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The Natural Monopoly effect in brand purchasing: Do big brands really appeal to lighter category buyers?

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ABSTRACT

This paper investigates the Natural Monopoly [NM] effect, which is that large brands have buyers who are on average less frequent or 'lighter' purchasers of the product category. The study analyzes the NM effect for brands in 28 consumer goods categories in The Netherlands. The analysis employs a multiple regression with category purchase rate as the dependent variable; and brand penetration, together with brand price, brand type, average pack size and promotion incidence as independent variables. The study finds that higher brand penetration is indeed associated with a lower rate of category purchase, controlling for the other variables in the model. The NM effect is reasonably large: the largest two brands in a category tend to have a buyer base that on average purchase the category about 25% less frequently than those of the smallest two. The study also derives an explanation for how large brands are generally purchased *more* frequently, even when their buyer base on average buys the category *less* frequently. The findings imply that a focus on heavy category buyers is inconsistent with the goal of growing a brand.

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1. Introduction and background

The *Natural Monopoly* effect is that popular items (products, brands) tend to attract lighter or less knowledgeable purchasers of the product category compared to less popular items. The effect was first reported by McPhee (1963) in the context of media. The Natural Monopoly [NM] effect in brand purchasing was noted by Ehrenberg (2000) and more explicitly discussed in Ehrenberg et al. (2004): 'large brands slightly "monopolize" light category buyers' (2004, p. 1310). What this means is that light category buyers, when they do purchase the category, unduly (but not exclusively) buy market-leading brands. This behavior leads to the large brand having a buyer base that purchases the category on fewer occasions on average, over a time period such as a year. By contrast, a small brand will have a buyer base with a more frequent category purchase rate. To help explain the NM effect, two graphs appear later in the paper. They are for brands in two product categories in The Netherlands, yoghurt and dishwashing liquid. The X-axis is the brand's penetration (the % of households that buy the brand at all in a year) and the Y-axis is the average rate at which each brand's buyers purchase the product category in a one-year period. We see that, for example in the Yoghurt category the largest brands have buyers who buy the category around 35 oc-

casions per year, whereas for the smallest brands the figure is approximately 40–45 occasions. This pattern is a manifestation of the NM effect.

The NM effect is of interest to academics and marketers for two reasons. First, it has an implication that if a small brand is to grow to become a leader in its category, its customer base will alter somewhat from one that buys the category relatively often, to one that buys the category less often. This knowledge helps marketers to understand that to grow their brand, they must construct marketing communication that will be noticed and understood by people who are comparatively less knowledgeable about the category, since less frequency of purchasing is related to less category knowledge (e.g. Allenby and Lenk, 1995; Bartels and van den Berg, 2011). The second reason for interest in NM is its relation to the well-known Double Jeopardy effect (Graham et al., 2017). Double Jeopardy is a pattern by which small brands obtain somewhat less loyalty, whereas large brands obtain somewhat higher loyalty from their buyers (e.g. Ehrenberg et al., 1990). Loyalty in this regard has most commonly been examined in terms of behavior, using metrics such as purchase frequency and share of category requirements (Dawes, 2013). The question arises, how can the large brand be bought *more often* than a small brand – when its buyer base purchases the category *less often*? This question has not been explicitly examined in the literature.

Despite there being a good rationale for interest in the NM effect, comparatively little research has been conducted on it. Sev-

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eral studies show NM quite clearly in contexts such as leisure activities (Gruneeklee et al., 2016), as well as brand image (Stocchi et al., 2017). The NM pattern in brand purchasing, namely that larger brands have buyer bases that purchase the category less often, has been presented in several books and studies, but several null results and counter-examples have also been reported. Indeed, Natural Monopoly has often been reported on as a 'side-line' to other variables of interest in a range of studies (Stocchi et al., 2017). In relation to brand purchasing, it is not clearly known whether the NM effect holds across a wide range of product categories, and indeed how strong the effect is. This is arguably an important question to tackle. From a practical viewpoint, consider that brand managers can readily commission brand metrics reports derived from panel data supplied by Kantar, GfK and Nielsen. Furthermore, suppose a manager notices their brand buyers purchase the category at 12 times per year, but for two competitor brands the rate is 15 times per year. This might be cause for consternation, because at face value it would appear bad for a brand to appeal to infrequent buyers, since they are a source of less potential volume. More work on the NM effect will help managers and researchers interpret such a scenario.

Pertinent questions about Natural Monopoly are: what is the average correlation between brand size and category purchase rate, and what magnitude of difference in category purchase rate is typically observed between the largest brands in a category and the smallest? Secondly, are there brand characteristics that mean certain brands have higher or lower category purchase rate? Third, how can larger brands be purchased more often by their buyers than small brands, but also appeal to a lighter category buying consumer base? These are questions the study will address.

The paper makes several contributions. First, it finds a robust, statistically significant NM effect in an analysis across 28 CPG categories. Furthermore, the average difference in the category purchase rate between biggest and smallest brands in a category is approximately 25%, therefore is managerially significant as well as statistically significant. Next, the study identifies several brand characteristics that are associated with a buyer base that skews towards heavier or lighter category buyers. First, low-priced brands – either store brands or manufacturer brands – have an undue appeal to heavier category buyers. Second, and seemingly counterintuitive, is that higher promotion incidence for brands is associated with them having a lighter, on average, category buyer base. An explanation for this result is presented in the discussion section. These findings represent useful knowledge for brand managers and researchers who study brand metrics.

Finally, the study contributes to the body of knowledge pertaining to brand loyalty: it explains how large brands can enjoy a higher average *brand* purchase rate despite them tending to appeal to a buyer base that purchases the *category* less frequently. The explanation is that they obtain a high share of requirements of heavy buyers, as well as appealing to light category buyers.

2. Literature review

The phenomenon of Natural Monopoly is a component of what is often described as NBD-Dirichlet theory (Uncles et al., 1995), an integrated view of buyer behavior and brand performance that encompasses the NBD distribution of purchase frequencies (Ehrenberg, 1968; Trinh, 2014), the Double Jeopardy pattern (Kooyman and Wright, 2017; Habel and Lockshin, 2013) and the Duplication of Purchase law (Lynn, 2013; Lees and Wright, 2009; Goodhardt and Ehrenberg, 1969). An in-depth view of the broader NBD-Dirichlet literature is beyond the scope of this paper, but is presented in works such as Ehrenberg et al. (2004) and Sharp et al. (2012).

The Natural Monopoly effect is that the more popular items in a category tend to appeal to buyers who are less frequent, lighter or less knowledgeable about the product category. It was originally described by McPhee (1963) who explained that for any 'product' – (McPhee did not use the term product, it is used here for clarity) – some alternatives are more *accessible* than others, i.e., they are exposed to, or reach more people at any time point. Moreover, people differ in their interest or consumption of the 'product' in question – some are more interested, or heavier consumers, than others. This means that "Over time, [exposures] ... accumulated by the end of the observed period will differ widely for individuals, some having been bypassed completely while exposure events piled up on others" (1963 p.110). The end result is that people with less interest in the product category are likely to only know about the alternatives with the most accessibility / highest reach. By contrast, to know about the less accessible alternatives, people would likely have been heavily exposed to *all* the alternatives in the product class.

This situation logically leads to the Double Jeopardy effect, whereby the people who know about the least popular alternatives also know about the most popular alternatives and are therefore less loyal to the former; but by contrast there are many people who *only* know about the most popular alternatives – and so are more loyal to them.

Despite the fact that Natural Monopoly and Double Jeopardy are conceptually linked, there is an aspect of Double Jeopardy that does not intuitively fit with the Natural Monopoly effect. It pertains to larger brands generally enjoying higher rates of purchase frequency. That is, how can a big brand be bought *more often* than a smaller one, when its customer base tends buy the product *category* less often? A possible answer might be that larger brands tend to obtain a higher proportion of their buyer's category purchases – higher 'SCR', or Share of Category Requirements. Higher SCR for the bigger brand is certainly a well-documented aspect of Double Jeopardy (e.g. Jung et al., 2010; Pare and Dawes, 2011). Therefore, perhaps, the high SCR for the bigger brand offsets the effect of it appealing to a somewhat lighter buyer base. However, it is not clear that obtaining a high proportion of the requirements of light category buyers should necessarily translate to a high rate of purchase frequency for a brand. Resolving this question will be of interest to industry practitioners and academics who examine brand performance measures such as penetration, purchase frequency and SCR.

In summary, the Natural Monopoly effect is an intriguing and important marketing concept but has been the subject of very little empirical research. The literature on NM and related areas is now reviewed in order to formulate a series of hypotheses.

2.1. Natural Monopoly in brand purchasing and other contexts

In the classic treatise *Repeat-Buying*, Ehrenberg (2000) briefly discussed the NM effect. He presented several tables of brand-related metrics including the size (market share and penetration) of the brand and the rate at which each brand's buyers purchased the category. One table showed the NM pattern (p. 171), but a second did not (p. 265, correlation between brand size and category purchase rate = -0.03), casting possible doubt on the ubiquity of the effect.

In a later review paper, Ehrenberg et al. (2004) examined 8 leading brands in 12 product categories and reported the average category purchase rate for the largest brand was 10 occasions per year, whereas for the 8th ranked brand it was 13. However, the results were presented as an overall aggregate figure for each brand rank, and whilst the study communicated the NM effect, it is less than clear if the effect holds for brands that are smaller than the top eight in their category. Also, it is possible that other brand

characteristics might influence the category purchase rate for different brands. For example, literature suggests that store brands tend to appeal to heavier category buyers (e.g., Lybeck et al., 2006). Additionally, Dick et al. (1995) found that family size correlated with store brand proneness, which suggests shoppers with larger category requirements prefer them. If store brands also tend to have lower penetration than the leading brands, then this could inflate the brand size – category purchase rate association. These points suggest a rationale for further investigation of NM, ideally incorporating brand characteristics as potential covariates of category purchase rate in the analysis.

The NM effect has also been examined in the context of what is called the 'long tail'. Anderson (2004) created the concept of the long tail in relation to online purchases of entertainment products. Elberse (2007) studied NM in the context of the long tail phenomena. She examined the buyer composition of popular and obscure entertainment products and found that it was indeed the more frequent buyers who tended to purchase obscure or unpopular titles.

NM was briefly mentioned in a study by Sjostrom et al. (2014) that examined the repeat-purchasing of 'light' (low-fat, low-sugar) foods compared to regular foods, and found that they exhibited the same loyalty metrics. The authors interpreted the results to mean that patterns such as Natural Monopoly existed in the examined categories, soft drinks and margarine. However, the actual category purchasing rates for brands in the product categories were not reported.

One study, by Chrysochou and Krystallis (2010) reported findings that were the opposite of the NM effect. They found that heavier wine buyers in Greece tended to purchase large-share wine brands, whereas light buyers tended to buy small-share brands. Stocchi et al. (2017) suggest the anomaly could be due to the unique nature of the very fragmented Greek market. Another study by Bassi (2011) examined buying metrics for beer brands in Italy. She reported penetration rates for the top 9 brands ranging from 22% to 0.3% but the category purchase rates hardly varied, ranging from 13.4 to 13.7. These two results suggest the NM effect cannot be assumed to always occur, and provides motivation for its further investigation.

Several studies have examined NM beyond the contexts of consumer goods brands or products. Lynn (2018) examined the cross-purchasing of quick service restaurants and noted that buyers of small brands tended to cross-purchase other brands in the category to a greater extent than occurred for large brands. He noted this pattern was consistent with the NM effect. That is, if small-brand buyers purchase the category more often, they have more opportunity to also buy other brands. However, the actual difference in category purchase rate across these brands was not in the scope of the study.

The NM effect has also been examined as one of a range of factors in investigations of leisure activity. One study, by Scriven et al. (2014) examined leisure pastimes. It found that the average number of pastimes reported by people who said they undertook the most popular options such as TV watching and spending time with friends was around 10. For the less popular options such as arts or musical instruments, the average number of options engaged in was around 13. Leisure therefore apparently follows the classic NM pattern. Another study examined NM in physical activity. Gruneklee et al. (2016) found that the most prevalent activities such as walking and aerobics attracted participants who participated in 6 to 9 sessions in a week, whilst the less prevalent activities attracted participants who engaged approximately 12 sessions of activity in a week, thereby showing a clear NM effect.

More recently Stocchi et al. (2017) explored whether the NM effect occurs in brand image associations. That is, the extent to which large-market share brands dominate the brand perceptions of consumers with least knowledge of the product category. They

found the NM effect did occur for brand perceptions in several packaged goods categories, as well as banking and mobile 'apps'.

To summarize the literature on this topic, there is certainly evidence for the existence of the NM effect. However, as shown in several of the studies of brands cited above, it does not always occur (e.g. Chrysochou and Krystallis, 2010; Ehrenberg, 2000); or occurs to an extremely weak extent (Bassi, 2011). Therefore, there is some uncertainty about how common, or how strong, the effect is for consumer goods brands. In the context of brands, no studies have examined if it occurs past the top five to eight brands in a category. Moreover, no studies have endeavored to identify or control for other brand characteristics that are related to category purchase rate in order to unambiguously identify the strength of the effect. Knowledge about the Natural Monopoly effect would be valuable contextual information for brand managers, customer insights practitioners and retailers in the consumer-packaged goods sectors. The hypothesis to be tested is therefore,

H1. Larger brands in a category will have a buyer base with an on-average lower level of category purchase frequency.

In order to accurately assess the evidence for H1, an empirical investigation should utilize multiple product categories in the spirit of striving for generalizable results (Hanssens, 2018; Precourt, 2009; Sharp and Wright, 1999). In addition, such an investigation should endeavor to control for other factors that might bias or obscure the association between brand penetration and category purchase frequency. Four such factors, each of them a brand characteristic, are now discussed. There is a justification for expecting that each of these four brand characteristics has its own association with category purchase frequency, therefore each is the subject of a separate hypothesis.

2.2. Brand type – manufacturer or store brand

Brands can be classified as two types, manufacturer or store brands (Baltas and Argouslidis, 2007; Romaniuk et al., 2014). Store brands have traditionally been lower-priced alternatives to manufacturer brands (e.g. ACNielsen, 2005; Conroy and Narula, 2010). In recent years store brands (also known as private-label, own-brands) have increased in quality and price levels (Geyskens et al., 2010; Knothe, 2010), however are still usually priced below manufacturer brands (Hansen et al., 2006). Many studies since the 1960's have examined the characteristic of the store brand buyer. Two key characteristics have been demographic characteristics and degree of price sensitivity. An early study by Frank and Boyd (1965) found, perhaps surprisingly, that many socioeconomic characteristics of store brand and manufacturer brand-buying households were quite similar (p. 32). Similar findings were reported by Myers (1967). However, Frank and Boyd (1965) also found heavier category buyers and those with more family members were more likely to buy store brands; likewise Dick et al. (1995) found the same in regards to family size. A number of studies, such as Burger and Schott (1972) and Hansen et al. (2006), have found that store brand buyers are more price sensitive. If price sensitivity is at least partly related to higher levels of category purchase (Dillon and Gupta, 1996), then store brands should appeal more to heavy buyers. It is worth noting, though, that these findings may reflect the fact that store brands have traditionally been less expensive than manufacturer brands rather than any other intrinsic feature of the store brand offering. A second rationale is that store brands tend not to be advertised as much as national brands (Nenycz-Thiel and Romaniuk, 2014). Therefore, in-store exposure is a more important mechanism by which buyers can become familiar with them, which is more likely to occur among frequent buyers of the category. Accordingly, H2 is:

H2. Store brands will attract a buyer base with a high average rate of category purchase frequency.

2.3. Brand price

Many but not all store brands are still low-priced, that is, priced below the average price level in their category. In addition, some manufacturer brands can also have low prices (Hilleke and Butscher, 1997). Several studies have examined the extent to which category buying is related to a preference for low-priced brands. Frank (1967) found a modest negative correlation between price paid and total purchases. A similar finding was reported by Baltas (1997 p. 320) in a survey-based study, that found heavier category buyers tended to shop for cheaper brands. Likewise, Dillon and Gupta (1996) found that heavier users of paper towels were more price sensitive and Hoch (1996) reported that household size was positively correlated with price sensitivity. In turn, it is likely that larger household size is linked to higher category purchasing in many cases. These findings imply that heavier, i.e., more frequent buyers of a category will tend to purchase lower-priced brands. Accordingly, H3 is:

H3. Low-priced brands will attract a buyer base with a high average rate of category purchase frequency.

Note, given the fact store brands are often lower-priced, the analysis will split both store brands and manufacturer brands into low and high-price classes to better distinguish between brand type and brand price effects.

2.4. Average pack size

Brands in grocery categories usually offer a variety of pack sizes. This practice accommodates for the fact that some consumers have heavier requirements for a product category, which are more readily satisfied by buying one large pack than several smaller ones. Conversely, lighter buyers avoid unnecessary expense and possible spoilage by being able to purchase smaller sizes. Next, pack sizes are an implicit mechanism for price segmentation, since larger sizes generally sell for lower price per gram or ounce (Fox and Melser, 2014). Therefore, buyers with larger requirements for the category have a ready way to pay less per unit of weight. While offering multiple size packs is the norm, brands within a category do differ in their average pack size. For example, in the breakfast cereal category in The Netherlands, the average pack-size purchase for the brand Hahne is 420 g, whereas the average for Cruesli is 585, and for the store brand Aldi it is 979 g.

The theoretical link between pack size and category purchase rate is that frequent buyers of a product category have a high rate of consumption. Alternatively, that they simply derive more utility from it (for example, some people simply like Yoghurt or Cereal more than others). This heightened requirement for a category should generally, but not always, translate into a preference for larger pack sizes to maintain adequate household inventory. Secondly, since larger packs generally sell at a lower price per unit of weight (Fox and Melser, 2014), larger packs represent better value for more frequent purchasers. That said, it is possible there are some buyers who buy certain categories with a very high frequency but only ever buy a small pack, perhaps for personal consumption. It is also arguable that buying bigger packs means the household does not need to purchase a category very frequently. However, in general we would expect shopper's category purchase frequency to be positively associated with preference for larger packs. Therefore, H4 is as follows.

H4. Brands that sell a larger average pack size will attract a buyer base with a high average rate of category purchase frequency.

2.5. Incidence of price promotion

Related to brand price is the extent to which the brand engages in temporary price promotions. Because frequent category buyers are, by definition, shopping in the category more often, they are more likely to notice and attend to price promotion information. Frequent purchasers of a category are more likely to make unplanned purchases that take advantage of price promotions, since they know they will consume the product. Indeed, price promotions offer buyers the chance to purchase brands they often buy anyway at a reduced price, and can induce both brand-switching but also stockpiling (Mela et al., 1998). It is logical that stockpiling is more attractive for heavy category buyers compared to light buyers. Kim and Rossi (1994) found frequent-buying households were more responsive to temporary price reductions. Similarly, Allenby and Lenk (1995) reported that frequent category buyers were more responsive to temporary price cuts (p. 288). Therefore, a high incidence of price promotion for a brand should in theory be associated with it having a buyer base that purchases the category more often. Accordingly, H5 is:

H5. Brands with higher promotion incidence will attract a buyer base with a high average rate of category purchase frequency.

2.6. Double Jeopardy and Natural Monopoly

The next issue to be addressed is the link between Double Jeopardy and Natural Monopoly. It is well known that big brands have higher brand purchase frequency than their small competitors (Ehrenberg et al., 1990). A question arises as to how the bigger brand achieves higher purchase frequency in the face of a lighter category buyer base. First, we know that big brands have higher Share of Category Requirements (SCR) - (Fader and Schmittlein, 1993), as well as higher purchase frequency (Uncles et al., 1994) - compared to small brands. SCR for a brand is measured as:

$$SCR = \text{average \# brand purchases} / \text{average \# category purchases among buyers of brand X}$$
 (Farris et al., 2016).

At face value, a brand that obtains a higher share of category purchases from its buyers should also have higher brand purchase frequency. However, if the big brand obtains a high SCR among a buyer pool that buys the category less often (as per the NM effect), it is not necessarily clear how high SCR translates into high brand purchase frequency. The answer may lie in the differences between big and small brands in terms of how much loyalty they obtain from light, medium and heavy category buyers. For example, it could be the case that while the big brand unduly attracts lighter category buyers as per the NM effect, it also obtains higher SCR from heavy buyers, which bolsters its purchase frequency. Elberse (2007) found that larger brands tended to be purchased somewhat more by lighter category buyers, but that they dominated the share of category requirements of both light and heavy buyers. Apart from that study, there is little other evidence on this phenomenon. Understanding the mechanism by which larger brands engender higher loyalty would be a useful piece of knowledge for brand managers, as well as academic researchers interested in loyalty metrics. Therefore, H6 is as follows:

H6. Large brands exhibit more loyalty despite having a lighter category-buying customer base, through achieving higher Share of Requirements among all category buyers: light, medium and heavy.

3. Empirical study

3.1. Data

Consumer panel data on 28 Dutch consumer goods categories were provided by GfK/AiMark. The GfK panel comprises

Table 1
Descriptive statistics.

Category	N of brands ^a	% of Households buying category in a year ^a	Average No. occasions the category is purchased in a year	Average pack size (grams;ml; oz.)	Average price ^b per weight unit: mfr. Brands	Average price ^b per weight unit: store Brands	% brand sales sold on price promotion ^c	Store brand share of category sales
Sweet Biscuits	90	82	37.9	257	0.43	0.52	9.9	23.3
Margarine	26	79	25.2	440	0.16	0.23	7.8	53.8
Yoghurt	35	78	32.0	666	0.10	0.19	9.2	25.7
Toilet Tissue	21	76	7.5	13	26.4	19.0	13.2	66.7
Pasta	29	73	10.6	485	0.16	0.30	13.8	44.8
Pure Fruit Juice	28	72	28.5	1023	0.09	0.18	13.9	46.4
Colas	19	70	14.5	1166	0.05	0.10	10.9	68.4
Ice Cream	32	69	12.0	582	0.28	0.45	19.7	46.9
Tea	18	68	15.7	82	1.66	2.13	15.4	61.1
Kitchen Papers	20	63	7.9	4	38.2	39.7	10.8	75.0
Cooking Fats / Oils	23	60	7.3	679	0.23	0.43	10.6	56.5
Household Clean	26	60	5.3	787	0.12	0.34	18.0	42.3
Beer	19	60	12.4	652	0.09	0.18	19.2	26.3
Frozen Vegetables	17	59	9.7	485	0.18	0.17	8.8	70.6
Toothpaste	15	58	3.8	78	0.80	3.39	7.8	26.7
Deodorants	13	55	7.4	141	0.85	1.80	21.1	15.4
Tinned Soup	14	53	5.4	679	0.19	0.14	20.8	78.6
Canned Fish	13	53	6.9	289	0.58	0.50	13.9	23.1
Shampoo	18	52	2.4	415	0.14	0.97	23.2	27.8
Bleach	14	45	3.6	964	0.06	0.09	14.9	71.4
Body Creams	17	43	4.9	155	2.19	5.72	4.5	23.5
Fabric Conditioner	12	43	4.8	833	0.14	0.20	23.8	58.3
Breakfast Cereal	19	41	10.1	616	0.27	0.30	9.0	57.9
Instant Coffee	6	31	9.0	139	2.46	1.60	12.1	50.0
Washing Powder	17	31	3.2	1446	0.16	0.35	24.1	35.3
Frozen Dinners	6	29	5.8	521	0.55	0.69	26.9	33.3
Wet Cat Food	16	19	31.6	205	0.14	0.51	6.5	56.3
Wet Dog Food	8	8	20.1	406	0.17	0.24	1.3	62.5
Tot /Average	591	55	12	507	2.75	3.3	14.0	47.4

^a N of Brands with over 1% penetration.^b Un-promoted price.^c The GfK data has a field indicating promotion purchase.

approximately 10,000 households who scan their grocery purchases. All panelist purchases from supermarkets (mainstream stores such as Albert Heijn as well as hard discounters such as Aldi), and convenience store chains are included. Purchases made online at these stores are included but are not specifically flagged in the data. Online purchasing constitutes a small proportion of total grocery sales in this market. The categories used here cover a spectrum of food and non-food categories, and include frequently purchased goods to those purchased less often. The time period is 52 weeks for the year 2015. Details of the categories are shown in Table 1. The categories range in annual penetration, from those that almost every household buy in a year, such as yoghurt with 93% penetration, to dog food, which was only bought by 10% of households in a year. The table also shows the wide variation in overall category purchase frequency, ranging from under 3 occasions per year for shampoo, to nearly 38 occasions on average for biscuits. Also shown is the average price per unit of weight, split by store and manufacturer brands. On average, store brands sell for 70% of the price of the manufacturer brands, and have 47% share of category sales.

Brands with under 1% penetration were excluded (e.g. Fader and Schmittlein, 1993; Pare and Dawes, 2011). This approach allows for a robust number of observations per category, but avoids the results being biased by very small brands with few purchases. Note the large number of brands (90) in the sweet biscuits category. The analysis was re-run omitting this category, to ensure the results were not unduly driven by it. The results were extremely similar to the analysis results using all categories as shown in Table 3.

In order to identify the separate effects of brand type (store brand, manufacturer brand) as per H2; and brand price as per H3, three dummy variables were created to reflect the two variables of

brand type and brand price. These were coded as 0,0,0 (high priced manufacturer brand – the contrast level) 0,0,1 (low-priced manufacturer brand) 0,1,0 (high priced store brand) and 1,0,0 (low priced store brand). The coefficients in the regression model therefore reflect the effects of brand type and price relative to a high-priced manufacturer brand. Price is calculated as price-per-gram and is the brand's normal, non-promoted shelf price. Normal price is used exclusive of temporary price promotions, because a separate variable is employed to capture promotion incidence. The distinction between low-priced and higher-priced brands was based on a median price split within each category.

3.2. Analysis variables

Hypothesis 1 is tested using an OLS regression model. The dependent variable is the rate at which buyers of each brand purchase the category in a 12-month period. For example, in the Yoghurt category, Albert Heijn brand buyers buy the category 32 times per year, while for Den Eelder and Super de Boer buyers the figure is 39 times. The independent variables, as per H1–H5 are brand penetration, brand type, brand price and average brand pack-size. Details of the analysis variables are presented in Table 2.

Note that brand penetration (% of households buying in a year) is used as the measure of brand size. Often, brand size is measured via market share (e.g., Fader and Schmittlein, 1993; Farris et al., 2016). However, a brand's market share is a product of its penetration and brand purchase rate, and brand purchase rate is in turn closely related to category purchase rate – which is the dependent variable. Therefore, penetration is used as the brand size measure, to avoid the category purchase rate appearing in both

Table 2
Variables used in the analysis.

Metric	Description
Dependent variable: Brands' Average Category Purchase Frequency	The number of times a particular brand's buyers bought the product category in a calendar year (Ehrenberg, 2000).
Independent variables: Brand Size: measured as Brand Penetration	The % of panel households who purchased the brand in a calendar year (Dawes, 2006; Yang et al., 2005).
Average Brand pack size	The average pack-size bought of the brand in the calendar year. This is calculated for each purchase as total weight purchased / number of units (Jain, 2012).
Brand type / Price level	Price is calculated firstly as the average selling price-per-gram or ml. of the brand in the calendar year (Allenby and Lenk, 1995). Brand type (store brand / manufacturer brand) and Brand price (average un-promoted price below /above the median for the category) are denoted with dummy variables.
Price promotion	% of brand's sales sold on deal in the calendar year (Bogomolova et al., 2015).

Table 3
Regression model 1. Dependent variable: category purchase rate.

Adjusted R ²	0.19				
ANOVA	Sum of squares	df	Mean square	F	Sig.
Regression	669.1	6	111.5	23.7	.000 ^b
Residual	2746.2	584	4.7		
Total	3415.3	590			
	B	S.E.	Standardized coefficients	t-statistic	p-value
Constant	-0.05	0.20	-	-0.25	0.80
Brand penetration	-0.08	0.01	-0.27	-6.83	0.001
Brand average pack size	0.00	0.00	0.02	0.46	0.64
Price promotion incidence	-2.96	0.90	-0.14	-3.30	0.001
Low priced manufacturer brand*	1.48	0.25	0.28	5.95	0.001
High-priced store brand*	-0.20	0.39	-0.02	-0.52	0.61
Low-priced store brand*	0.41	0.25	0.08	1.67	0.10

* The contrast for these three dummy variables is high-priced manufacturer brand.

sides of the regression.¹ To enable the analysis to be conducted across all categories simultaneously, the metrics for each category (excepting store brand) were mean-centered (Dhar et al., 2001). There were no apparent problems with collinearity with all VIF's below 1.3, far below the threshold of 10 considered to be problematic (Mendenhall and Sincich, 1996, Ch. 6). The model results are shown in Table 3. The adjusted R² is modest at 0.19 but several variables emerge as statistically significant.

In relation to H1, we see the coefficient for brand penetration is negative and significant at $p < 0.01$. This provides support for H1 – larger brands do tend to attract buyers who on average purchase the category less often, controlling for the effects of the other variables in the model.

Supplementary analysis was done to calculate how much lower the category purchase rate is for large brands. We compared this variable for the largest two brands in each category against the smallest two, and the average difference was 25%. Therefore, not only is there a statistically significant relationship between brand size and category purchase rate, the difference of 25% appears large enough to be managerially relevant. Next, to check the pervasiveness of the NM effect, we calculated the bivariate correlation between brand size and category purchase rate, and found it was negative (in-line with the regression results above) in all 28, statistically significant ($p \leq 0.10$ level) in 18, and averaged $r = -0.31$.

H2 posited that store brands will attract more frequent category buyers. As Table 2 shows, two of the parameters for brand type / price are positive and significant. The parameter for low-priced store brand is 0.41, marginally significant at $p = 0.10$. Therefore, there is tentative evidence to partially support H2: namely that low-priced store brands attract buyers with higher rates of cate-

gory purchase compared to low-priced manufacturer brands. However, high-priced store brands do not ($-0.20, p = 0.61$).

Next, we examine H3, relating to brand price. The parameter for low-priced manufacturer brand is positive and significant (1.48, $p < 0.01$) indicating that a manufacturer brand with a lower than median price has a buyer base that purchases the category at 1.48 occasions more than the category average, compared to what occurs for a high-priced manufacturer brand. As mentioned above, the parameter for low-priced store brand is also positive, and marginally significant (0.41, $p = 0.10$). This indicates that low price level is influential in store brands' appeal to frequent category buyers.

H4 pertain to pack size. The model results indicate that average pack size is not related to category purchase rate (0.0, $p = 0.64$) – there is no evidence that brands with bigger average pack sizes appeal to heavier buyers of the product category. It could be the case that within each brand, larger pack sizes have differential appeal but we do not see an overall effect at the brand level.

Next, we examine H5, relating to price promotion incidence. Here, the model results indicate a surprising finding – the parameter for promotion incidence is negative and significant ($-2.96, p < 0.01$). This indicates that brands with a higher price-promotion incidence have a buyer base that skews towards less frequent category buyers. This is unexpected, given that promotions offer the chance for buyers to purchase brands at lower than normal price, which should be particularly appealing to heavier or more frequent category purchasers (e.g. Kim and Rossi, 1994). An explanation for this finding appears in the managerial implications section.

H6 relates to how large brands achieve their higher purchase frequency in the face of lower category purchasing by their buyers. To address this, we tabulated the average Share of Requirements for small, medium and large brands; among groups of light, medium and heavy category buyers. Brands were classified as small, medium or large based on their size rank order: the largest

¹ The analysis was also conducted using market share as an independent variable in the regression instead of penetration and the results were essentially the same.

Table 4
Share of category requirements.

	Share of category requirements			
	Light buyers	Medium buyers	Heavy buyers	Average
Brand size				
Small	70.8	35.4	19.5	42 ^a
Medium	74.8	38.7	25.5	46 ^a
Large	78.8	47.3	34.9	54 ^a
Average	75 ^b	40 ^b	27 ^b	

^a Column figures statistically significantly different at $p < 0.05$.

^b Row figures statistically significantly different at $p < 0.05$.

1/3 in each category were classed as large, the middle 1/3 were medium and the smallest 1/3 were classed as small. Buyers who bought from a category at a rate 1.5 times or higher than the average were classified as heavy, between 0.5 and 1.5 were medium, and below that level were classified as light. Variations of this algorithm were tested and the results did not alter substantially. Results are summarized in Table 4.

Table 4 shows the average purchase loyalty or Share of Category Requirements differs by buyer group. Reading across the columns, we see that light buyers are on average more loyal to their brands, because they purchase the category less often (Banelis et al., 2013) whereas heavy buyers allocate less of their requirements to any particular brand – average SCRs of 75% for light buyers, 40% for medium and 27% for heavy. Second, reading down the rows shows that loyalty varies according to brand size, in line with the Double Jeopardy effect (Ehrenberg et al., 1990): large brands on average get more loyalty than small brands (42%, 46%, 54% SCR for small, medium and large respectively).

The information in Table 4 supports H6. Large brands enjoy higher Share of Category Requirements not only among light buyers (average 78.8% large brand SCR compared to 70.8 for small brands; $p < 0.05$) but also among medium and heavy buyers. Indeed, the large brands enjoy proportionally more purchase loyalty among heavy category buyers than light ones: 8 points more loyalty for the large brand compared to the small brand among light buyers, but the difference is greater among medium buyers (47.3–35.4) = 11.9 points (significant difference at $p < 0.05$); and even more (34.9–19.5) = 15.4 (significant difference at $p < 0.05$) points more loyalty for the large brand among heavy category buyers.

A multiple regression was run to formally ascertain if there is an interaction effect between brand size and buyer type. Brand type was coded into dummy variables (0/0, 0/1, 1/0) to denote small, medium and large brand; and buyer type was coded in the same way (0/0, 0/1, 1/0) to denote light, medium and heavy category buyer. An interaction term was formed for large brand * heavy buyer. The regression results are shown in Table 5. The parameters for medium and large brand are positive and significant, confirming higher loyalty for these brands compare to small brands. There is also a statistically significant positive effect for the large brand * heavy buyer interaction (4.5, $p < 0.05$).

The results help explain the generally reported higher purchase frequency enjoyed by large brands (e.g. Uncles et al., 1994) in the face of them appealing somewhat more to light or infrequent category buyers. Not only does the large brand dominate the requirements of its light category buyers, it gains comparatively higher Share of Requirements among heavy category buyers. This high heavy-buyer SCR raises the average annual frequency for the larger brand.

Natural Monopoly can therefore be understood as follows: bigger brands have more buyers, and proportionally more light category buyers; but big brands are also bought by heavy category buyers. And indeed, those buyers tend to give more of their requirements to the big brands. Smaller brands do tend to have a

higher proportion of their buyers that are heavy category buyers, but they end up suffering from a lower brand purchase rate because their buyers also buy a wider selection of other brands.

4. Discussion and managerial implications

This study has confirmed an important phenomenon in brand purchasing that has been briefly reported on in previous studies, but not explicitly investigated. The study finds a pervasive, moderately strong effect: larger brands have buyers who on average purchase the category less often compared to smaller brands. This effect is a piece of basic knowledge that all managers in consumer goods markets should know. An implication of the study is that for a brand to grow from small to big, its buyer base will alter, from one that tends toward heavy category buyers, to one that tends toward lighter category buyers. In turn, this suggests that ardently pursuing heavy category buyers, as is sometime advocated (Thayer, 1998; Hallberg, 1999; Smith and Blair, 2018) might not be the route to brand growth. Indeed, since light buyers tend to know less about a category or the brands in it, the finding provides a rationale for mainstream advertising, to inform and remind these infrequent category buyers about one's brand.

Next, the study finds that low-priced brands, both manufacturer and store brands (albeit the results were only marginally significant for low-priced store brand) do tend to appeal to heavier category buyers – controlling for the brand's penetration level and other variables included in the model. This finding is in line with the stated theoretical expectations based on economic incentives and information acquisition by the heavy category buyer. Several past studies have previously reported (Dillon and Gupta, 1996; Kim and Rossi, 1994; Dick et al., 1995) that high-frequency purchasers are more price-sensitive. The present study has extended that finding, which pertained to characteristics of buyers, to one about a characteristic of brands. It is an important finding as it helps brand managers know what to expect from a brand based on its price level – high priced brands will appeal slightly more to light category buyers, and low-priced brands will appeal somewhat more to heavier category buyers. The finding suggests that reliance on price as a quality cue (e.g. Rao, 2005) is more prevalent among buyers with less knowledge of the product category compared to those for whom it is more familiar.

The study also adds clarity to an issue whether store brands appeal to a particular type of buyer (Richardson et al., 1996), such as the heavy category buyer. The findings here suggest any such appeal occurs when a store brand is low-priced; it does not occur when the store brand is higher-priced relative to the median for the category. These findings are consistent with the view that consumers have a greater understanding that store brands do now indeed encompass multiple price and quality tiers (González-Benito and Martos-Partal, 2011; Kumar and Steenkamp, 2007). However, the findings also suggest that low priced manufacturer brands attract an on-average more frequent category buyer base than do low-priced store brands – the parameter for low-priced manufacturer brand is 1.48, compared to 0.41 for low-priced store brand (difference in parameters significant at $p < 0.05$).

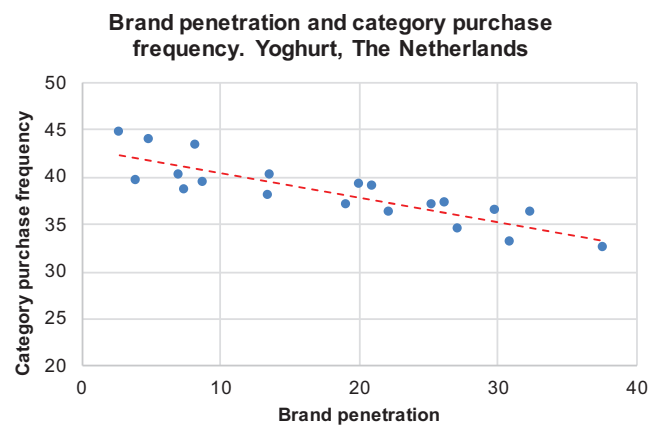
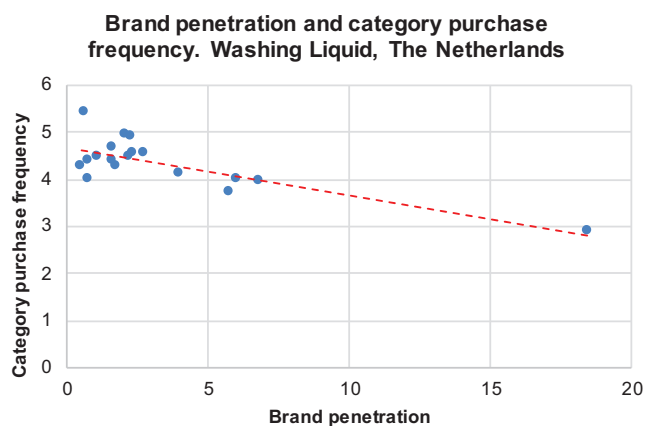
The findings also add to an extensive literature on brand segmentation. A stream of work on segmentation has focused on whether observable variables such as age, gender, and income relate to brand choice (e.g. Hammond et al., 1996; Uncles et al., 2012). This study finds there are observable differences for certain brands in the type of buyer they attract, in terms of category purchase rate. A practical implication for brand managers arising from the present findings is that if they have a high-price offering it will tend to appeal somewhat more to lighter category buyers, and if they intend to launch a brand to appeal more to heavier category buyers, it should be a low-priced offering, as well as possi-

Table 5
Regression Model 2. Dependent variable: brand's share of category requirements.

Adjusted R ^b ANOVA	0.64	Sum of squares	df	Mean square	F	Sig.
Regression	610,358	5	122,071	493.7	0.0001	
Residual	347,889	1407				
Total	958,247	1412				
	B	S.E.	Standardized coefficients	t-statistic	p-value	
Constant	70.06	1.0		69.5	0.0001	
Brand Size 1 (medium) ^a	10.1	1.2	0.19	8.3	0.0001	
Brand Size 2 (large) ^a	4.3	1.0	0.08	4.1	0.0001	
Buyer type 1 (medium) ^b	-49.7	1.2	-0.90	-40.7	0.0001	
Buyer type 2 (heavy) ^b	-34.3	1.0	-0.62	-33.5	0.0001	
Heavy buyer * large brand	4.5	1.8	0.06	2.4	0.02	

^a The 'base' for comparison is small brand.

^b The 'base' for comparison is light buyer.



Figs. 1 and 2. Association between brand penetration and category purchase frequency (52 weeks, The Netherlands).

bly under a different name to minimize cannibalization (e.g. Lomax et al., 1997; Srinivasan et al., 2005; Dawes, 2012).

Likewise, the study adds to the large body of evidence on price promotions (e.g. Kim, 2019; Empen et al., 2015; Choi et al., 2014). Past studies have found a link between heightened promotion responsiveness among consumers who buy more of the category over a time period (Kim and Rossi, 1994; Allenby and Lenk, 1995). The results from this multi-category study produced an apparently counterintuitive finding that brands with a higher incidence of price promotions have an on-average less frequent category buyer base. A potential explanation relates to the fact that only a very small proportion of light/infrequent category buyers buy in a particular week. A brand would therefore have to price-promote very frequently in order for a significant proportion of light category buyers to purchase it on promotion in a year. But if this did occur, the brand would then exhibit an on-average lighter or less frequent category buyer base, which is consistent with the results of the present study. By contrast, a higher proportion of heavy buyers purchase the category in any given week. Therefore, a brand that promotes even quite infrequently will give ample opportunity for these heavy buyers to purchase it on promotion. As a consequence, increasing the brand's level of promotion frequency to higher levels will not alter the brand's proportion of heavy category buyers as much as it will alter the brand's proportion of light category buyers. However, more investigation to tease out empirical validation of this explanation is a direction for further work.

Finally, the study answers the question: how do large brands enjoy heavier brand purchase frequency in the face of having buyers who buy the category less often? The answer is that large brands not only enjoy high Share of Category Requirement (SCR)

among light category buyers, they also perform well on SCR among the heavy category buyers that buy them. This SCR performance helps to boost the big brands' average brand purchase rate. The findings are similar to those found by Elberse (2007) for entertainment products: heavier buyers tended to be the ones buying obscure titles, but they also bought popular titles as well; and indeed bought more of the latter.

5. Limitations and directions for future research

The study tested a series of hypothesis using an extensive dataset ranging across dozens of consumer goods categories in a European market. One of the findings of the study makes a strong implication about brand growth: if larger brands have lighter category buyers, then for a small brand to become large, it needs to implement marketing actions that attract these light buyers. However, the data and analysis were cross-sectional. A longitudinal study could test the extent to which brand growth (or decline) over time coincides with changes in the rate at which its buyers buy the category.

Next, the study used consumer goods categories such as toothpaste, yoghurt and pet food. Future work could test the Natural Monopoly effect in different types of repeat-purchase categories. For example, services categories such as insurance in which consumers purchase multiple policies (home, contents, vehicle), or banking in which consumers have multiple products such as transaction accounts, credit cards and loans.

Whilst the study finds a pervasive NM effect, a question arises about the role of in-store factors such as the amount and favorability of a brand's shelf space in physical stores. It may be the case

that (a) large brands tend to receive more and better shelf space in any particular store; and (b) light category buyers are unduly influenced by this greater in-store presence of large brands. If this were the case, then the NM effect for grocery brands might be at least partially linked to shelf space. However, the NM effect has been identified in several contexts in which shelf space is not a factor (e.g. Gruneklee et al., 2016; Stocchi et al., 2017) which implies a shelf-space advantage for the larger brand is not necessarily a prerequisite for the NM effect. Furthermore, there is an absence of evidence about whether in-store brand visibility affects the choices of lighter category buyers to a greater or lesser extent than heavy ones. Nevertheless, further work could examine whether the NM effect is manifest in purchasing contexts where physical shelf space is less of a factor, such as online brand purchasing.

The study presented a theoretical rationale for expecting a positive association between a brand's average pack size, and the rate at which its buyers purchase the category. This association was not identified in the data. Therefore, an avenue for further work is to examine at a finer level the extent to which particular variants within a brand have differential appeal to light or heavy category buyers.

Lastly, the focus of this study was branded goods sold through retailers. Considerable work has been conducted to identify that retailers themselves exhibit law-like patterns such as double jeopardy (Keng and Ehrenberg, 1984) and the duplication of purchase law (Keng et al., 1998; Uncles and Kwok, 2008). No work has explicitly examined whether the Natural Monopoly effect is exhibited by competing retailers. Addressing this issue would form a very useful contribution further linking the literatures on brand metrics and empirical buyer behavior patterns, with that on retailer metrics.

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