(4\mu\bar{\theta}+\bar{\theta}^2)\text{for } s=1 \end{cases}$	$\Pi^{BI} = \begin{cases} \frac{1}{4}(4\mu\bar{\theta} + s\bar{\theta}^2) \\ \frac{1}{4}(4\mu\bar{\theta}+\bar{\theta}^2) \text{ for } s=1 \end{cases}$	$\Pi^{CI} = \begin{cases} \frac{1}{4}(4\mu\bar{\theta} + s\bar{\theta}^2) \\ \frac{1}{4}(4\mu\bar{\theta}+\bar{\theta}^2) \text{ for } s=1 \end{cases}$
Consumer Surplus	$CS^{AI} = \begin{cases} \frac{1}{8}\bar{\theta}^2 s \\ \frac{1}{8}\bar{\theta}^2 \text{ for } s=1 \end{cases}$	$CS^{BI} = \begin{cases} \frac{1}{8}\bar{\theta}^2 s \\ \frac{1}{8}\bar{\theta}^2 \text{ for } s=1 \end{cases}$	$CS^{CI} = \begin{cases} \frac{1}{8}\bar{\theta}^2 s \\ \frac{1}{8}\bar{\theta}^2 \text{ for } s=1 \end{cases}$
Total Welfare	TW^{AI} $= \begin{cases} \frac{1}{8}(8\mu\bar{\theta} + 3s\bar{\theta}^2) \\ \frac{1}{8}(8\mu\bar{\theta}+3\bar{\theta}^2) \text{ for } s=1 \end{cases}$	TW^{BI} $= \begin{cases} \frac{1}{8}(8\mu\bar{\theta} + 3s\bar{\theta}^2) \\ \frac{1}{8}(8\mu\bar{\theta}+3\bar{\theta}^2) \text{ for } s=1 \end{cases}$	$TW^{CI} = \begin{cases} \frac{1}{8}(8\mu\bar{\theta} + 3s\bar{\theta}^2) \\ \frac{1}{8}(8\mu\bar{\theta}+3\bar{\theta}^2) \text{ for } s=1 \end{cases}$

4.2 NB and SB direct competition: NB and SB both aimed at Switchers

In contrast to the situation where the two goods are deliberately priced in a manner to serve different consumer segments, in this sub-section we consider the case where the NB and SB are in direct competition for the same customers. While the SB by definition cannot compete with the NB for the custom of Loyals, we consider here the situation where for appropriate price levels they could compete directly for the custom of Switchers.

We start by considering the situation where SB quality is given as $s < 1$, i.e. quality below that of the NB, but we will be examining what happens in approaching the quality limit, as $s \to 1$. We will also consider what happens at the point where the quality of the SB is viewed as being exactly the same as that of NB, i.e. $s = 1$. Covering all these cases will allows us to consider the retailer's choice of s once we have determined all the outcomes from pricing under the different scenarios and made comparisons with the results in the previous sub-section where consumers were purposefully segmented to see what market configuration is likely to emerge as an equilibrium outcome.

With SB quality at $s < 1$, the Switchers may be divided into three groups: those who buy the NB (product "1"), those who buy the (inferior) SB (product "2"), and those who do not buy at all. The switching consumer who is indifferent between the NB and SB is characterized by $\tilde{\theta}$ where

$$\tilde{\theta} s - p_2 = \tilde{\theta} - p_1 \Leftrightarrow \tilde{\theta} = \frac{p_1 - p_2}{1 - s}$$

The switching consumer who is indifferent between the SB and not buying at all is characterised by $\hat{\theta}$ such that

$$\hat{\theta} s - p_2 = 0 \Leftrightarrow \hat{\theta} = \frac{p_2}{s}$$

With a uniform distribution and unit mass of Switchers, their demand for the NB is then

$$D_1(p_1, p_2, s) = \overline{\theta} - \tilde{\theta} = \overline{\theta} - \frac{p_1 - p_2}{1 - s}$$

and Switchers' corresponding demand for the SB is

$$D_2(p_1, p_2, s) = \tilde{\theta} - \hat{\theta} = \frac{p_1 - p_2}{1 - s} - \frac{p_2}{s}$$

We can observe that both goods will be sold to switchers if the following two constraints hold:

$$\overline{\theta} - \frac{p_1 - p_2}{1 - s} > 0 \Leftrightarrow (1 - s)\overline{\theta} > p_1 - p_2 \text{ ; for } p_1 < \overline{\theta}$$

and

$$\frac{p_1 - p_2}{1 - s} - \frac{p_2}{s} > 0 \Leftrightarrow \frac{s}{p_2} > \frac{1}{p_1}$$

The latter condition implies the quality per dollar (or euro) must be greater for the low-quality product otherwise no consumer would buy this product.

With these conditions, the respective total quantities demanded for the NB and SB across both consumers segments are

$$q_1(p_1, p_2, s) = \mu + \overline{\theta} - \frac{p_1 - p_2}{1 - s}$$

$$q_2(p_1, p_2, s) = \frac{p_1 - p_2}{1 - s} - \frac{p_2}{s}$$

Our next step is to determine the market outcomes under each of the three different scenarios for how the NB is priced while the retailer prices the SB. We consider each pricing scenario in turn.

4.2.1 Outcomes with NB pricing under Scenario A with Direct Competition ("AD")

We take the case where the retail prices of the NB and SB are set simultaneously and determined as a Nash equilibrium.[31] With the NB producer setting the NB retail price and taking all the profit on sales (implicitly by setting its wholesale price equal to the retail price, i.e. $w = p_1$), then its profit function on sales to both Loyals and Switcher is:

$$\pi_{N1}(p_1, p_2, s) = p_1 q_1(p_1, p_2, s) = p_1 \left(\mu + \overline{\theta} - \frac{p_1 - p_2}{1 - s} \right)$$

Optimising with respect to p_1, the NB producer's best-response function is

$$p_1(p_2, s) = \tfrac{1}{2} \left[(1 - s)(\mu + \overline{\theta}) + p_2 \right]$$

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[31] The alternative would be to consider sequential retail price setting and a Stackelberg leader-follower equilibrium, say with the NB producer first setting the NB retail price with a commitment to the price through its RPM contract and which the retailer could then subsequently respond in setting the SB retail price. However, we instead assume that retail price commitments are not so steadfast and that adjustment can be made, and in the absence of any other *a priori* reason for price setting being sequenced we assume simultaneous retail price setting and, with complete information on each other's situation and preferences, each competing party correctly anticipating each other's optimal conditioned decision to arrive at a pure strategy Nash equilibrium.

For the retailer setting the SB price, the SB's only sales can be achieved through selling to Switchers and the retailer's profit function is simply

$$\pi_{R2}(p_1, p_2, s) = p_2 q_2(p_1, p_2, s) = p_2 \left(\frac{p_1 - p_2}{1 - s} - \frac{p_2}{s} \right)$$

Optimising with respect to p_2, the retailer's best-response function is

$$p_2(p_1, s) = \tfrac{1}{2} s p_2$$

Solving for equilibrium prices:

$$p_1(s) = \frac{2(1-s)(\mu + \overline{\theta})}{4-s} = \frac{2(1-s)(1+\alpha)\overline{\theta}}{4-s} < \overline{\theta} \text{ if } \alpha < \frac{2+s}{2(1-s)} \in [1, \infty) \text{ for } s \in [0,1)$$

$$p_2(s) = \frac{s(1-s)(\mu + \overline{\theta})}{4-s} = \frac{s(1-s)(1+\alpha)\overline{\theta}}{4-s}$$

The conditions on the requirement for $p_1(s) < \overline{\theta}$ ensure that the NB generates some sales with Switchers and so is directly competing against the SB for their custom. In these circumstances, the NB price will be at least double the SB price, as shown by their ratio:

$$\frac{p_2(s)}{p_1(s)} = \frac{s}{2} \in \left[0, \tfrac{1}{2}\right) \text{ for } s \in [0,1)$$

The resulting equilibrium sales for the NB and SB are then:

$$q_1(s) = \frac{2(\mu + \overline{\theta})}{4-s} > \mu \text{ if } \alpha < \frac{2}{2-s} \in [1,2) \text{ for } s \in [0,1) \; ; \; q_2(s) = \frac{\mu + \overline{\theta}}{4-s}$$

Assuming this condition on α is met, and so the NB makes positive sales to Switchers, then sales of the NB are double those of the SB regardless of the SB's quality, so that even if there were just a fractional difference in the quality of the two products then the NB, by still fractionally being the superior product of the two, gains considerably over the fractionally inferior SB.

The combination of the NB being pitched at a higher price and yet selling more units means that the profit for the NB producer exceeds that of the retailer by more than four-fold:

$$\pi_{N1}(s) = \frac{4(1-s)(\mu + \overline{\theta})^2}{(4-s)^2} \; ; \; \pi_{R2}(s) = \frac{s(1-s)(\mu + \overline{\theta})^2}{(4-s)^2} \; ; \; \frac{\pi_{N1}(s)}{\pi_{R2}(s)} = \frac{4}{s}$$

Given this outcome from pricing competition, we can consider next the retailer's preference for where it would like to position the SB in terms of its quality. Maximising $\pi_{R2}(s)$ with respect to s and solving reveals that the optimal level of SB quality for the retailer is $s = \tfrac{4}{7} \approx 0.57$. This is the same quality level as derived by Choi and Shin (1992) in a standard two-firm vertical

differentiation model where the market is not fully covered and the firm operating with the inferior product has to determine the quality level in balancing the desire to raise product quality to drive more sales against the impact of this intensifying price competition, so driving prices down, as the two products become less differentiated. In this situation, the firm with the inferior product prefers a quality position at slightly over the mid-way point. The same balancing calculation is going on in the present set-up with the same outcome in terms of the preferred quality position. However, the difference here is that the sales levels achieved for both firms are affected by the proportion of Loyals relative to Switchers, as they are increasing in total as this proportion increases (represented by α increasing) but declining for the NB in its Switcher sales as it focuses more on extracting surplus from Loyals which allows the SB to increase sales to Switchers but still means that fewer Switchers are served overall, i.e. less of the market is covered.

If the retailer were able to set $s = \frac{4}{7}$ then this would allow the retailer to sell $q_2 = \frac{7}{24}(\mu + \overline{\theta})$ and make a profit of $\pi_{R2} = \frac{1}{48}(\mu + \overline{\theta})^2$, while sales of the NB would be $q_1 = \frac{7}{12}(\mu + \overline{\theta})$ and the producer would earn $\pi_{N1} = \frac{7}{48}(\mu + \overline{\theta})^2$, i.e. seven times more than the retailer. Nevertheless, this would still leave the producer worse off than if it held a monopoly position and sold to both segments, where (from sub-section 3.2) its profit would be $\pi_{N1} = \frac{1}{4}(\mu + \overline{\theta})^2$. It would also leave the industry as a whole worse off with joint profits at $\Pi = \pi_{N1} + \pi_{R2} = \frac{1}{6}(\mu + \overline{\theta})^2$.

However, from the consumers' perspective this is a more attractive situation than when only the NB was available and being sold to both segments. In the present case with $s = \frac{4}{7}$, the combined quantity of the NB and SB sales is $Q = q_1 + q_2 = \frac{7}{8}(\mu + \overline{\theta})$, so that considerably more of the potential market is covered, compared to when the NB was holding a monopoly position targeting both segments with $Q = q_1 = \frac{1}{2}(\mu + \overline{\theta})$ (as shown above in sub-section 3.2). Also, the price paid for the NB is lower at $p_1 = \frac{1}{4}(\mu + \overline{\theta})$, which is exactly half the level compared to when the NB is in a monopoly position with $p_1 = \frac{1}{2}(\mu + \overline{\theta})$. Accordingly, it is not just Switchers that gain by the introduction of the SB but Loyals as well with the producer and retailer competing head-to-head for the custom of Switchers. Indeed, the difference in consumer surplus in this situation from the level attained under NB monopoly is equal to $\frac{1}{6}(\mu + \overline{\theta})^2$, i.e. a gain in surplus for consumers equal the amount of joint industry profit under this direct competition.[32]

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[32] Consumer surplus consists of the surplus attained by three groups: Loyals purchasing the NB; quality-oriented Switchers purchasing the NB; and value-oriented Switchers purchasing the SB. Formally stated:
$CS = (\overline{\theta} - p_1)\mu + \int_{\tilde{\theta}}^{\overline{\theta}}(\theta - p_1)d\theta + \int_{\hat{\theta}}^{\tilde{\theta}}(\theta s - p_1)d\theta = (\overline{\theta} - p_1)\mu + \frac{1}{2}\tilde{\theta}^2 - \overline{\theta}p_1 + \frac{1}{2}\tilde{\theta}^2(1 - s) - \frac{1}{2}\hat{\theta}^2 s + \hat{\theta}p_2$

4.2.2 Outcomes with NB pricing under Scenario B with Direct Competition ("BD")

We now consider the opposite extreme where, rather than the producer setting the NB price and taking all the profit on the sale of this good, it is the retailer that sets both the NB and SB prices and takes all the profit from both their sales. In this case, the profit function for the retailer in pricing the NB and SB so that both can appeal in principle to Switchers along with the NB also serving Loyals is

$$\pi_R(p_1, p_2, s) = p_1 q_1(p_1, p_2, s) + p_2 q_2(p_1, p_2, s) = p_1 \left(\mu + \overline{\theta} - \frac{p_1 - p_2}{1 - s} \right) + p_2 \left(\frac{p_1 - p_2}{1 - s} - \frac{p_2}{s} \right)$$

Maximising with respective to p_1 and p_2, the optimality conditions for the NB and SB price are

$$p_1(p_2, s) = \tfrac{1}{2}(1 - s)\left(\mu + \overline{\theta}\right) + p_2 \ ; \quad p_2(p_1, s) = \tfrac{1}{2}sp_2$$

Solving reveals the equilibrium pair of prices as

$$p_1 = \tfrac{1}{2}\left(\mu + \overline{\theta}\right) = \tfrac{1}{2}(1 + \alpha)\overline{\theta} \ < \ \overline{\theta} \text{ if } \alpha < 1; \ p_2(s) = \tfrac{1}{2}\left(\mu + \overline{\theta}\right)s = \tfrac{1}{2}(1 + \alpha)s\overline{\theta}$$

At these prices, the quantities sold of the NB and SB are

$$q_1 = \tfrac{1}{2}\left(\mu + \overline{\theta}\right) > \mu \text{ if } \alpha \stackrel{\text{def}}{=} \frac{\mu}{\theta} < 1; \ q_2 = 0$$

Thus while the SB retail price might depend on s, the level of s has no impact on the market outcomes. In this case, regardless of the value of s, all sales go to the NB. So, in effect, the SB serves merely as a "dummy product". It might be available to Switchers, but for these price levels those consumers who decide to buy a product all choose the NB over the SB. With the retailer having full control over setting both retail prices it is able to internalise any externality effects that would otherwise arise if each product price were set independently. Thus the retailer only requires one product, the NB, to extract as much surplus as possible from Switchers while also serving Loyals, and the other product, the SB, is completely superfluous as it makes no difference by its presence to the equilibrium prices and quantities or to the retailer's profit which in this case is $\pi_R = \tfrac{1}{4}(\mu + \overline{\theta})^2$, i.e. exactly the same as that achieved if the NB were the only product available (as shown in sub-section 3.2).

So, under this pricing scenario, the presence of the SB has no effect on market outcomes and its quality position does not matter as the product is redundant. The analogy is that it might be stocked by the retailer but it is effectively de-marketed and will just sit on the shelf while the NB makes all the sales. So it might give the illusion of choice, but actually it serves no choice role.

4.2.3 Outcomes with NB pricing under Scenario $\underline{C}$ with $\underline{D}$irect Competition ("CD")

Consider next the situation where the retailer sets both the NB and SB prices after the NB producer has set and committed to a wholesale price for the NB while taking into account that the retailer will be offering a SB of a known quality. Formally, we model this as a three-stage game. In Stage 1, the retailer introduces the SB with an assigned quality level, s. In Stage 2, the NB producer sets the NB wholesale price, w. In Stage 3, the retailer simultaneously determines the NB and SB retail prices.

In Stage 3, for the given prior decisions over s and w, the profit function for the retailer is

$$\pi_R(p_1, p_2, w, s) = (p_1 - w)q_1(p_1, p_2, s) + p_2 q_2(p_1, p_2, s)$$
$$= (p_1 - w)\left(\mu + \overline{\theta} - \frac{p_1 - p_2}{1 - s}\right) + p_2\left(\frac{p_1 - p_2}{1 - s} - \frac{p_2}{s}\right)$$

Maximising with respective to p_1 and p_2, the optimality conditions for the NB and SB price are

$$p_1(p_2, w, s) = \tfrac{1}{2}\left[(1 - s)(\mu + \overline{\theta}) + w + 2p_2\right] \; ; \quad p_2(p_1, w, s) = \tfrac{1}{2}s(2p_1 - w)$$

Solving reveals the equilibrium pair of prices as

$$p_1(w) = \tfrac{1}{2}(\mu + \overline{\theta} + w) \; ; \quad p_2(s) = \tfrac{1}{2}(\mu + \overline{\theta})s$$

As with retail pricing under Scenario (B), by setting both retail prices the retailer internalises the externality effects that would otherwise arise under separate pricing of the two products and prices the goods in such a way as to ensure that combined sales are equal to the monopoly level with $Q = q_1 + q_2 = \tfrac{1}{2}(\mu + \overline{\theta})$. However, in respect of the individual quantities, they depend on the values of w and s, and unlike where the NB was the only product available and its sales where increasing in w, when facing competition from the SB in the present situation the NB's sales are decreasing in w:

$$q_1(w, s) = \tfrac{1}{2}\left[(\mu + \overline{\theta}) - \frac{w}{1 - s}\right] \; ; \quad q_2(w, s) = \tfrac{1}{2}\left[\frac{w}{1 - s}\right]$$

In anticipating this Stage 3 outcome from retail price setting, the producer in Stage 2 seeks to set the NB wholesale price to maximise the following profit function:

$$\pi_{N1}(w, s) = wq_1(w, s) = \frac{w}{2}\left[(\mu + \overline{\theta}) - \frac{w}{1 - s}\right]$$

Maximising with respect to w and solving for the profit maximising NB wholesale price reveals

$$w(s) = \tfrac{1}{2}(1 - s)(\mu + \overline{\theta})$$

Putting this value into the above Stage 3 outcomes shows that the NB and SB prices and quantities are respectively:

$$p_1(s) = \tfrac{1}{4}(3-s)(\mu+\overline{\theta}) \; < \; \overline{\theta} \text{ if } \alpha \overset{\text{def}}{=} \tfrac{\mu}{\theta} < \tfrac{1-s}{3-s} \in \left(0, \tfrac{1}{3}\right]; \; \; p_2(s) = \tfrac{1}{4}(\mu+\overline{\theta})s \; ; \; q_1 = q_2 = \tfrac{1}{4}(\mu+\overline{\theta})$$

Accordingly, the profit for the NB producer and retailer are respectively:

$$\pi_{N1}(s) = \tfrac{1}{8}(1-s)(\mu+\overline{\theta})^2 \; \; ; \; \; \pi_R(s) = \tfrac{1}{16}(1+3s)(\mu+\overline{\theta})^2$$

Comparing these outcomes to the monopoly situation where the NB was the only product choice (sub-section 3.2), we can see that the presence of the SB lowers the wholesale price and profit for the NB producer, other than when $s = 0$ (which amounts to the retailer offering a product so inferior that it has to be given away at zero price and so has no competitive impact on the NB whatsoever). In contrast, for the retailer, the introduction of the SB has a clearly positive effect on its profit, particularly as s increases in value as this has the effect of allowing the SB retail price to be set higher while putting competitive pressure on the NB producer to lower its wholesale price, which also serves to lower the NB retail price but only to the extent of increasing the retailer's profit margin on NB sales as the NB to SB retail price difference remains at least two fold.

Taking account of these outcomes from Stages 2 and 3, when it comes to the retailer's preference over SB quality it is evident that, with $\pi_R(s)$ strictly increasing in s, the retailer would like to set the SB quality as close as absolutely possible to the NB quality, ideally matching it. In this way, it will push the NB producer's profit down to zero and ensure that it captures all the available profits from extracting as much surplus as possible from Switchers in how it sets the NB and SB retail prices while ensuring that the NB retail price is sufficiently high as not to give away too much surplus to the Loyals. However, this is not necessarily an equilibrium outcome, since the retailer would not expect the NB producer simply to accept its profits being stripped away in this fashion without retaliating. We consider this issue in the next section of the paper where we derive the equilibrium outcomes and the retailer's optimal choice of SB in taking account of how prices will be subsequently set.

For completeness and ease of making comparisons, Table 4 summarises the results from this sub-section. Superscripts *AD*, *BD* and *CD* respectively denote the equilibrium outcomes under each for Scenario (A, B or C) for this situation of *direct* competition ("*D*") for Switchers.

Table 4 – Outcomes with *Direct* Competition between NB and SB

	Scenario A	Scenario B	Scenario C
Required conditions ($p_1 < \overline{\theta}$ and $q_1 > \mu$)	$\alpha \stackrel{\text{def}}{=} \dfrac{\mu}{\overline{\theta}} < \dfrac{2-s}{2} \in [1,2)$	$\alpha \stackrel{\text{def}}{=} \dfrac{\mu}{\overline{\theta}} < 1$	$\alpha \stackrel{\text{def}}{=} \dfrac{\mu}{\overline{\theta}} < \dfrac{1-s}{3-s} \in \left(0, \dfrac{1}{3}\right]$
NB wholesale price	$w^{AD} \begin{cases} = 2(1-s)(\mu+\overline{\theta})/(4-s) \\ = \frac{1}{4}(\mu+\overline{\theta}) \text{ for } s = \frac{4}{7} \\ \to 0 \text{ as } s \to 1 \end{cases}$	$w^{BD} = 0$	$w^{CD} \begin{cases} = \frac{1}{2}(1-s)(\mu+\overline{\theta}) \\ \to 0 \text{ as } s \to 1 \end{cases}$
NB retail price	$p_1^{AD} \begin{cases} = 2(1-s)(\mu+\overline{\theta})/(4-s) \\ = \frac{1}{4}(\mu+\overline{\theta}) \text{ for } s = \frac{4}{7} \\ \to 0 \text{ as } s \to 1 \end{cases}$	$p_1^{BD} = \frac{1}{2}(\mu+\overline{\theta})$	$p_1^{CD} \begin{cases} = \frac{1}{4}(3-s)(\mu+\overline{\theta}) \\ \to \frac{1}{2}(\mu+\overline{\theta}) \text{ as } s \to 1 \end{cases}$
SB retail price	$p_2^{AD} \begin{cases} = s(1-s)(\mu+\overline{\theta})/(4-s) \\ = \frac{1}{14}(\mu+\overline{\theta}) \text{ for } s = \frac{4}{7} \\ \to 0 \text{ as } s \to 1 \end{cases}$	$p_2^{BD} \begin{cases} = \frac{1}{2}(\mu+\overline{\theta})s \\ \to \frac{1}{2}(\mu+\overline{\theta}) \text{ as } s \to 1 \end{cases}$	$p_2^{CD} \begin{cases} = \frac{1}{2}(\mu+\overline{\theta})s \\ \to \frac{1}{2}(\mu+\overline{\theta}) \text{ as } s \to 1 \end{cases}$
NB sales	$q_1^{AD} \begin{cases} = 2(\mu+\overline{\theta})/(4-s) \\ = \frac{7}{12}(\mu+\overline{\theta}) \text{ for } s = \frac{4}{7} \\ \to \frac{2}{3}(\mu+\overline{\theta}) \text{ as } s \to 1 \end{cases}$	$q_1^{BD} = \frac{1}{2}(\mu+\overline{\theta})$	$q_1^{CD} = \frac{1}{4}(\mu+\overline{\theta})$
SB sales	$q_2^{AD} \begin{cases} = (\mu+\overline{\theta})/(4-s) \\ = \frac{7}{24}(\mu+\overline{\theta}) \text{ for } s = \frac{4}{7} \\ \to \frac{1}{3}(\mu+\overline{\theta}) \text{ as } s \to 1 \end{cases}$	$q_2^{BD} = 0$	$q_2^{CD} = \frac{1}{4}(\mu+\overline{\theta})$
NB producer profit	$\pi_N^{AD} \begin{cases} = 4(1-s)(\mu+\overline{\theta})^2/(4-s)^2 \\ = \frac{7}{48}(\mu+\overline{\theta})^2 \text{ for } s = \frac{4}{7} \\ \to 0 \text{ as } s \to 1 \end{cases}$	$\pi_N^{BD} = 0$	$\pi_N^{CD} \begin{cases} = \frac{1}{8}(1-s)(\mu+\overline{\theta})^2 \\ \to 0 \text{ as } s \to 1 \end{cases}$
Retailer profit	$\pi_R^{AD} \begin{cases} = s(1-s)(\mu+\overline{\theta})^2/(4-s)^2 \\ = \frac{1}{48}(\mu+\overline{\theta})^2 \text{ for } s = \frac{4}{7} \\ \to 0 \text{ as } s \to 1 \end{cases}$	$\pi_R^{BD} = \frac{1}{4}(\mu+\overline{\theta})^2$	$\pi_R^{CD} \begin{cases} = \frac{1}{16}(1+3s)(\mu+\overline{\theta})^2 \\ \to \frac{1}{4}(\mu+\overline{\theta})^2 \text{ as } s \to 1 \end{cases}$
Total profit	$\Pi^{AD} \begin{cases} = (4+s)(1-s)(\mu+\overline{\theta})^2/(4-s)^2 \\ = \frac{1}{6}(\mu+\overline{\theta})^2 \text{ for } s = \frac{4}{7} \\ \to 0 \text{ as } s \to 1 \end{cases}$	$\Pi^{BD} = \frac{1}{4}(\mu+\overline{\theta})^2$	$\Pi^{CD} \begin{cases} = \frac{1}{16}(3+s)(\mu+\overline{\theta})^2 \\ \to \frac{1}{4}(\mu+\overline{\theta})^2 \text{ as } s \to 1 \end{cases}$
Consumer Surplus	$CS^{AD} \begin{cases} = \frac{1}{24}(7\overline{\theta}^2 - 5\mu^2 + 14\overline{\theta}\mu) \text{ for } s = \frac{4}{7} \\ \to \frac{1}{2}(\overline{\theta}^2 + \mu^2 + 4\overline{\theta}\mu) \text{ as } s \to 1 \end{cases}$	$CS^{BD} = \frac{1}{8}(\overline{\theta}-\mu)(\overline{\theta}+3\mu)$	$CS^{CD} \to \frac{1}{8}(\overline{\theta}-\mu)(\overline{\theta}+3\mu)$ as $s \to 1$
Total Welfare	$TW^{AD} \begin{cases} = \frac{1}{24}(11\overline{\theta}^2 - \mu^2 + 22\overline{\theta}\mu) \text{ for } s = \frac{4}{7} \\ \to \frac{1}{2}(\overline{\theta}^2 + \mu^2 + 4\overline{\theta}\mu) \text{ as } s \to 1 \end{cases}$	$TW^{BD} = \frac{1}{8}(3\overline{\theta}^2 - \mu^2 + 6\overline{\theta}\mu)$	$TW^{CD} \to \frac{1}{8}(3\overline{\theta}^2 - \mu^2 + 6\overline{\theta}\mu)$ as $s \to 1$

5. Store Brand Quality Choice and Equilibrium Outcomes

The results from the two previous sections show the outcomes from essentially twelve different cases as the different combinations arising from (i) <u>either</u> the NB is the only available product ("NB monopoly") <u>or</u> where both the NB and SB are available ("NB and SB duopoly"), (ii) the NB is priced to appeal <u>either</u> only to Loyals ("segmentation" and "indirect competition") <u>or</u> both Loyals and Switchers ("non-exclusion" and "direct competition"), and (iii) for <u>three</u> different retail pricing scenarios ("A", "B" or "C"). Given these different outcomes resulting from how prices are set in the market for each of the twelve cases, in this section we consider the equilibrium market outcomes based on the retailer's decision as to whether it would want to offer an SB and if so how it would seek to position the SB relative to the NB in respect of setting the SB quality level in a fashion that would serve its best interests in maximising its profit. We do this by considering the retailer as moving first in setting the SB quality level (should it desire to offer an SB) in knowledge and anticipation of the subsequent pricing outcomes that would arise respectively under each of the three different pricing scenarios.

With this sequential structure in mind then, in identifying the sub-game perfect equilibrium outcomes, the retailer has effectively the final say on outcomes by moving first in determining its store brand quality level, since in doing so it sets in train the process by which market outcomes will be determined by reasoning ahead and then working backwards. So in selecting SB quality, the retailer will take into account how this decision will affect its interaction with the NB producer, whether and by how this will mean that the consumer types will or will not be segmented, and ultimately what the consumers will buy based on the eventual NB and SB prices set according to the three different retail pricing scenarios (as summarised in Tables 2-4 above).

In selecting SB quality, we can consider two different possibilities in respect of the flexibility and scope the retailer has for setting SB quality relative to NB quality. First, we take the case where the retailer has complete freedom and ability to set freely and without cost whatever SB quality level, *s*, suits its own interest for the full range of viable quality levels between zero quality (i.e. utterly useless as far as consumers are concerned) and perfectly matching the NB quality at unity, i.e. $s \in [0,1]$. Secondly, to give some further consideration and nuance to the effect of the SB quality choice on market outcomes, we consider the situation where the retailer is constrained in how high it can set SB quality, either because of a *technological* obstacle limiting the ability of the SB supplier to make a high quality SB (e.g. non-availability of the same high quality inputs as used

by the NB or an inability to replicate the formula and performance of the NB) or a *perception* obstacle (e.g. inability to replicate brand image, reputation and consumer trust of the NB). In this constrained SB quality case, we consider the retailer's restricted choice of selecting SB quality where the maximum value of s is $\bar{s}\ (<1)$, i.e. $s \in [0, \bar{s}]$. We proceed by determining the equilibrium SB quality choice and market outcomes for each of the three pricing scenarios in turn.

5.1 Equilibrium outcomes in Scenario A

In this pricing scenario, where the NB producer sets the NB retail price and captures all the profits on the sales of the NB, then the retailer earns zero profit under NB monopoly so stands to gain by developing an SB under its pricing control and earn profit on the sales that the SB makes. Thus, for the retailer it will be considering when it determines the SB quality choice the amount of positive profit it will earn under indirect competition (i.e. π_R^{AI}) and direct competition (i.e. π_R^{AD}). From the values reported in Table 3 and 3, we can observe a stark difference in the effect of s on the retailer's profit. With indirect competition and targeted segmentation then the retailer's profit is strictly increasing in s and is at its maximum with $s = 1$, where $\pi_R^{AI} = \frac{1}{4}\bar{\theta}^2$. In contrast, with direct competition and both the NB and SB competing for Switchers then the retailer's profit is concave in s, being at or approaching zero when respectively $s = 0$ and $s \to 1$, and at a maximum when $s = \frac{4}{7}$, where $\pi_R^{AD} = \frac{1}{48}(\mu + \overline{\theta})^2 = \frac{1}{48}(1 + \alpha)^2\bar{\theta}^2$. In comparing these two levels of profits at the respective levels of s, then $\pi_R^{AI} - \pi_R^{AD} = \frac{1}{12}(11 - 2\alpha - \alpha^2)\bar{\theta}^2 > 0$ if $\alpha < 2\sqrt{3} - 1 \approx 2.4641$. So the only possibility with these respective values of s for retailer profit to be higher with direct competition is when α is very high (> 2.4641). However, this level of α is ruled out because it exceeds the threshold where the NB would serve both segments, i.e. the requirement that $q_1^{AD} > \mu$ which is only satisfied if $< 2/(2 - s) \in [1, 2)$. Accordingly, with a free and unrestricted choice, the retailer will opt to set $s = 1$ and look to achieve a profit of $\pi_R^{AI} = \frac{1}{4}\bar{\theta}^2$ with the SB serving the Switchers and the NB targeted solely at the Loyals. Also, we can see that the NB producer will oblige the retailer in this respect because it would face the stark choice of earning zero profits by competing for Switchers (noting $\pi_N^{AD} = 4(1 - s)(\mu + \overline{\theta})^2/(4 - s)^2 \to 0$ as $s \to 1$) or earning positive profit by setting the NB at the reservation price of the Loyals and serving just them (and so gaining $\pi_N^{AI} = \mu\overline{\theta} > 0$) and leaving the SB on its own to serve the Switchers.

Next, consider the situation where the retailer is constrained in the level of SB quality it can set then $\pi_R^{AI} > \pi_R^{AD}$ for any non-zero value of s. This can readily be seen since the SB sells more and at a higher price under segmentation when it does not face direct competition for the custom of Switchers, which would entail sharing sales with the NB and having to compete on price. Here we can note that $q_2^{AI} - q_2^{AD} = (2 - s - 2\alpha)\overline{\theta}/(2(4-s)) > 0$ for $\alpha < (2-s)/2$ which is the same condition required for $q_2^{AD} > \mu$. Also $p_2^{AI} - p_2^{AD} = s(2 + s - (1-s)2\alpha)\overline{\theta}/(2(4-s)) > 0$ for $\alpha < (2+s)/(2(1-s))$ which is the same condition required for $p_1^{AD} < \overline{\theta}$. Accordingly, the retailer will in all circumstances prefer segmentation over direct competition.

Thus the retailer's preference for segmentation is very clear, but for the NB producer its preferred outcome will depend on trading off the security of extracting all the surplus from Loyals under segmentation against the benefit of extending its sales to cover Switchers as well with direct competition, but tempered by the fact that this will give rise to price competition with the SB, so decrease the profit margin on sales. Here, in contrast to the effect of s on the respective profit levels for the retailer, the NB producer's profit with segmentation is independent of s, as $\pi_N^{AI} = \mu\overline{\theta} = \alpha\overline{\theta}^2$, but is strictly decreasing in s when it faces direct competition with the SB for Switchers, as $\pi_N^{AD} = 4(1-s)(\mu + \overline{\theta})^2/(4-s)^2 = 4(1-s)(1+\alpha)^2\overline{\theta}^2/(4-s)^2$. Noting that both profit levels are increasing in α, the difference between the two is $\pi_N^{AI} - \pi_N^{AD} = [\alpha s^2 + 4s(1 + \alpha^2) - 4(1-\alpha)^2]\overline{\theta}^2/(4-s)^2$. Denoting the critical level of s where $\pi_N^{AI} = \pi_N^{AD}$ as s_N^A then $\pi_N^{AI} > \pi_N^{AD}$ if $s > s_N^A = 2[(1 + \alpha)\sqrt{(1 - \alpha + \alpha^2)} - \alpha^2 - 1]/\alpha$. This condition is at its maximum with $s_N^A \to 1$ as $\alpha \to 0$, decreasing and concave in the range of $\alpha < 1$, at its minimum with $s_N^A = 0$ when $\alpha = 1$ then increasing for $\alpha > 1$. However, bearing in mind that for $q_1^{AD} > \mu$ (so at least some positive number of Switchers are served by the NB) requires $\alpha < 2/(2 - s)$ and observing the tightness of this condition, the s_N^A condition is only relevant for $\alpha \leq 1$. For situations where $\alpha > 1$ then we can take it that the relative size of the Loyals consumer segment is sufficient to ensure that $\pi_N^{AI} > \pi_N^{AD}$. Thus only when the proportion of Loyals is small will the NB producer entertain the prospect of competing directly with the SB for sales to Switchers, and this becomes less attractive the higher is the SB quality since this intensifies the competition between the NB and SB.

As shown above, when the retailer has unrestricted choice in setting s then it will set $s = 1$ as this maximises its profit under segmentation and obliges the NB producer to also follow suit and price for segmentation. However, if the retailer is restricted in how high it can set s then it may find that the NB producer prefers direct competition over segmentation. For the retailer, to ensure that the NB producer opts for segmentation over direct competition, then it has to set $s > s_N^A$. For

$\alpha > 1$ this is achieved by the required price and quantity conditions under direct competition, but for $\alpha < 1$ then the critical level of s increases at an increasing rate as α declines, where in the limit $s_N^A \to 1$ as $\alpha \to 0$. To illustrate the effect of α decreasing, for $\alpha = \frac{3}{4}$ then $s_N^A = (7\sqrt{13} - 25)/6 \approx 0.0398$, for $\alpha = \frac{1}{2}$ then $s_N^A = 3\sqrt{3} - 5 \approx 0.1962$, for $\alpha = \frac{1}{4}$ then $s_N^A = (5\sqrt{13} - 17)/2 \approx 0.5139$, and for $\alpha = \frac{1}{10}$ then $s_N^A = (11\sqrt{91} - 101)/5 \approx 0.7867$.

If the retailer is able to set SB quality to exceed s_N^A then it should set the level as high as possible to maximise its profits under market segmentation. However, if the retailer is restricted in its choice of s and cannot meet the required critical value of s_N^A then its chosen level of s will trigger the NB producer to price for direct competition. In these circumstances, the retailer should set s as high as possible up to the level of $s = \frac{4}{7}$, as exceeding that level will decrease its profit under direct competition. Here the critical level of α for $s_N^A = \frac{4}{7}$ is $\alpha = (17 - 4\sqrt{15})/7 \approx 0.2154$, so that for lower values of α then the retailer should set restrict SB quality to $s = \frac{4}{7}$ if direct competition is inevitable (as setting a higher level of s will diminish its profit) while for values of α that exceed this critical level then the retailer should set s as high as it can towards $s = \frac{4}{7}$.

In summary, the retailer's optimal strategy in choosing SB quality is to set the quality level as high as possible with $s = 1$ or, if constrained, the maximum level it can set, $\bar{s}$, as long as $\bar{s} > s_N^A$. In these circumstances, it presents the NB producer with a game of chicken where it has moved and committed first in setting a high SB quality forcing the NB producer to opt for segmentation in order to avoid profit destroying direct competition. Only when the retailer is very restricted in how high it can set s and when the proportion of Loyals is very small, so the NB producer is eager to sell to Switchers, will this strategy not be feasible. Then, with $\bar{s} < s_N^A$, the retailer's best strategy is to accommodate the inevitable direct competition by setting s in a manner that balances its interest in setting quality high enough to allow it to allow it to price positively to attract Switchers but not so high as to bring it to a point where the lack of differentiation with the NB results in destructive head-to-head competition, and its ideal balance is $s = \frac{4}{7}$.

In short, under this pricing scenario, the retailer will want to avoid direct competition for Switchers and so has a very strong incentive to ensure that it is able to set SB quality unrestrictedly, and then ideally it will position the SB exactly to match the NB's quality and in this way force a situation where the NB only serves Loyals while the SB is left uncontested to serve Switchers.

5.2 Equilibrium outcomes in Scenario B

In contrast to Scenario A where each party in setting its own product price needs to take account of the other party's position and interests, in Scenario B the retailer has complete control over both the NB and SB prices and captures all available profits in the market. In this case, the retailer does not have to give any consideration to the NB producer's preferences and will simply act to maximise the combined profits on sales from the NB and SB.

In this setting, the benefit of having an SB is to serve as a complement to the NB, where they can work in tandem for the retailer's interest as a price discrimination mechanism to extract as much surplus as possible from the two different consumer segments, with the NB targeted at Loyals and leaving the SB for the Switchers. In this regard, the retailer is essentially a multi-product monopolist, where the NB is a monopoly product serving Loyals and the SB is a monopoly product serving Switchers. This works at its optimum when $s = 1$, so that the SB quality exactly matches the NB quality (as viewed by Switchers), and the retailer can then use segmentation to extract all the surplus from Loyals and as much as possible from Switchers. In contrast, the alternative outcomes involve using the NB on its own either to serve just Loyals (when $\alpha \geq 1$) or both segments (when $\alpha < 1$), but this respectively leaves behind profits that could be made on sales to Switchers or surplus that could be extracted from Loyals. Specifically, when $s = 1$ then for $\alpha \geq 1$ the profit difference is $\pi_R^{BI} - \pi_N^{BM} = \frac{1}{4}\bar{\theta}^2 > 0$ and for $\alpha < 1$ the profit difference is $\pi_R^{BI} - \pi_R^{BM} (= \pi_R^{BD}) = \frac{1}{4}\alpha(2 - \alpha)\bar{\theta}^2 > 0$.

If, though, the retailer is constrained in how high it can set SB quality, this will affect how much surplus it can extract from Switchers. Constrained to a maximum of $\bar{s}$ then for $\alpha \geq 1$, at any non-zero level of SB quality, i.e. $\bar{s} > 0$, even a low quality SB offers additional profit (noting $\pi_R^{BI} - \pi_N^{BM} = \frac{1}{4}s\bar{\theta}^2 > 0$). However, for $\alpha < 1$ then there is a trade-off between segmenting consumers to leave the NB to extract all the available surplus from Loyals but only a limited amount from the Switchers with the SB (because of its low quality) against using the NB to serve both segments and using this to extract more surplus from Switchers but foregoing some from Loyals. The profit difference for the retailer is $\pi_R^{BI} - \pi_R^{BM} (= \pi_R^{BD}) = \frac{1}{4}(2\alpha - \alpha^2 - 1 + s)\bar{\theta}^2$. Denoting the corresponding boundary condition as $s_R^B = 1 - 2\alpha + \alpha^2$ then segmentation offers greater profit, i.e. $\pi_R^{BI} > \pi_R^{BD}$, if $\bar{s} > s_R^B$, otherwise the retailer would be better off with just using the NB to serve both segments and either choose not to offer an SB (as with NB monopoly case examined in

section 3.2) or offer the SB but de-market it and over price it in such a way that it does not attract any sales (as with the direct competition case examined in section 4.2.2).

We can observe that the requirement on s_R^B is strictly declining and at a decreasing rate (i.e. convex) in α for $\alpha < 1$, such that $s_R^B \to 0$ as $\alpha \to 1$ and $s_R^B \to 1$ as $\alpha \to 0$. Thus the restriction becomes tighter the lower is α, since this means the retailer's profit is relatively more dependent on the amount of surplus that can be extracted from the Switchers, as sales to and thus surplus from the Loyals shrinks. To illustrate the effect of α decreasing, for $\alpha = \frac{3}{4}$ then $s_R^B = \frac{1}{16} = 0.0625$, for $\alpha = \frac{1}{2}$ then $s_R^B = \frac{1}{4} = 0.25$, for $\alpha = \frac{1}{4}$ then $s_R^B = \frac{9}{16} = 0.5625$, and for $\alpha = \frac{1}{10}$ then $s_R^B = \frac{81}{100} = 0.81$.

In summary, in this pricing scenario, the retailer's strategy is to maximise the level of SB quality, ideally to the point where it exactly matches the NB quality with $s = 1$, and then use segmentation with the NB targeted at Loyals and the SB targeted at Switchers to extract as much surplus as possible from these two different consumer segments. If, though, the retailer is constrained in the quality level it can set for the SB then it will still use this segmentation strategy as long as it can set s to meet the requirement of $\bar{s} > s_R^B = 1 - 2\alpha + \alpha^2$, which always holds for $\alpha > 1$ with $\bar{s} > 0$, but will be binding for $\alpha < 1$ and require higher levels of $\bar{s}$ for smaller α. If the requirement on s_R^B cannot be met then the retailer will rely simply on the NB to make all sales.

5.3 Equilibrium outcomes in Scenario C

In Scenario C, with leader-follower wholesale-then-retail price setting, the retailer will have to bear in mind when determining SB quality that the NB producer can always secure monopoly profits over the Loyals by setting $w = \bar{\theta}$ and so obliging the retailer to set $p_1 = \bar{\theta}$, and then leaving the SB to serve Switchers. In that case, the retailer will earn $\pi_R^{CI} = \frac{1}{4}\bar{\theta}^2 s$, which is strictly increasing in s and at its maximum when $s = 1$. If the retailer is able to set $s = 1$ then this profit is more than it would earn under NB monopoly, where for $\alpha \geq \frac{1}{3}$ then $\pi_R^{CM} = 0$ and for $\alpha < \frac{1}{3}$ then $\pi_R^{CM} = \frac{1}{16}(\mu + \bar{\theta})^2 < \frac{1}{9}\bar{\theta}^2$. However, if the retailer were constrained in how high it could set SB quality then the latter profit condition would take on take on significance and would require a minimum level of s, which we can denote as $\underline{s}^C$, such that using the SB with segmentation would offer more profit where $\pi_R^{CI} - \pi_R^{CM} = \frac{1}{16}(4s - 1 + 2\alpha + \alpha^2)\bar{\theta}^2 > 0$ if $s > \underline{s}^C = \frac{1}{4}(1 + \alpha)^2$. Here, $\underline{s}^C$ is increasing and convex in α, and at minimum with $\underline{s}^C \to \frac{1}{4}$ as $\alpha \to 0$ and at maximum with $\underline{s}^C \to$

$\frac{4}{9}$ as $\alpha \to 1$. Thus as long as the retailer is able to set a minimum of $s = \frac{4}{9} = 0.\dot{4}\dot{4}$ then it will always be profitable to develop the SB and target it at Switchers if the NB is targeted at Loyals compared to allowing the NB to serve both consumer segments on its own.

However, we have yet to consider the NB producer's response to the presence of a SB. Here it can either forego serving the Switchers and focus on the Loyals, extracting all the surplus from them and securing a profit of $\pi_N^{CI} = \mu\bar{\theta}$, or it can choose to compete for Switchers, in which case its profit will be $\pi_N^{CD} = \frac{1}{8}(1-s)(\mu + \bar{\theta})^2$. The former is independent of s while the latter is strictly decreasing in s, and in the limit $\pi_N^{CD} \to 0$ as $s \to 1$. The reason for the latter effect is that with direct competition the retailer can use the SB quality along with the SB's zero wholesale price as a means to control the NB producer and ensure it sets a low wholesale price (where $w^{CN} \to 0$ as $s \to 1$), which it will be required to do in order for the NB to remain competitive relative to the SB in competing for Switchers. This will be a very attractive outcome for the retailer and its own profit is maximised under direct competition by setting the SB quality to be as close as possible to that of the NB quality, where $\pi_R^{CD} \to \frac{1}{4}(\mu + \bar{\theta})^2$ as $s \to 1$, so allowing it to take all the available joint profit.

Clearly, while desirable for the retailer, this will be an outcome that the NB producer would seek to avoid. In this regard, competing for Switchers becomes a trap that the NB producer would want to escape and the way to do this would be to ensure that the NB is only targeted at Loyals with the segmentation outcomes discussed above by setting $w = \bar{\theta}$ and so pushing the retailer to set $p_1 = \bar{\theta}$. Accordingly, we can see that if the retailer were to set $s = 1$ then the equilibrium outcome would be targeted segmentation with the retailer earning $\pi_R^{CI} = \frac{1}{4}\bar{\theta}^2$ and the NB producer earning $\pi_N^{CI} = \mu\bar{\theta}$.

If, though, the retailer were constrained in its choice of s then for any given level of s the difference in the NB producer's profit between direct and indirect competition is $\pi_N^{CD} - \pi_N^{CI} = \frac{1}{8}[1 - 6\alpha + \alpha^2 - s(1+\alpha)^2]\bar{\theta}^2$. Denoting the critical value of s where $\pi_N^{CD} = \pi_N^{CI}$ as s_N^C then $\pi_N^{CD} > \pi_N^{CI}$ if $s < s_N^A = 1 - 8\alpha/(1+\alpha)^2$. This condition is decreasing and concave in α, being at its maximum with $s_N^C \to 1$ as $\alpha \to 0$ and at a minimum with $s_N^C = 0$ when $\alpha = 3 - 2\sqrt{2} \approx 0.1716$, so only if the proportion of Loyals is particularly small will the NB producer benefit in competing directly with the SB for Switchers, and less so the higher is s. For example, for $\alpha = \frac{1}{10}$ then $s_N^C = \frac{41}{121} \approx 0.3388$, for $\alpha = \frac{1}{20}$ then $s_N^C = \frac{281}{441} \approx 0.6372$, and $\alpha = \frac{1}{50}$ then $s_N^C = \frac{2201}{2601} \approx 0.8462$.

The corresponding profit comparison for the retailer reveals that it has a strict preference for direct competition over segmentation, since $\pi_R^{CD} - \pi_R^{CI} = \frac{1}{8}[1 - s + (1 + 3s)(2\alpha + \alpha^2)]\bar{\theta}^2 > 0$. Here, the benefit for the retailer of NB and SB direct competition is while it foregoes some SB sales to Switchers (compared to when the SB captures all Switcher sales with segmentation) it gains a profit margin on all the NB sales (where it has a zero margin on NB sales with segmentation) making its overall profit higher. Accordingly, the retailer has a strong vested interest in trying to encourage the NB producer to engage in direct competition rather than segmentation. This is only possible if the retailer sets $s < s_N^C$, and a necessary condition is that $\alpha < 3 - 2\sqrt{2} \approx 0.1716$. In these circumstances, though, other than by coincidence if $\bar{s} = s_N^C$, the retailer will be conflicted between the desire to set s as high as possible, which increases its profit under both direct and indirect competition, and limiting the SB quality to ensure that the NB producer opts for direct competition rather than indirect competition with segmentation.

To consider how this conflict plays out, take the situation where the retailer is capped in the level of s it can set to ensure that the NB producer goes for direct competition by restraining SB quality to $s = s_N^C$ compared to setting SB quality at the maximum possible level it can set with $s = \bar{s} \equiv s_N^C + \sigma < 1$, where σ is the gap in quality between the limit value and the maximum it could set, but then have to contend with segmentation. In this situation, the retailer's difference in profit will be $\pi_R^{CD}(s_N^C) - \pi_R^{CI}(\bar{s}) = [\alpha(4 - 7\alpha - 2\alpha^2 + \alpha^3) - \sigma(1 + \alpha)^2]\bar{\theta}^2/(1 + \alpha)^2 > 0$ if $\sigma < [\alpha(4 - 7\alpha - 2\alpha^2 + \alpha^3)]/(1 + \alpha)^2$, where this condition is concave in α, being at a minimum with $\sigma = 0$ when $\alpha = 0$ and $\alpha \approx 0.5151$ and positive for in-between values of α, with a maximum at $\sigma \approx 0.3516$ when $\alpha \approx 0.2089$. Accordingly, there is some – albeit quite limited – scope for the retailer to set a lower level of SB quality less than its capability in order to ensure that the NB producer will also have a preference for direct competition.[33] The scope is restricted to very low levels of α and also σ being small, otherwise the retailer will prefer to set the SB quality at its maximum, $\bar{s}$, and push the NB producer into opting for market segmentation.

In summary, this pricing scenario, with wholesale-then-retail pricing, is more complicated than the previous two considered scenarios because in this case the retailer has a strict preference for direct competition, which serves as an effective means to force the NB producer to lower its wholesale price and allow the retailer to capture more of the available total profit. This retailer

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[33] To use the above values of α as illustrations, when $\alpha = \frac{1}{10}$ and $s_N^C = \frac{41}{121} \approx 0.3388$ then $\sigma < \frac{3281}{12100} \approx 0.2716$, for $\alpha = \frac{1}{20}$ and $s_N^C = \frac{281}{441} \approx 0.6372$ then $\sigma < \frac{29161}{176400} \approx 0.1653$, and $\alpha = \frac{1}{50}$ and $s_N^C = \frac{2201}{2601} \approx 0.8462$ then $\sigma < \frac{482401}{6502500} \approx 0.0742$.

desire becomes more pronounced the closer is the SB to the NB in quality terms, but the NB producer always has the option of going for market segmentation by setting its wholesale price at the reservation price of the Loyals. The retailer then has to decide whether it should strategically limit how high it sets the SB quality level as a way to subdue the intensity of direct competition or to set the maximum possible level of SB quality and accept that this might trigger the NB producer going for market segmentation. The above analysis shows that only for a very restricted set of parameter values (with a necessary condition that $\alpha < 0.1716$ and tighter sufficient conditions on α as s increases) will the strategic profit sacrifice be worthwhile and otherwise the retailer will have to accept the profit under segmentation and seek to maximise this level by setting s as high as possible, and ideally at $s = 1$ to exactly match the NB quality.

6. Discussion

6.1 Comparisons across the different pricing scenarios

The equilibrium outcomes for all three scenarios show that the retailer has a keen interest to develop a store brand and generally ensure that its quality is set as close as possible to that of the national brand. However, the reasons and motives are subtly different between the three scenarios.

In Scenario A, the NB producer controls the NB's price and sales and, in the absence of the SB, takes all the profits, so the SB offers the retailer a means to make profits which are maximised when it can force, through the threat of profit-destroying direct competition, the NB producer to retreat to just serving Loyals and thereby leaving the SB to take all the sales from Switchers. This competitive threat increases as SB quality increases but higher SB quality also serves to ensure in the resulting segmented market structure that the retailer is best placed to set a high price and extract as much surplus as possible from Switchers and so maximise its profits. Thus the purpose of the SB is a tool for *shifting profits* and to wrestle away market control from the NB producer, where the retailer will favour the SB over the NB because it offers a higher (positive) margin compared to the (zero) margin on the NB.

In Scenario B, and in complete contrast, the retailer controls the NB's price and sales and takes all the profits. In this case, the role of the SB is as a *price discrimination* device to work in tandem with the NB to extract more surplus from consumers than the NB could achieve on its own. The added value of the SB for the retailer is that rather than have to pitch an averaging price for the NB to serve both Loyals and Switchers (and so losing some surplus from Loyal and losing some sales to Switchers), it can target the NB at Loyals with a precise price to extract all their surplus and target the SB at Switchers with a lower price (knowing that Loyals will still not buy the SB) to generate higher sales and extract more surplus from them.

In Scenario C, and representing a more intermediate case where both parties have a degree of market power in a successive pricing structure, the presence of a high quality SB works as a tool for *bargaining leverage* restraining the NB producer in the wholesale price it can charge if it wants to serve both consumer segments by forcing it to concede on its margin to remain competitive on retail price or obliging it to accept segmentation and just serving Loyals and leaving the SB to

serve Switchers. Either way, the high quality SB in serving Switchers will also serve as a tool for *expanding category sales* by alleviating double marginalisation if the NB serves Switchers or increasing total sales if otherwise Switchers would be excluded when only the NB is available.

Accordingly, each scenario paints a slightly different picture for the reason the retailer will want to develop a high quality store brand. In each scenario, the retailer has to contend with the NB having guaranteed exclusive sales to Loyals but it can use this brand loyalty to its advantage by forcing the NB producer either to focus on this segment but then exclude itself from potentially high sales to Switchers or face having to compete directly with the SB for Switchers and earn less margin. If the NB did not have this secure market with Loyals then it would have to fight for sales with the SB over Switchers, but in having this security and not wanting to forgo these profits on Loyals then the brand loyalty for the NB opens the door for the SB to seize complete control over sales to Switchers. Thus brand loyalty is a double edged sword for the NB producer, as it offers a secure profit but in the process means that it will be less willing to sacrifice this to take on the SB and fight for additional customers. Knowing this, the retailer can be very aggressive in choosing its SB quality to match the NB quality, forcing the NB producer into a "fight-or-flight" response, where "flight" will generally be the more attractive option allowing the NB producer to avoid profit destroying direct competition but in the process acquiescing to consumer segmentation.

6.2 Strategic implications for industry participants

With these results in mind, we can see why retailers will be keen to improve SB quality and increase SB sales and why they might relentlessly strive to match NB quality with SB equivalents. To this end, retailers will be encouraging their store brand producers to overcome any technical, input requirement or production problems that could prevent the SB matching the performance (including taste, look and/or feel) and formula/composition of the NB. Also, we can see why retailers might be inclined to deliberately use a "lookalike" strategy for SBs to mimic the look, presentation and image of leading NBs when perceived quality differences (including from packaging design, brand logos and associated brand imagery) remain despite the absence of any notable physical quality differences.

The issue of SB lookalikes has become a hotbed of contention and running source of friction between NB producers and retailers developing copycat SBs (Johnson *et al* 2013; Dobson and

Zhou 2014). For NB producers, they wish to protect brand identity and distinctiveness and not have retailers develop SBs that free-ride on the brand investments that they have made to build up consumer goodwill and trust in the brand. Equally, for retailers they might view developing lookalike SBs as fair game in ensuring that consumers are given the best possible quality of SB products to ensure SB comparability with the NB and benefit quality-conscious and value-conscious consumers alike in making their product choices.

However, our analysis gives an interesting perspective on deeper reasons for their different stances. For the NB producer, brand loyalty offers security on profits and so it will be eager to maintain that security and ensure that it remains indispensable to the retailer, i.e. the NB cannot be delisted and not stocked without the retailer losing sales and perhaps brand loyal customers shopping elsewhere. In contrast, the retailer will be keen to substitute sales of NBs with sales of SBs, but only so long as this allows for higher margins and total profits to be made. If NB brand loyalty is weakened then this can work to the retailer's advantage when the threat of intense competition with the copycat SB forces the NB producer to lower its wholesale price. However, if taken too far, this will mean that the retailer will lose a valuable price discrimination tool in how the NB and SB are perceived and which allows it to separate quality- and value-conscious consumers by targeted pricing and in the process extract more consumer surplus.[34]

The latter aspect also has relevance in terms of how far retailers might be prepared to go with *switching marketing* and "compare and save" advertising campaigns backed up by in-store promotions, blind taste tests, brand delisting trials, and more favourable SB shelf-space allocation and positioning as a means to encourage consumers to switch away from NBs to equivalent SBs.[35] This can benefit the retailer if it increases SB quality perceptions and in the longer term allows it to increase SB prices, but if all it does is to encourage consumers to trade down and buy cheaper products then such marketing runs the risk of making consumers more price conscious and prepared to pay less for goods and so take value out of the market.

In respect of developing lookalikes and using switch marketing tactics to favour SBs over NBs, the retailer has to balance the desire to raise the perceived quality of the SB and encourage trial to

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[34] Even so, the emergence of multi-tier store branding offering "good, better, best" choices, e.g. with budget, standard and premium private labels, means that retailers are increasingly capable of just using store brands pitched at different quality tiers to segment consumers. On the practicalities and effectiveness of this strategy, see Kumar and Steenkamp (2007, chapter 5) and Geyskens et al (2010).

[35] For examples of switch marketing, see http://idei.fr/doc/conf/inra/2011/dobson2%20table%20ronde.pdf.

gain increased SB sales against undermining NBs and damaging brand equity so that they lose their cachet with high-value consumers. Given the very significant advancement of broad-based SB portfolios by retailers and the increasing ability and wherewithal of SB suppliers to replicate the physical quality of NBs (and indeed even the image quality when placed under a reputable retailer premium umbrella brand) then it might come as a surprise why SBs have not completely replaced NBs. Certainly many secondary brands with limited brand loyalty have been replaced by SBs.[36] However, our analysis suggests the continuing presence of category-leading NBs is because they do remain indispensable to retailers, in being able to satisfy particularly choosy and exacting customers as well as serving as a useful device to segment consumers, but can be much more effectively controlled and tamed when the retailer is able to develop quality-equivalent SBs. In this sense, rather than the traditional view of a retailer as merely a brand producer's agent serving as its distributor, the power relationship could go the other way with the brand producer being the retailer's agent, played off against other suppliers and needing the retailer as the gatekeeper it has to go through if its products are to reach final consumers. The only defence for the NB in these circumstances is to ensure that it remains indispensable. This requires a two-fold investment effort in firstly continuing to invest in quality improvements and product distinctiveness to keep one step ahead of SB copycats while taking a tough enforcement stance against lookalikes to protect its intellectual property and secondly continually investing in maintaining brand loyalty and building its loyal customer base.[37]

6.3 Implications for consumers

Thus far we have only discussed how the market outcomes affect the industry players and have yet to comment on how consumer welfare is affected by the interplay of the NB and SB. Tables 2-4 report the consumer surplus levels in each pricing scenario for respectively NB monopoly, NB/SB indirect competition with segmentation, and NB/SB direct competition. In principle, consumers stand to gain by the introduction of the SB as offering both choice and competition

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[36] Kumar and Steenkamp (2007, pp. 186-8) and Bell (2009) provide examples and evidence on the squeeze on secondary brands at category level. Also, Walmart has been quite open about delisting secondary brands, e.g. Steiner (2004, p.112) and Berg and Roberts (2012, p. 98). Its UK subsidiary, Asda, has been operating brand delisting trials to test whether consumers will miss the absence of secondary brands (Leyland 2007; Smith 2009). For a theoretical model showing why SBs replace secondary NBs, see Scott Morton and Zettelmeyer (2004).

[37] Kumar and Steenkamp (2007, chapter 12) provide a wealth of examples on where such brand investments should be directed.

with the NB for their custom, and the more so the higher is the quality of the SB. However, as we have seen, the market outcome under each pricing scenario is likely to be segmentation with the retailer using the NB and SB as price discrimination devices to strip Loyals of all surplus and restrict Switchers' surplus and in this case consumers could be even worse off than in aggregate terms than when the NB was the only choice. [Specifically, if under NB monopoly both segments are served, requiring $\alpha < 1$ for Scenarios A and B and $\alpha < \frac{1}{3}$ for Scenario C, then consumer surplus will be more in Scenarios A and B compared to segmentation unless $s > (1 - \alpha)(1 + 3\alpha)$ (where it is sufficient for $\alpha < \frac{2}{3}$ even with $s = 1$) and more in Scenario C (and despite the double marginalisation) unless $s > (1 - 3\alpha)(1 + 5\alpha)$ (where it is sufficient for $\alpha < \frac{2}{15}$ even with $s = 1$).

In contrast, consumers would be better off with direct competition, at least for Scenarios A and C, where in competing head-to-head for Switchers, both consumer segments gain from lower prices. Yet, such possibilities only arise in two circumstances. In Scenario A, the benefits of direct competition will only flow to consumers if the retailer is sufficiently constrained in how high it can set SB quality such that the NB producer is still prepared to price the NB at a level which will allow it to directly compete for Switchers, which in the process benefits Loyals. The conditions for this case are shown in section 5.1 and essentially require the value of α to be low so the NB producer would otherwise be greatly restricted in its sales if it only sold to Loyals and s to be sufficiently low to constrain the intensity of direct head-to-head competition in the NB producer's favour. In Scenario C, direct competition will only arise under similar but even tighter conditions, shown in section 5.3, on α being low and the retailer restraining how high it can set s without triggering the NB producer preferring to avoid direct competition and instead opt for its secure profit by pricing just to serve Loyals.

There is, though, an important difference between these two cases. For the Scenario A case, it is the NB producer which prefers direct competition and the retailer is unable to ward off competition for Switchers because the SB quality is too low to support a credible threat of profit-destroying competition. For the Scenario C case, it is the retailer which prefers direct competition and it has to soften its position to strategically accommodate competition by deliberately limiting the SB quality.

From the consumers' perspective, it is the intense competition under the former case, i.e. with Scenario A, which is the more attractive prospect, as here direct competition for Switchers is about two independent firms competing head-to-head, with each setting the retail price of its own

product and not considering each other's profit situation, i.e. *pure horizontal competition* in the sense of not internalising the externality effects arising from independent decision making in competing over the same set of customers.[38] In contrast, in the latter case, under Scenario C, the benefits from direct competition largely flow to the retailer because competition here is really about *vertical competition* and the NB wholesale price level, where the more closely the retailer can imitate the NB's quality then the greater its bargaining leverage to ensure that the NB producer has to set a low wholesale price. Horizontal competition over retail prices is absent because it is the retailer which sets both the SB and NB prices to maximise its own combined profits on the sales of the SB and NB (i.e. akin to acting as an in-store cartel).   It is only by the indirect means through how it sets the wholesale price that the NB producer can influence (but not dictate) the NB retail price. So, if it wants the NB to be more price competitive with the SB then it has to concede on the wholesale price as this is the only mechanism by which it can encourage the retailer to reduce the NB price and so close the price gap with the SB and thereby gain additional sales. The upshot is that while the vertical competition delivers lower supply prices for the retailer, it does not necessarily mean that these benefits are passed on to consumers in the form of lower retail prices when the retailer opts to maintain a high retail price while widening its own profit margin and pocketing higher profits in the process.

Put another way, this case under Scenario C represents the extreme form of the double-agency problem facing the NB producer, where it has to contend with a retailer-created "competitor" in the SB, which is striving to match the NB's quality to make it a perfect substitute (in the eyes of Switchers), and yet has to deal with a "customer" which (from a joint standpoint because of double marginalisation) "over-prices" the NB and so chokes off demand to the detriment of both the NB producer and consumers.[39]

In contrast, the direct horizontal competition and independent retail price setting in the Scenario A case means the NB producer does not have to contend with the vertical control aspect of the retailer as a strategic customer, and instead only has to deal with a horizontal competitor in the form of the SB as a rival product, where price competition intensifies the closer is the SB to the NB's quality and which directly benefits all consumers. Thus being in a position where it sets,

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[38] In effect, it is as if the retailer is a platform operating as a marketplace where it sells its own goods (SBs) but also through which other suppliers can sell their own goods (NBs) and set their own prices to compete with the retailer, i.e. analogous to online marketplaces like Amazon Marketplace.

[39] For further discussion and indicative evidence that retailers might over-price NBs to favour SBs, see Kim and Parker (1999), Soberman and Parker (2004; 2006) and Meza and Sudhir (2010).

rather than the retailer sets, the NB price not only ensures the NB producer earns more profit (which can be readily seen from Table 4 that $\pi_N^{AD} > \pi_N^{CD}$ for any given value of $s < 1$) but makes sure the SB also has to compete squarely and on non-favoured terms. In this regard, direct NB/SB competition with independent retail price setting ensures that competition is on a more even keel and both the NB producer and retailer stand to lose out the less differentiated and so more substitutable are their products – which is what we would expect of competition but does not arise if the retailer controls both SB and NB retail prices.

In this context, the NB producer's control of its own product's retail price through (maximum) RPM in Scenario A stands to benefit both itself and consumers. Here, RPM serves two roles in keeping prices down since not only does it eliminate the double marginalisation problem by avoiding inefficient successive mark-ups, but it is the vehicle which ensures independent retail price setting that drives genuine head-to-head competition. The benefits of brand producer-led RPM to compete with store brands have been pointed out previously (most forcefully by Olbrich et al (2005; 2009) and Kuipers (2009)) but competition authorities remain suspicious of RPM as a competition-reducing device that weakens overall price competition.[40] The key qualification here is that our findings relate to a single dominant retailer where there is no intrabrand competition, so RPM is in effect a surrogate to vigorous retail competition in suppressing the NB price and thus might not be so essential in highly competitive and fragmented retail markets.

6.4 Implications for regulators and policymakers

The discussion in the two preceding sub-sections raises two important issues for public policy. Firstly, the appropriate scope for protecting intellectual property ("IP") rights on producer branded goods when faced by the challenge of copycat store brands. Secondly, the extent to which producers should be able to influence or control how their brands are priced and marketed by retailers to best ensure fair and effective competition with store brands.

For the former, it will be important for policymakers to strike the right balance in affording IP protection that does not create barriers to effective competition but is sufficient to stop intentional parasitic copying that either fuels an otherwise unnecessary product development

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[40] However, attitudes may be softening with greater recognition of the efficiency benefits of RPM, e.g. OECD (2008). Nevertheless, competition concerns remains about RPM, especially in fragmented retail markets, and its potential harm to both interbrand and intrabrand competition, e.g. Shaffer (2013).

arms race with spiralling costs that are ultimately borne by consumers or discourages brand investment leading ultimately to less innovation, poorer quality products and category demand not being fully realised, i.e. a market distortion through either economically wasteful over-investment or economically damaging under-investment. Given the increasing body of evidence on consumer confusion and consumers being misled by copycat brands,[41] it would appear that present policy might not be offering a suitable level of protection.

For the latter, as our analysis shows, competition can be more effective when a brand producer is allowed to control or at least cap the retail price of its own product to meet the store brand challenge. Given the level of concentration, scale, sophistication and channel power present in modern retailing, it would seem that the old arguments about prohibiting RPM might be less important today. Increasingly, competition authorities are applying a rule-of-reason approach to RPM (e.g. OECD 2008), and our analysis (subject to the above noted caveats) lends support to this perspective, at least in respect of maximum RPM when it can help limit excessive prices to the benefit of consumers.

Nevertheless, these are not the only policy matters raised by our analysis that might have a bearing for regulators and competition authorities. In one sense, it is almost taken as axiomatic by such bodies that competition and choice is good. However, our analysis shows a situation where this is not the case, when consumers would actually be better off without the option of a store brand (i.e. when the NB no longer serves Switchers). This provides pause for thought about differences in "good" and "bad" competition in terms of meeting consumers' needs (e.g. Stucke 2013). In our case, this arose when introducing choice led to higher overall prices, because using two products in tandem rather than just selling one permitted more effective consumer surplus extraction. In short, regulators and policymakers should not blindly fall into the trap in thinking that the presence of store brands is necessarily in consumers' interests, but instead they should take a more considered assessment of the role of store brands and how they interact with national brands. Generally, more choice will be better for consumers, but not always.

One interesting aspect for any economic assessment is to consider whether store brands "expand" or simply "extend" consumer demand. If all store brands do is mimic national brands with a "me too" approach then all they can really achieve is to "extend" demand by serving additional

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[41] For a summary of the empirical evidence, see Johnson et al (2013). Experimental evidence also points to copycat branding causing confusion, e.g. Miceli and Pieters (2010), van Horen and Pieters (2012; 2013), Satomura et al (2014) and Falkowski et al (2014).

marginal customers, e.g. bringing in more price-conscious consumers prepared to buy a cheaper alternative to the NB. This is what characterises our analysis, and as we show the net outcome of whether or not choice benefits consumers can go either way depending on the model's parameters. If, alternatively, store brands are fundamentally different propositions in character serving consumers' needs of the product in different ways, such as offering distinctive, novel and valuable features, then they can "expand" demand by attracting new consumers or re-ordering consumers' product preferences (e.g. where store brands offer different combinations of features that are not currently offered by national brands). This is more likely to be the case with "premium" store brands staking out a differentiated position – i.e. what fundamentally characterises national brands – and these can genuinely add to the choice set for all consumers rather than using me-too store brands to segment consumers by their type with illusory choice via carefully managed price targeting. Yet, even for store brands that extend rather than expand demand in this way, they too can offer significant economic benefits when demand is substantially extended. A good example is how the development (or at least re-emergence) of "budget" and "economy" private labels has provided a genuinely different proposition in the marketplace, serving extremely price-conscious (e.g. low-income) consumers that otherwise would not be well served.

6.5 Implications for competition authorities defining markets

All of this discussion, though, highlights a more fundamental issue posed by the title of the paper about how national brands and store brands compete. For competition authorities, they might be more interested in the binary question: "Do they compete?" Industry participants and most observers would take this as given, appreciating how store brands pose both a vertical and horizontal competition challenge to national brands. However, at issue for a competition authority should be whether they compete "effectively", in delivering economically beneficial effects, such as lower prices, better quality, more choice or variety, more innovation and greater productive and overall efficiency. Even in our simple model we can see there may be trade-offs at play, such as more choice but higher overall prices. Moreover, the equilibrium market configurations in our set-up generally point to the store brand mimicking national brand quality, resulting in targeted pricing and consumer segmentation. While this might not necessarily leave consumers worse off than in the absence of a store brand, it does not fit with the common perception (perhaps which the industry would like to promote) of national brands and store

brands confronting each other head-on in the marketplace and falling over themselves in vigorously fighting over the same set of consumers to serve all their needs.

Of course, the problem with this notion is a failure to appreciate the nexus of vertical and horizontal competition and the fact that it is the retailer that typically has total control over both retail pricing and the relative market positioning of the different product types (because it adjusts SB quality relative to fixed NB quality). In these circumstances, as we have seen, direct head-to-head competition for the same type of consumers only arises in limited circumstances, typically when there are relatively few brand loyal consumers and store brand quality cannot match national brand quality. Thus, there is an irony. The less differentiated are the two types of products (i.e. the closer they are to being perfect substitutes, at least for Switchers) – which we would normally associate with more intense price competition – then the less likely they are to compete head-on for the same type of consumers and price closely. Indeed, as witnessed in our model, the price gap can be very wide even for nominally identical products in quality terms.

Nevertheless, we need to be cautious here. These findings are from a model with a stripped-down market structure that excludes consideration of *interbrand* competition between different NB producers and *intrabrand* competition between different retailers selling the same NB as well as offering their own SBs. The absence of the latter is perhaps the more important, since the ability to use indirect price discrimination and consumer segmentation is likely to be checked if all consumer types have a willingness to shop-around for the best prices. Even so, retail competition does not guarantee this, especially if consumers are store loyal (and naturally retailers put in a great deal of effort to ensure this), and when store loyalty is aided by consumer familiarity with retailer-unique SBs (e.g. Corstjens and Lal 2000).[42]

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[42] One potentially interesting extension of our model would be to have two retailers selling the NB and allow the brand loyal customers to choose between these two retailers, also with each retailer offering its own unique store brand. This could then allow for consideration of *intrabrand* competition for consumers choosing from which retailer to buy the NB but also allow for *instore-interbrand* competition between the NB and a SB. For instance, one could consider re-naming Loyals as "Brand-Loyal-Store-Switchers" ("BLSS") and Switchers as "Store-Loyal-Brand-Switchers" ("SLBS"), and then allow *horizontal* differentiation between the retailers (say, located at end points on a Hotelling line along which BLSS consumers are uniformly distributed and incur a transportation or disutility cost to visit either retailer depending on their address) and *vertical* differentiation between the NB and each SB (using the same Switcher demand characterisation as here). This could be a sufficiently tractable model, especially as it eschews the complicating issue of *interstore-interbrand* competition, i.e. direct SB rivalry between retailers, and so it might provide some illuminating insights on how the relative strength of brand and store loyalty and the degree of product and retailer substitutability play out.

Speculating further, the other aspect to bear in mind with retail competition is that what might be a preference for one retailer to use targeted segmentation could be shared by all other retailers. The upshot might be then that they all use targeted segmentation to a degree but they compete separately for the different types of consumers. We might then expect to see item-by-item retail price competition, so that while retailers seek to match each other on the price of the same national brand and on the price of each other's equivalent store brand, there might be no or little pricing relationship between the two different products.[43]

In relation to retail prices then we should not be surprised to see a wide price gap between NBs their equivalent SBs, and wider than might be expected given apparently narrow quality differences. This is indeed borne out in numerous empirical studies.[44] We should also not be surprised to find a lack of a strong price correlation between NBs and SBs, as their respective prices are more likely to track each other across stores than across products in the same product category if price changes are more driven by tactical changes around brand demand (e.g. temporary price promotions) and retailer competition (e.g. price matching promises) than shared cost changes (e.g. as might be experienced in an inflationary period with significant cost increase to the products' ingredients). However, this does not mean that NBs and SBs are not in competition with other, only that item-by-item retail price competition is likely to be a more dominant explanation for observed price correlations given that it is the retailers – and not the individual NB and SB producers – which are the ones setting retail prices for their entire product range and assortment.

This highlights a problem for competition authorities in terms of the empirical toolkit which they usually employ to assess the degree to which products are competing with other. Normally, examining the price gap and price correlations between different products can be quite telling about how they relate to each. Indeed, this might be a first step in market definition for consumer products before applying more sophisticated econometrics with Granger-causality tests, cointegration analysis, demand elasticity estimation and structural equation modelling, usually

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[43] Indeed, the kinds of price matching promises (which are for price comparisons on matching items) witnessed in the UK lend themselves to this type of item-by-item competition (*Which?* 2013). For empirical evidence on the nature and outcomes of such competition, see Chakraborty et al (2011). Also, theoretical models of bilateral oligopoly (say, with two retailers both selling the products of two producers) also show such item-by-item competition because each retailer internalises the externality effects from the products it sells but cannot (in the absence of a retail cartel) exercise any control over how a rival retailer would independently price its own matching products (e.g. Dobson and Waterson 2007).

[44] For example, see reviews by Pauwels and Srinivasan (2009) and Sethuraman and Raju (2012) and a multi-country study by Steenkamp et al (2010).

relying on supermarket scanner or household panel data for prices and quantities.[45] The problem with all such analysis relying on retail prices and retail sales is that it is only directly representative of the nature and extent of retail competition and not the nature and extent of underlying producer competition. This is because it is the retailers which are setting the retail prices that consumers pay, so any interpretation of how this relates to producer competition must necessarily only be indirect as it is one stage removed. This might work fine when retailers are all perfectly competitive and are simply passive and non-strategic agents distributing producers' goods at the prices at which they are instructed by producers. However, this does not match the reality of modern mass retailing, where large retailers wield enormous power and influence over supply chains and are very strategic in nature, including controlling the development and positioning of store brands.

So, to maintain some justification for continuing to use retail data for product market definition purposes, competition authorities are often forced into making assumptions about the nature of vertical competition in order to interpret what retail data says about producer competition. Despite the application of increasingly sophisticated econometrics, this is necessarily quite a subjective task (and so with plenty of scope for debate and argument) and rarely is it sufficiently nuanced to cater for the distorting effect of real-world retail competition and how this varies from one product category to another, from one time period to another, and from one retailer type to another. It lends itself to a rough-and-ready approach, seduced by the availability of bountiful and reliable retail sales data. However, this does not necessarily reflect or attain a true understanding of producer competition, which is one stage up the supply chain where it is the retailer – and not final consumers – that is the customer, and it is here where competition authorities should be focusing their interest on price competition. If competition authorities want to analyse producer competitor then they should not be relying on retail price and retail sales data but instead at the wholesale level. Even so, pricing analysis is difficult at this supplier-retailer interface level not just because of the lack of ready-to-hand publicly available data, but because of the complicated structure of supply prices which are rarely a single fixed wholesale price – which we used in our model for convenience and tractability. Supply prices are more likely to be in the form of negotiated price schedules with different elements covering sales incentives and lump sum payments (such as for shelf-space fees), with these pricing structures

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[45] For a wealth of US and European examples, with details on the empirical techniques applied and findings in market definition cases involving brands and private labels, see Schmidt and Calvani (2009), Bishop and Walker (2010), and Doyle and Murgatroyd (2011).

varying quite significantly according to retailer preferences and how they go about their negotiations with individual suppliers, which can differ greatly if they are national brand or store brand suppliers (e.g. Competition Commission 2000; 2008).

Yet, the bigger issue here is the reliance by competition authorities on what they see (rightly or wrongly) as easily-measurable price competition and then using this to define product markets and determine whether or not national brands and store brands are constraining each other as competitors. This misses or underscores the very considerable importance and effort made in respect of non-price competition, and indeed the mix and interaction of the two, which has been the theme of our analysis. To an extent the prices paid by consumers are reflective of non-price efforts made in terms of product design and quality along with marketing support because these involve costs that necessarily need to be covered and reflect differentiation. However, the prices seen in markets are only one part of the picture. They are attached to the goods that are in the market, not the goods that are not in the market, i.e. which are yet to be developed (i.e. future goods), have been supplanted (i.e. past goods) or available but not sold (i.e. current goods denied access to the market).

As we have seen in our model, the availability of products is a discrete (yes/no) choice over which retailers have a very considerable influence because not only can they determine whether or not to allow a product to be sold in their stores (i.e. their gatekeeper role) but they can – through store brands – also commission and introduce products to the design and specification of their own choosing. Moreover, once in the store, then it is left to the retailer to influence and ultimately determine what consumers buy through the in-store marketing levers that it controls, i.e. deciding on product assortment, product placement, product pricing, and product promotion. Indeed, we have talked about the *double-agent* role that the retailer plays towards the NB producer, but in reality it holds a *triple-agent* role (Dobson 2005). This is because the retailer serves not just as the NB producer's "customer" (buying and then reselling the NB to consumers) and as "competitor" (offering SBs to compete with NBs), but also as its "supplier" in selling it access to its stores and its shelf space either directly through listing and slotting fees or indirectly through the discounts and promotional support required by the retailer.[46]

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[46] See Kuipers (2009) for a general discussion of the shelf-space supplier role of retailers and particularly how retailers can use informational asymmetry to their advantage. For formal modelling of the NB/SB interaction where the NB producer can buy retail shelf-space, see Amrouche and Zaccour (2007; 2009).

While competition authorities might accept that powerful retailers can exert socially benign countervailing bargaining power against powerful producers, they perhaps do not give full recognition to their influence over producer competition in making or breaking product success, artfully playing off suppliers against each other, and determining the product choices on offer to consumers. Of course, consumers cannot be forced to make purchases they do not want and they can vote with their feet by opting not to buy or shop elsewhere, but competition authorities should be under no illusion just how influential powerful retailers are in terms of the choices and prices made to – and indeed how they are shrewdly presented to – consumers and this in turn gives them a huge degree of control and leverage over producers. No powerful retailer will subject itself to a lack of product choice. If needed, it will create choice – even if none is presently there – by one means or another.

So, to come back to the question that a competition authority might ask in trying to decide whether national brands and store brands are in the same relevant market, standard empirical techniques relying on retailer-level price and quantity data might give misleading indications and should be used with considerable caution, preferably informed and responsive to a very detailed understanding of vertical relationships in the sector. Yet better still, authorities need to assess how retailers are shaping producer competition and particularly non-price competition in the marketplace, understanding how choice facing consumers is fashioned and presented. Too often non-price competition is given scant consideration. It is non-price competition which gives consumers products in the first place, determines their features, drives quality improvement, leads to innovation, and creates desire. How far NBs and SBs push each other in these dimensions matters greatly in determining whether or not they are competitors. In such markets, authorities and courts should avoid blind reliance on the *hypothetical monopolist test* (also known as the "SSNIP test" or "5-10% test", e.g. Bishop and Walker 2010).[47]

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[47] Here we concur with the articulate reasoning of Robert Steiner (2002, p.22) who stated:

"The object of delineating the relevant product market is to identify the group of firms that are close competitors. In my view, firms that can take significant market shares from each other are close competitors and are so considered by firm managements. *The focus should therefore be on the ability to gain market share rather than the means by which the gain is attained.*

However, in the Merger Guidelines the relevant product market is determined by whether a monopolist over the category could profitably sustain a roughly 5% price increase. But we have seen that NB/PL competition also has non-price dimensions. Private labels seem more likely to gain market share by improving their quality and obtaining more prominent shelf space than by price cutting. I can envision rather frequent instances in which PLs had consistently been gaining market share, yet by the "5% test" only the NBs would be included in the relevant product market."

With the development of evermore sophisticated econometrics techniques and the availability of bountiful retail sales data, there is a great temptation to rely on statistical analysis to define which products and firms are effective competitors to each other and which are not. Sometimes, though, even simple inspection of market shares can be quite telling, such as providing clear evidence of store brands increasing their category share or these shares being volatile over time, implying swaying competitive fortunes. This has certainly applied in many countries which have seen a rapid growth in store brands over recent years as retailers expanded their private label portfolios across different product categories and also at different levels, especially with the development of multi-tier store branding and sub-branding (e.g. "budget", "standard", "premium", "super-premium", "healthy", "organic", etc).

Yet, in some countries, like the UK, store brands in aggregate share terms seem to have plateaued at somewhere below the 50% mark as an average across CPG categories as well as being relative stable across individual product categories.[48] Clearly, though, this maturing of store brand share should not be taken to infer an absence of competition between store brands and national brands, and indeed perhaps just the opposite as they battle to maintain their respective shares. Moreover, as retailers become more adept at managing and extending their store brand portfolios, and enhancing their retail brand reputation and image in the process, then fewer product categories will be beyond their means and wherewithal to target with SBs. In this way, barriers to entry and mobility for SBs will likely weaken as retailers gain experience, reputation and learning from success in other categories which can help them not only target new categories but also new consumer segments, notably more quality-conscious consumers that brings them even more into direct competition with NBs over exactly the same set of consumers. In particular, this is the very obvious further threat posed to NBs by the emergence of premium private labels and so-called retailer-exclusive "venture brands".[49]

Competition between national brands and store brands is then much deeper and more involved than simply about pricing and positioning of products serving the same consumer needs. Yet, market definition testing often looks at competition more narrowly, even to the extent of

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[48] For some international comparisons, see http://www.fdin.org.uk/output/Brands%2014/Kantar%20-%20Private%20label%20whos%20up%20to%20what%20why%20present%20and%20future.pdf

[49] Tesco led the development of venture brands in the UK but these occur in other countries as well; see http://www.threshinfo.com/downloads/Should%20Manufacturers%20Fear%20Venture%20Brands.pdf

questioning whether store brands are in the same economic market as national brands when they are "functionally" the same (i.e. same features, same purpose and same performance).

So, as a final thought exercise, let us return to considering our highly stylised analytical model and the equilibrium outcomes we find. The set-up has a fundamental demand asymmetry: all consumers are interested in buying the NB (at the right price), but only Switchers are interested in buying the SB. As we have shown, in the equilibrium outcomes generally the NB does end up just serving the Loyals, i.e. it "monopolises" them, leaving the SB to "monopolise" Switchers. Are the NB and SB in separate markets? Surely, with such a simple setting this should be easy to answer?

At face value it would appear that they do not compete for the same set of final consumers – but of course they do compete to supply the same retailer – because the *outcome* (not necessarily every party's *intention*) is complete market segmentation, and of course there is a big price gap in their equilibrium prices. Now, if it were in a real-world setting, we clearly could not apply the hypothetical monopolist test by observing their actual pricing behaviour because they are already "monopolists" for their customer segment, i.e. we would come up against the co-called *cellophane fallacy*. However, it is evident from our model that monopolising Loyals is profitable to the NB, and indeed that represents its "secure" (fall-back) profit because it is unchallenged for these consumers. But, of course, the NB producer is not targeting these particular consumers with one product (say a "premium NB") and then using a different product (say a "standard NB") to target the other consumers (i.e. Switchers). Rather, it is interested in serving both consumer segments with its one branded product. Also it is the retailer's introduction of the SB and control of prices that leads to segmentation.

At stake here is a problem reminiscent of what has been termed the "toothless fallacy", named after the *United Brands* EC decision,[50] suggesting that in the absence of direct (third-degree) price discrimination (i.e. with separate prices for different segments with the same product) that it is better to focus product market definition at the product level rather than the consumer segment level.[51] Certainly the product category is worth monopolising and so is each consumer segment,

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[50] Case 27/76 *United Brands and Co. and United Brands Continental BV v Commission* [1978] E.C.R. 207; [1987] 1 C.M.L.R 429

[51] As Bishop and Walker (2010, p.134) explain: 'In this decision, the [European] Commission argued that bananas formed a separate relevant market because the very young and very old (i.e. those without teeth) did not consider other fruit a substitute for bananas. However, the fact that there is a captive group of consumers for whom there are no substitute products available is not enough to define the relevant market.

but ultimately the market definition question is about whether the NB and SB are just two broadly substitutable versions of what is essentially the same product (i.e. the one which defines the product category) or whether they are separate and distinct products appealing to fundamentally different consumers (which is not really the case here, despite the asymmetric demand and the market segmentation equilibrium outcomes).

In practice, competition authorities face far more complicated market structures and demand structures than are modelled here. Consumer segments are likely to be much more blurred in regard of willingness to pay and willingness to switch, whether to alternative products or to alternative stores. Degrees of brand loyalty and store loyalty are much more likely to be on a spectrum rather than in the distinct "love/hate" form here. Consumers are much more likely to think about substituting across product categories (outside of buying essential goods), especially when so many CPG purchases are unplanned and made on impulse. All of these features make the task of market definition in CPG markets quite challenging and it is not surprising that there are many disputed decisions.

The important question in United Brands was not "will the toothless switch to other fruit in response to a rise in the price of bananas", but "will enough consumers switch to other fruit in response to a rise in the price of bananas to make that price rise unprofitable".'

7. Conclusion

In this paper we have sought to encapsulate the essence of competition between national brands and store brands by focusing on the trading relationship and market behaviour of a single leading brand producer and a single leading retailer in a given CPG product category. There is an inherent tension in this essentially vertical relationship because it is one that necessarily involves both cooperation and competition: the former to ensure products are made and sold to final consumers and so profit is generated and the latter in regard to how that profit is shared and distributed within the channel. The presence of a retailer-commissioned store brand only exacerbates that tension because it adds a horizontal dimension to this trading relationship, where the brand producer then faces a direct competitor at the same level of the supply chain. In this way, the retailer becomes both a customer and a competitor for the brand producer, and so holds a double-agent role where it will naturally act in its own interest rather than any joint interest. This presents a problem for the national brand producer when it only has an indirect means of influencing consumers' purchasing decisions compared to the very direct means which the retailer can avail itself through its control of the retail selling environment and the in-store marketing levers at its disposal, especially when it unilaterally sets all its retail prices.

Within this setting, we consider both price and non-price competition between these firms. Price competition relates to how both wholesale (i.e. supply or factory) and retail (i.e. consumer) prices are set. Non-price competition is modelled in respect of product quality and specifically how closely or distantly the store brand's quality is positioned relative to that of the national brand. We examine the interaction of this combination of price and non-price competition for different scenarios regarding the means by which prices are set and who has channel control (contrasting brand producer-led, retailer-led and more evenly balanced channels).

We find the outcome of such vertical and horizontal competition is that the retailer will generally seek to position its store brand as closely as possible to that of the national brand and then seek to use price differentiation to segment consumers by setting a wide price gap. In this way, the national brand only sells to brand loyal consumers and the store brand sells to the remaining consumers who are prepared to switch products and choose the one that offers them the best value for money in terms of the combination of quality and price. There are exceptions, notably when the retailer is very much constrained in how far store brand quality can go towards matching national brand quality and also if brand loyal consumers are few and brand switchers

are numerous and so the national brand is eager to expand its customer base and prepared to fight vigorously on price. However, we find that the indirect price discrimination and market segmentation outcome generally prevails for most market conditions considered.

These results then lead on to consideration of the impact on the industry participants and the consumers served and the implications for regulators, policymakers and competition authorities that oversee the sector and would wish to promote welfare-enhancing competition.

Within the industry, the availability of a quality-equivalent store brand provides the retailer with bargaining leverage to reduce the wholesale price of the national brand or as a means to substitute low margin national brand sales for high margin store brand sales. This can benefit consumers if it alleviates double marginalisation from successive producer-then-retailer mark-ups or delivers lower prices and better value. For the national brand producer, though, beyond the prospect of reduced sales and profits, it will be concerned to ensure fair competition and not have the retailer either free ride on its brand investments and abuse its intellectual property by creating an intentional *lookalike* store brand which could mislead or confuse consumers or abuse its control over the retail environment and distort retail price setting to favour store brand sales at the expense of those of the national brand.

Consumers can benefit when there is healthy and vigorous competition between the national brand and store brand but they face the possibility of higher overall prices if the two products are simply used as a means for price discrimination and segmentation. Consumers are most likely to benefit when there is intense head-to-head price competition, which is more likely to come about when the products are quite differentiated and the brand producer has some control over the retail price of its own good and so retail prices are independently set, rather than simply coordinated by the retailer.

In respect of public policy, taking a tough stance against store brand copycatting and intentional lookalikes could offer economic benefits in protecting intellectual property rights and helping to restrict free-riding behaviour which undermines and discourages brand investments. However, our results suggest that such a stance might offer a further benefit as well by encouraging more head-to-head direct price competition when the national brand and store brand are differently positioned in quality terms.

Furthermore, the prospect of intense head-to-head price competition becomes more likely the greater is the brand producer's ability to have an even playing field with the retailer's store brand when it comes to retail price setting. One means to achieve this could be through maximum resale price maintenance (RPM), where the national brand producer sets a price cap so that the retailer cannot raise (but is free to lower) the national brand price above the level set to ensure that the price gap with the store brand is not so wide as to choke off its sales. Competition authorities are wary about allowing powerful producers to use RPM, but in this setting maximum RPM could be effective not just in alleviating double marginalisation (which is the usual vertical restraint argument) but also in facilitating more independent pricing between what are supposed to be rival products (i.e. a horizontal competition argument).

In addition, our findings point to the need for considerable care when undertaking market definition analysis in respect of CPG markets, and particularly understanding the true extent and nature of competition between national brands and store brands. Reliance on simple techniques measuring the extent of price gaps and price correlation might give misleading indications when there is item-by-item retail pricing and retailers intentionally use different quality products in the same product category as a means to apply indirect price discrimination and segment consumers. Similarly, care is needed when using and interpreting demand elasticity modelling to make inferences about product-level competition when the competition authority uses retail prices set by retailers and not by producers. In particular, the extent of substitutability between national brands and store brands could well be underestimated, giving rise to the possibility of the wrong inference being drawn that they are in separate economic markets rather than the same market. This is particularly important in the context of merger analysis and assessing market dominance where the true extent of the price and non-price competitive constraint of store brands on national brands might not fully understood.

In drawing these conclusions, we are mindful that the analytical model we have developed is limited by its stylised nature and restrictive assumptions, even if it allows for a range of market conditions and different channel behaviour scenarios. In particular, we are aware that the academic literature has developed an array of analytical models, often much more sophisticated than one here, looking at many different aspects of national brand and store brand competition. Taking account of the developments and gaps in the literature, we suggest five areas where further fruitful research might be developed, extending the framework here with insights and techniques from elsewhere in the literature. First, allowing for differential production costs,

particularly costs associated with quality improvements, might offer interesting insights on whether a retailer might want to develop a multi-tier store brand portfolio, positioning each variant to appeal to particular consumer segments on a quality-conscious-to-price-conscious spectrum. Second, introducing bargaining rather than take-it-or-leave-it contracting might provide further insights on how the parties might seek more complicated contracts than simply specifying price and quantity (e.g. covering slotting fees and non-compete/exclusivity contracts). Thirdly, introducing additional retailers and national brand producers would allow for a more extensive consideration of the interplay between intrabrand and interbrand competition, and in particular allow for consideration as to whether this would disrupt or further encourage retailers' efforts to use national brands and store brands to segment consumers. Fourthly, modelling competition as a dynamic game would allow for studying how competition evolves over time, and particularly the responses and counter responses in market positioning between national and store brands. Fifthly, and perhaps the avenue that has been least explored so far and the one that has probably the greatest potential for offering fresh insights, we would suggest there is considerable opportunity to apply behavioural economics thinking to this setting. For example, this could be to examine lookalikes and consumer confusion, mistaken purchases and the role of trust when consumers are neither fully rational nor fully informed and particularly prone to loss aversion, and how then retailers' control over the shopping environment and consumers' shopping experience affects competition.

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