Ehrenberg-Bass Institute Working Paper

Forthcoming in the *Journal of Consumer Behaviour*

# "How persistent are Duplication of Purchase partitions?"


Authors:

Dr Zachary Anesbury - Ehrenberg-Bass Institute
Assoc Prof Dag Bennett - London South Bank University
Prof Rachel Kennedy - Ehrenberg-Bass Institute



University of South Australia | Ehrenberg-Bass Institute for Marketing Science


# How persistent are Duplication of Purchase partitions?

## Author Details

**Dr Zachary William Anesbury**

Senior Marketing Scientist, Ehrenberg-Bass Institute, Inaugural Gerald Goodhardt Postdoctoral Research Fellow, UniSA Business

University of South Australia, South Australia, AUS

Level 4 Yungondi Building, 70 North Terrace Adelaide, South Australia, AUS 5000

Zachary.Anesbury@marketingscience.info

Zac Anesbury is a Senior Marketing Scientist at the Ehrenberg-Bass Institute and was the Inaugural Gerald Goodhardt Postdoctoral Research Fellow. Zac is the Top Early Career Researcher Research for UniSA Business for his research on fresh fruits and vegetables, consumer buying behaviour, and media consumption. He is a member of the Editorial Boards of the Journal of Consumer Behaviour, Australasian Marketing Journal, and the International Journal of Market Research.

**Associate Professor Dag Bennett**

Director, Ehrenberg Centre for Research in Marketing

London South Bank University, London, UK

Bennetd@lsbu.ac.uk

**Professor Rachel Kennedy**

Associate Director (Product Development), Ehrenberg-Bass Institute, UniSA Business

University of South Australia, South Australia, AUS

Rachel.Kennedy@marketingscience.info

Professor Kennedy is one of the founders of the Ehrenberg-Bass Institute, where she regularly advises many of the world's premier brands on evidence-based growth. Rachel has been recognised as one of "Advertising's Big Thinkers" by the Advertising Association (UK) and ranks in the top 1% of advertising researchers. Working with Goodhardt and colleagues in the UK, gave her a leg up in her research career.

Her research can be found in the Journal of Consumer Behaviour, Journal of Advertising Research, Journal of Advertising, and Journal of Business Research, among other journals. She is also on numerous editorial boards.

**Conflicts of Interest**

The authors have no conflicts of interest to report.

**Funding Information**

The authors have no funding information to report.

**Abstract**

Brands share more of their customers with bigger competitors and fewer with smaller ones. But there are occasional deviations to this predictable Duplication of Purchase (DoP) pattern. When two or more brands share excess customers because of functional or non-functional differences – it is called a partition. While past research using the NBD-Dirichlet model demonstrates partitions in annual or shorter data, there is no empirical evidence for partition persistency over the longer term, though some other NBD-Dirichlet deviations are known to persist over time. Examining expected partitions in ten consumer goods categories in the United Kingdom, the authors show partitions overwhelmingly persist over three years. The findings contribute support to Dirichlet theory, especially on market stability, boundary conditions, and provide practical implications for portfolio management.

Keywords: partitions, duplication of purchase, consumer goods categories, market stationarity, Dirichlet

# 1 Introduction

Analyzing consumer purchase data shows how competing brands share customers. Ragú, the leading brand of pasta sauce in the United States, shares 41% of its customers with Prego, 44% with Ragú Old World, and 40% with Francesco. In return, these brands share, on average, 47% of their customers with Ragú (Dawes, 2016). Experienced marketers understand that their brand's customers are also their competitor's customers, given that repertoire buying is normal.

Such brand level analyses are a regular feature in consumer goods categories. However, determining if the level of sharing is as expected requires benchmarks. For example, is Ragú sharing too many or too few customers with Prego, or is the level of sharing normal. Previous research finds that the level of sharing is mostly predictable - brands share more customers with bigger brands and fewer customers with smaller brands (Ehrenberg and Goodhardt, 1970) – the duplication of purchase (DoP) pattern (Goodhardt and Ehrenberg, 1969b; Bennett and Graham, 2010; Anesbury et al., 2018b), or the DoP law (Sharp, 2010).

Deviations to the DoP pattern (known as partitions) have easily identifiable causes (Sharp et al., 2012), often occurring when brands are functionally different. However, there are also non-functional causes, including price tiers, quality perceptions, availability restraints including regional brands with different mental and physical availability or perhaps even nationalism or a combination of the above, as seen with the slight partitioning between Russian and foreign consumer goods brands (Kennedy and McColl, 2012). To date, it is unclear whether previously discovered partitions (Scriven and Danenberg, 2010; Dawes and Nenycz-Thiel, 2013) are isolated cases resulting from particular marketing interventions or if they persist over time (Scriven and Bound, 2004).

Consumers typically purchase 2-3 brands a year out of the dozens of alternatives within any consumer goods category (Banelis et al., 2013; Trinh, 2014). Consumers' repertoires may comprise brands sharing a particular functionality (e.g., decaffeinated coffee brands (Uncles et al., 1995) or other common traits (e.g., available in a remote area). Only some brand offerings will meet the needs of consumers whose requirements vary from the category norm - hence greater sharing across

these offerings compared to brands without that particular trait is unsurprising. As many manufacturers aim to appeal to a broad market, they typically field brand portfolios covering diverse needs (Tanusondjaja et al., 2018). It becomes normal for all coffee brands to offer caffeinated and decaffeinated options (or other popular features). Hence partitions may be temporary.

But to date, most partition analyses have been based on single period data of up to one year (Dawes et al., 2010; Ehrenberg and Uncles, 1999; Goodhardt et al., 1984), so their persistence has not been systematically investigated. Only three studies have looked at partitions across consecutive years (Mansfield and Romaniuk, 2003; Mansfield et al., 2003; Ehrenberg and Bound, 1999), but these studies were limited to passenger cars, and tourism destinations.

Hence examining the persistence of partitions, as a boundary condition, to DoP is worthy of further investigation. While useful in its own right, the DoP pattern is also one of the generalizations underpinning the widely used NBD-Dirichlet model (hereafter Dirichlet) (Wright et al., 2002; Ehrenberg, 1959; Sharp et al., 2012) a purchase incidence and brand choice stochastic model (Goodhardt et al., 1984; Wright et al., 2002; Rungie and Goodhardt, 2004) which applies in broad choice-making contexts including political polls (Kooyman and Wright, 2017), radio listening (Lees and Wright, 2013), and subscription services (Lee et al., 2011). Double jeopardy (DJ) (McPhee, 1963; Ehrenberg et al., 1990), another generalization underpinning Dirichlet (Goodhardt et al., 1984), is also typically examined for a single, often annual, period. Occasionally, observations are over continuous weeks (Wright and Sharp, 2001; Wright and Riebe, 2010; Danaher and Dagger, 2012), months (Dall'Olmo Riley et al., 1997), quarters (Graham, 2009; Ma et al., 2010; McCabe et al., 2012; Habel and Lockshin, 2013), six-months (Bongers and Hofmeyr, 2010), or years (Ehrenberg, 1997; Wright and Riebe, 2010; McCabe et al., 2012). However, one examination of DJ deviation persistency across time by Pare and Dawes (2011) shows that approximately one-fifth of brands continue deviating after two years (or two-fifths for private

labels). This research similarly aims to quantify and understand Dirichlet deviations, specifically partition persistence for consumer goods categories over time.

Building on the foundational work by Gerald Goodhardt (Goodhardt, 1966; Goodhardt et al., 1984; Goodhardt and Ehrenberg, 1969a), the current study provides one *major* contribution:

- Providing novel evidence for the stability of partitions across time despite the independence assumption (Scriven et al., 2017) and parameter stability (Stocchi and Wright, 2010) of the Dirichlet model (Ehrenberg, 1959; Goodhardt et al., 1984); and two *minor* contributions:
- Replicating the DoP pattern showing predictable customer sharing (Uncles and Ellis, 1989; Anesbury et al., 2018a; Goodhardt, 1966), and
- Clarifying and extending knowledge on partition differences, including functional differences (Wrigley and Dunn, 1984b; Brewis-Levie and Harris, 2000; Goodhardt et al., 1984), private labels (Ellis and Uncles, 1991; Dawes and Nenycz-Thiel, 2013), and other causes (e.g., availability) as partition causes.

## 2 Background and research questions

The DoP pattern was discovered in television viewing data (i.e., duplication of viewing). The number of duplicated viewers (i.e., people watching any pair of programs) is predictable from the programs' audience size - irrespective of other factors, including day or program content (Goodhardt, 1966; Goodhardt and Ehrenberg, 1969a). The DoP pattern occurs within other media, including radio listening (Lees and Wright, 2013), and across media, including social media (Romaniuk and Sharp, 2016).

The call for further investigations to improve the finding's generalizability (Uncles et al., 1995) resulted in duplication analyses of store patronage (Romaniuk, 2005; Sharp and Sharp, 1997; Wright et al., 1998; Uncles and Kwok, 2008; Uncles and Hammond, 1995); financial services (focused on consumer segments (Lees et al., 2016; Lees and Winchester, 2014)); SKUs such as flavors and pack-sizes (Singh et al., 2008); and across varied countries including emerging markets

(Uncles and Kwok, 2009; Uncles and Kwok, 2008; Bennett, 2008; Bennett and Graham, 2010; Kennedy and McColl, 2012). Other research has documented the pattern across varied consumer categories such as retail fuel (Wright et al., 1998), cars (Ehrenberg and Bound, 1999; Bennett and Graham, 2010), televisions (Bennett, 2008), and clothing (Dawes, 2009; Brewis-Levie and Harris, 2000) with lots of evidence from consumer goods categories (Uncles and Ellis, 1989; Scriven and Danenberg, 2010; Keng et al., 1998; Wrigley and Dunn, 1984a; Goodhardt et al., 1984; Anesbury et al., 2018a; Keng and Ehrenberg, 1984; Wrigley and Dunn, 1984b; Kennedy and McColl, 2012). DoP analysis has also been applied to categories that require a minimum age to purchase (i.e., alcohol) (Dawes, 2008; Dawes, 2014) and expanded to leisure activities (Scriven et al., 2014), gambling (Hand and Singh, 2014; Lam and Ozorio, 2013), and tourism destinations (Mansfield et al., 2003; Mansfield and Romaniuk, 2003). The accumulated evidence confirms that consumers typically buy several brands within any category, that duplication levels between brands are predictable from brand size, and that when a partition occurs in a category, it often has a functional basis.

Empirically demonstrated deviations include excess sharing across gender-specific clothes brands (UK high street women's wear stores) (Brewis-Levie and Harris, 2000), gender-specific bodysprays (Scriven and Danenberg, 2010), cuisine-specific fast-food chains (Romaniuk, 2005), and health butters (Scriven and Danenberg, 2010). Extant empirical evidence also shows that non-functional differences between brands can cause partitions. These include consumers sharing their instant coffee purchases between supermarkets geographically close to one another or located within the same shopping centers (Wrigley and Dunn, 1984b), Australian beer brands sharing a parent company and distribution (Dawes, 2008), and television sets that were global brands (potentially a price point partition) (Bennett, 2008).

Further, some consumers may restrict their purchases to private labels in specific categories, perhaps because they occupy a lower price point or provide a simple heuristic that makes purchases quicker and easier. However, the existing empirical evidence on private label partitions remains

unclear. For example, there was no evidence of partitioning between private label brands and manufacturer brands in the UK coffee market, while other categories, including fruit squash and fabric conditioner, showed little evidence of excessive sharing between private labels (Uncles and Ellis, 1989). Studies in the US and UK for household cleaners, paper towels, cheese, and ketchup showed that private label buyers also buy national brands within the same store, also at other stores without the private label, and other private labels from other stores (Bound and Ehrenberg, 1997). Yet later analysis of 27 consumer goods categories in the UK reported excessive sharing amongst private label brands in 14 (52%) categories (Dawes and Nenycz-Thiel, 2013). Given the mixed evidence for the consistency of private label partitions, this study includes several categories where private label partitions have been found to further investigate whether they are persistent over time (when identified).

Importantly the discussed partition examples only cover one analysis period ranging from 24 weeks (Wrigley and Dunn, 1984b), 48 weeks (Brewis-Levie and Harris, 2000), and 52 weeks (Scriven and Danenberg, 2010; Bennett, 2008; Uncles and Ellis, 1989; Dawes and Nenycz-Thiel, 2013). However, no evidence shows whether the deviations carried over into the following period(s). Such evidence is vital. As Dawes and Nenycz-Thiel (2013) note, the finding that private labels compete against one another more intensely than expected shapes both a manufacturer's and retailer's strategy. However, if we find that the deviations are not persistent, the strategies may alter.

The Dirichlet model assumes category buyers purchase a small number of the available brands (Scriven et al., 2017). Early evidence shows consumers purchased on average 2.6 brands of toothpaste in 12 weeks (Goodhardt et al., 1984) or 2.4 brands of instant coffee over 24 weeks (Wrigley and Dunn, 1984b). Later, findings show Australians buy on average 2.8 beer brands over a year (Dawes, 2008), while British consumers bought 2.3 brands of instant coffee, 2.4 brands of tea bags, and 2.9 brands of toilet tissue (Trinh, 2014). The most comprehensive study analyzed 48 categories in the UK and 74 categories in the US, finding that consumers bought between 2.0 and

2.4 brands per category on average (Banelis et al., 2013). These findings apply to in-store purchasing and online supermarket buying (Trinh et al., 2017).

The empirical evidence is clear – most consumers limit their purchases to a few brands within a category. However, the brand repertoire literature is vague about how consumers choose their particular brand portfolios. For example, are toothpaste repertoires typically comprised of brands sharing functional traits such as tartar control, whitening, or formulations for sensitive teeth or across traits? DoP analyses provide insights into how customers purchase brands in aggregate. Where partitions occur, repertoire buying is somewhat restricted for either functional or non-functional reasons.

A variety of factors may influence the stability or persistence of such deviations across time. First, functional factors (i.e., the motor vehicle fuel category has diesel, leaded and unleaded petrol) may be subject to mandatory change (e.g., legislation) that prevents the partition's persistence (e.g., leaded petrol is no longer on the market). Second, the addition of product types or features into the category may only lead to temporary deviations. For example, initially, hybrid cars (using energy recovery systems) were a separate vehicle category. Over time, such technology has been introduced across many vehicle types, blurring the distinctions that separate partitions in the automotive category. Third, brands may, through their actions, create new partitions, changing the category. In the coffee category, manufacturers have introduced branded machines that brew coffee contained in capsules. Machine design and patents may restrict which brands offer which type of capsules. Fourth, the creation of entirely new categories may remove existing partitions. For example, the shampoo and conditioner markets were separate categories, but the introduction of 2-in-1 shampoo plus conditioner variants created a new category and distorted the previously clear partition between shampoo and conditioner brands. Furthermore, brands copy each other's sales effective attributes, so over time, deviations may disappear with all brands covering the full range of functional differences that matter to the market. Finally, it has been noted that deviations from the DoP pattern occur much less often than one might think (Scriven and Danenberg, 2010) and are

often a minor or a "second-order" effect) (Scriven and Danenberg, 2010; Uncles et al., 1995). Hence if deviations are so minor, they may appear in one period and disappear in the next.

The Dirichlet is underpinned by numerous generalizations and is based on the assumption of zero-order loyalty. One of the five model assumptions relates to product category and brand choice (i.e., independence of purchase incidence and brand choice) (Goodhardt et al., 1984; Ehrenberg et al., 2004; Lee et al., 2011). Within a fixed period, the model determines how many people buy a brand, how often, and what other brands they buy (Scriven et al., 2017). The independence assumption proports that buyers purchase propensities for brands are independent of their propensities to buy any other brand. That is, no partitions should exist (Scriven et al., 2017).

While the model is remarkably robust, confirmed by many replication studies, it has some established boundary conditions or deviations. The model underpredicts sole brand loyalty, the average purchase frequency of sole brand buyers, and the annual purchase frequency for bigger market-leading brands (Graham et al., 2017; Fader and Schmittlein, 1993). The model overpredicts the period-to-period repeat brand buying rate, the erosion of repeat purchase loyalty, and flatter distributions of light, medium, and heavy category buyers (Scriven et al., 2017; Goodhardt et al., 1984; Ehrenberg et al., 2004). These deviations are relatively small.

Examining the persistence of partitions adds to the knowledge on deviations and more broadly provides an opportunity to further examine the robustness of the Dirichlet, including its underpinning generalizations and the assumption of zero-order loyalty. In considering Dirichlet deviations, Ehrenberg (1988) suggested they would not persist over multiple years. However, his speculation provided no empirical evidence. Subsequent analysis and support for Dirichlet's parameter stability (Stocchi and Wright, 2010) showed little variation between two and three years – even when analyzing quarter-to-quarter measures which incorporate natural seasonality.

Overall, despite the large body of empirical evidence regarding how brands predictably share customers, including occasional deviations (excessive sharing), to the best of the authors' knowledge, only three studies have looked at deviations across multiple consecutive years

(Mansfield et al., 2003; Ehrenberg and Bound, 1999; Mansfield and Romaniuk, 2003), and none of these were for consumer goods categories. Our study is, therefore, the first to document the consistency of consumer goods partitions across time. Our specific research questions are:

**RQ1:** When partitions occur, is the level of excessive sharing within (i.e., intra) persistent?

**RQ2:** When partitions occur, is the level of under sharing between (i.e., inter) persistent?

## 3 Method and Data

The current study builds on methods used in previous DoP research (Scriven and Danenberg, 2010; Mansfield and Romaniuk, 2003; Lam and Ozorio, 2013) and Partition Sharing Index (PSI) studies (Anesbury et al., 2020; Anesbury et al., 2018b; Sjostrom et al., 2014), extending the analysis over three consecutive years of data. The approach enables an exploration of whether partitions persist from period to period and over the entire period. The data come from consumer goods categories in the United Kingdom. The analysis method begins with an algebraic approximation equation known as the DoP pattern (see Equation 1).

Equation 1 - the duplication of purchase pattern

$$\frac{bY}{X} = D \; x \; bY$$

In Equation 1, there are two brands – X and Y, where bY is the percentage of the population that buys brand Y, and bX is the percentage who buy brand X. Therefore, bY/X is the percentage of buyers of X who have also bought brand Y. D is the duplication coefficient, the average of the observed duplications for all pairs of brands, divided by the average penetration (Sharp et al., 2003; Scriven and Danenberg, 2010; Ehrenberg and Bound, 1999; Ehrenberg and Pouilleau, 1992; Lees and Wright, 2009)), and x is the multiplication sign. The analysis continues with Equation 2.

Equation 2– Partition Sharing Index

$$PSIij = \frac{Sij}{(D \; x \; pi)}$$

The formula involves dividing the duplicated purchases between two brands by multiplying the duplication coefficient by the penetration of the first brand. The PSIij between any brand i and j

represents the duplication of purchases between the two brands divided by the expected sharing for brand i (Anesbury et al., 2018b; Sjostrom et al., 2014). A PSI of 1 indicates that the sharing of customers is as expected, a PSI of 2 means that the brands share twice as many customers as expected, and a PSI of 0.5 means the brands share half as many as expected. The inter and intra-PSI both use Equation 2, however; inter-PSI examines the level of sharing *between* two groups of brands, while intra-PSI examines the level of sharing *within* a group of two or more brands. When the brands have an intra-PSI of 1.2 or higher, they are potentially managerially significant and are classified as partitions (Sjostrom et al., 2014; Anesbury et al., 2018b; Anesbury et al., 2020).

In this study, we use a Many Sets of Data approach (Bound and Ehrenberg, 1989) to focus on fundamental description (Ehrenberg et al., 2000). We utilize the software developed by Tanusondjaja et al. (2014) to calculate our inter and intra PSI values. Unlike earlier DoP studies (Keng and Ehrenberg, 1984; Wrigley and Dunn, 1984b), our study uses the PSI to identify excessive sharing instead of the Duplication coefficient that shows how likely a buyer in the market is to buy another brand or the expected proportion of brand A buyers who also buy brand B. The PSI, which incorporates the Duplication coefficient, indexes the level of sharing by the brand's size and gives marketers an easier figure to interpret. To date, there has been no direct study analyzing or comparing the results.

Our data source for this study was Taylor Nelson Sofres (TNS)/Kantar. TNS is a global panel data provider established in 1991 that has grown to become Great Britain's leading continuous demographically and regionally representative household consumer panel (Kantar, 2015). The average panel contains 20,027 households, with panel sizes ranging from 25,093 (nappies 2013) to 6,467 (yogurt 2000). TNS collects data twice a week from electronic terminals kept in consumers' homes, which marketers view through an interface called Powerview V.

TABLE 1 ABOUT HERE

Table 1 outlines the current study data, including three consumer goods categories that have previously demonstrated functional partitions: decaffeinated coffee (Ehrenberg and Uncles, 1999),

male-orientated body sprays (Scriven and Danenberg, 2010), and butter (Scriven and Danenberg, 2010). We add six additional categories with evidence of private label partitions: yogurt, deodorant, toothpaste, margarine, colas, and nappies (Dawes and Nenycz-Thiel, 2013). The categories' annual penetrations vary considerably, with a high of 99.3% (yellow fats 2009) and a low of 14.8% (nappies 2014), adding nice variation across the many sets of data for pattern spotting. The annual average purchase frequencies range from 31 (yogurt in 1998) to six occasions per year (toothpaste 2010). The wide assortment, high percentage of the population buying, and how often those consumers buy the categories enhance the study's generalizability on partition existence and persistence.

## 4 Results

The top five brands, covering substantial proportions of the purchases of each market / potential partition, were analyzed. For example, for the coffee category in 2014, the top five national brands accounted for 50% of all national brand sales, and the top five private label brands accounted for 26% of all private label sales. On average, the top five brands account for 49% of their respective overall sales. Limiting the analysis to just the top brands within a category is common (Anesbury et al., 2018b; Ehrenberg et al., 1990; Hammond et al., 1996), especially for initial studies in an area, with one study analyzing the top three national and private label brands (Bound and Ehrenberg, 1997). Importantly having a consistent number of brands inside and outside a potential partition (e.g., five decaffeinated and five caffeinated brands) also ensures sharing levels are not because of the number of available options or any changes from year to year. For example, including the top ten caffeinated coffee brands and only the top five decaffeinated coffee alters the duplication coefficient and PSI. Further, having five decaffeinated coffee brands in year one, ten in year two, and four in year three similarly influences the PSI through the duplication coefficient. Therefore, in the first instance, to check the stability of partitions, we remove the bias from an unequal or inconsistent number of brands.

To demonstrate the approach, data from the coffee category over three years (2012 to 2014) is used. For each brand, the percentage of buyers who bought other brands was calculated. For example, in Table 2, of the 4,639 consumers (19% penetration) who bought Nescafe Original Instant Coffee, 835 (18%) bought Nescafe Gold Blend Standard, 557 (12%) bought Douwe Egbert Pure Gold, and 65 (1%) bought Tesco Classic Gold Decaffeinated Instant Coffee.

TABLE 2 ABOUT HERE

The first stage of applying the PSI formula involves calculating the duplication coefficient (i.e., the average duplication divided by the average penetration). In this case 10.3 divided by 7.15 = 1.43. The second stage is summing the duplicated purchases between the two brands. Using the data in Table 2, Douwe Egbert Pure Gold (DEPG) shares 24.1% of its customers with Nescafe Gold Blend Standard (NGBS). The third stage is dividing the sum of duplicated purchases by the duplication coefficient multiplied by the penetration of the first brand. In Table 3, the PSI of DEPG and NGBS is 1.43 (24.1% divided by the 1.43 (duplication coefficient) multiplied by 11.7% (NGBS's penetration)). The same three steps repeat. NGBS shares 20.7% of its customers with DEPG, divided by 1.43 (duplication coefficient) multiplied by 10.1% (DEPG's penetration), which equals 1.43. As the PSI is an index, the two figures average – giving the intra-PSI between DEPG and NGBS of 1.43. The inter-PSI (i.e., the averaging of the PSI between the two groups of brands) is 0.82 (the average of the cells in the bottom left or top right of Table 3). The result highlights that slightly fewer buyers than expected of caffeinated coffee also buy decaffeinated coffee and vice versa – that is, in the UK in 2014, there is a decaffeinated partition.

TABLE 3 ABOUT HERE

We calculate the average intra-PSI and inter-PSI for each previously evidenced functional partition, including decaffeinated coffee (Ehrenberg and Uncles, 1999), male-orientated body sprays (Scriven and Danenberg, 2010), butter (Scriven and Danenberg, 2010), and six categories with perceived private label partitions (Dawes and Nenycz-Thiel, 2013). When intra-PSIs are 1.2 or larger, and the inter-PSI is 0.8 or smaller, they are identified as potentially managerially significant

and classified as a partition. In Table 3, the decaffeinated intra-PSI is 2.5, meaning that the top five decaffeinated coffee brands share customers almost two and a half times more than expected. The inter-PSI is 0.82, meaning that they share 18% fewer customers with the top five regular coffee brands. Table 5 within the Appendix contains the intra-PSI and inter-PSI for the coffee category for each of the years.

The initial analysis replicates the existing knowledge that in some categories, functional similarities amongst a group of brands, which are different from the other brands, share more customers. We now extend the analysis to all categories and years.

TABLE 4 ABOUT HERE

Table 4 demonstrates support for previously identified partitions. These include decaffeinated coffee (2010, 2012, and 2013) (Ehrenberg and Uncles, 1999), private label toothpaste (2008 to 2010) (Dawes and Nenycz-Thiel, 2013), male-orientated body sprays (Scriven and Danenberg, 2010), butter (Scriven and Danenberg, 2010), and private label partitions (Dawes and Nenycz-Thiel, 2013). In this data, the functional or private label partitions have excess sharing (i.e., intra-PSI >1.2), even if they are not isolated from the rest of the category (i.e., inter-PSI >0.8).

To determine when partitions persist – we use a coefficient of variance (CV). The measure is simple – a division of the standard deviation by the index's mean (Brown, 1998). A lower CV indicates lower levels of mean dispersion (UCLA: Statistical Consulting Group, 2021), which in this instance, is higher persistence. We consider all CVs below the defined upper boundary as persistent. The upper boundary is the average CV plus two standard deviations divided by the square root of the number of categories multiplied by 1.96. Therefore, here the upper boundary for intra-PSI is 18, and inter-PSI is 8.7.

Table 4 shows that 83% of the CVs are below the upper CV boundaries. The only category above the upper boundary for both inter, and intra-PSI is decaffeinated coffee for 2010 to 2012. Further investigation shows excessive consumer sharing between the caffeinated and decaffeinated variety of the same brand in 2011. Specifically, Nescafe Cappuccino and Nescafe Decaffeinated

cappuccino. This may have been a result of the range being price promoted or advertised simultaneously and is consistent with the existence of a 'same name' partition during this period (Dawes, 2016). Overall, our results show that in the 24 categories/years examined; all had partitions. Further, the current research finds that in all cases, where a group of brands excessively shares customers in one year, they continue to do so in the following two years.

## 5 Discussion

This research builds on the foundational work of Gerald Goodhardt by successfully replicating the duplication of purchase pattern (Goodhardt, 1966; Goodhardt and Ehrenberg, 1969a), extending the knowledge of functional and private label partitions (Wrigley and Dunn, 1984b; Goodhardt et al., 1984; Dawes and Nenycz-Thiel, 2013), and notably, providing systematic novel evidence about the persistency of partitions over time, specifically within the UK market.

### 5.1 Theoretical Implications

The research provides multiple theoretical contributions. The first is to support the literature that repertoire buying is predictable across consumer goods categories (Banelis et al., 2013; Goodhardt et al., 1984; Dawes, 2008; Wrigley and Dunn, 1984b; Trinh, 2014). The study offers initial evidence that in given conditions, consumers not only buy brands predictably in line with size (as outlined by DoP) but also systematically overshare some brands that share certain similarities (e.g., functions, price-tiers, private label). Crucially, purchases are not exclusively within any partition (i.e., buyers purchase other brands across the category as well in line with brand popularity on average).

The second contribution is additional empirical support for the medium-term stability of brands (Graham, 2009; Trinh and Anesbury, 2015; Vaughan, 2020). Previous research shows that most brands remain at the same market share levels in the medium term (e.g., five years), with only exceptional circumstances such as innovation altering brand share performance. Further, the study shows that the competitive structure of consumer goods categories is mostly stable in the medium-

term – reinforcing previous market share stability findings (Dekimpe and Hanssens, 1995; Graham, 2009; Trinh and Anesbury, 2015; Vaughan, 2020). Here the findings on market stability quantify partition stability over three years. If brands compete heavily with other brands (e.g., with shared functionality), they will continue to do so over extended periods; hence partitioning is mostly stable. While there are many reasons that partitions might not persist over time, they were remarkably stable in categories analyzed here.

The research builds on a known empirical generalization (DoP) that underpins the Dirichlet model, a simple stochastic model of purchase incidence and brand choice (Ehrenberg, 1959; Goodhardt et al., 1984). Our results broadly support the independence assumption of the model (i.e., the purchase propensity for any brand is independent of buying any other brand), which assumes that there are no partitions within a market (Scriven et al., 2017)). However, when it does not hold (i.e., when partitions occur), they are persistent. The existence of partitions is consistent with sub-categories (e.g., rather than a single coffee category, there are two sub-markets caffeinated and decaffeinated coffee). These results reinforce the claim from Sharp et al. (2012) that partitions are easily identifiable (i.e., most people would suspect there is a caffeinated and decaffeinated coffee market). The research contradicts an earlier suggestion by Ehrenberg (1988) that over multiple years deviations would not persist but supports the research on Dirichlet parameter stability (Stocchi and Wright, 2010) and deviation stability (Pare and Dawes, 2011).

### 5.2 Practical Implications

Marketers must decide which products and variants they will sell (Day et al., 1979; Srivastava et al., 1981) and which promotion strategies they will employ (Fraser and Bradford, 1983; Urban et al., 1984). Such decisions are ideally made with a clear understanding of the relevant competitive market structure. The DoP analysis conducted here helps marketers understand the market(s) they compete in (Goodhardt and Ehrenberg, 1969a; Uncles and Ellis, 1989; Anesbury et al., 2018a). More broadly, the results imply that market structures will typically remain stable

over the medium-term. Such reassurance of market stability helps mitigate the risks of taking decisions based on the likes of a partition.

Over the medium and longer-term, marketers decide which offers to introduce or remove from their portfolio, often influenced by the structure of the market. For example, as the global decaffeinated coffee market grew (Grand View Research, 2020), brand managers examined the level of competition between brands and variants to determine whether the decaffeinated partition offered attractive opportunities (depending on the size, growth rate, and intensity of competition) for expansion through new product development or brand extension. A wrong decision can be costly, so robust benchmarks derived from systematic work like this are useful. Such knowledge helps answer questions like — "Is it better for a brand to share more customers with competitor brands than to share customers within its own portfolio and cannibalize itself?". Our paper aids marketing decision making by providing a simple answer to the novel question about whether partitions are persistent. The affirmative answer helps marketers make evidence-based medium-term decisions about brand introductions, new product development, and marketing interventions. Marketers who understand the DoP pattern make different decisions and allocate resources differently to those who do not (Kennedy and McColl, 2012).

Understanding the structure of a market and the persistence of deviations can help marketers make informed communications and positioning decisions. With persistent deviations, it may be wise to invest in building the long-term mental availability of particular brands and brand attributes.

## 6 Limitations and Future Research

Future research should address the limitations of this study. Although the research tests the persistence of key partitions over time, the analysis was limited to nine consumer goods categories in one market. Given that partitions occur in other markets such as television sets (Bennett, 2008), cars (Ehrenberg and Bound, 1999), or tourism destinations (Mansfield and Romaniuk, 2003), further longitudinal documentation outside consumer goods categories is encouraged. Ideally, future researchers should test the stability of deviations in diverse situations which may include and

are certainly not limited to different types of markets such as highly fragmented markets like wine (Wilson and Winchester, 2019), memory associations (Romaniuk, 2005), and other less traditional marketing situations such as physical activities (Wilson et al., 2019), voting preferences (Kooyman and Wright, 2017), entertainment choices (viewing) (Lees and Wright, 2013), and gambling (Lam and Ozorio, 2013; Lam, 2006). Further examination of deviations from other NBD-Dirichlet patterns (e.g., double jeopardy, natural monopoly) in both consumer goods and other contexts (Pare and Dawes, 2011; Stocchi et al., 2017; Dawes, 2020; Stocchi et al., 2015; Nenycz-Thiel and Romaniuk, 2014), and their persistence may also prove fruitful. Given that this study only analyzed the UK, future research should confirm that the persistent pattern holds in other diverse markets. Given the robustness of Dirichlet patterns across markets and that previous studies have identified deviations in other markets such as Russia, Thailand, and China (Uncles and Kwok, 2009; Uncles and Kwok, 2008; Bennett, 2008; Bennett and Graham, 2010; Kennedy and McColl, 2012) it would be surprising if the same persistence patterns do not hold. Last, our research focuses on partitions but does not make the distinction between partitions and groupings (i.e., brands with excess sharing (within) that share as expected with the rest of the market (between)), an additional categorization that has some traction in industry. Future systematic research of this additional sub-pattern is encouraged.

# TABLES

Table 1: Summary of data

| Category | Year | Category Penetration | Category Purchase Frequency |
|---|---|---|---|
| Cola | 2010 | 72 | 14 |
| | 2011 | 73 | 14 |
| | 2012 | 74 | 15 |
| | 2013 | 75 | 15 |
| | 2014 | 75 | 15 |
| Coffee | 2010 | 84 | 9 |
| | 2011 | 83 | 9 |
| | 2012 | 82 | 9 |
| | 2013 | 82 | 10 |
| | 2014 | 81 | 9 |
| Toothpaste | 2008 | 89 | 6 |
| | 2009 | 89 | 6 |
| | 2010 | 89 | 6 |
| Deodorant | 2008 | 76 | 6 |
| | 2009 | 74 | 7 |
| | 2010 | 75 | 7 |
| Nappies | 2010 | 15 | 8 |
| | 2011 | 16 | 8 |
| | 2012 | 16 | 8 |
| | 2013 | 16 | 7 |
| | 2014 | 15 | 7 |
| Yoghurt | 1998 | 87 | 31 |
| | 1999 | 88 | 29 |
| | 2000 | 88 | 29 |
| Margarine | 2008 | 92 | 22 |
| | 2009 | 92 | 22 |
| | 2010 | 91 | 21 |
| Yellow Fats | 2008 | 99 | 22 |
| | 2009 | 99 | 22 |
| | 2010 | 99 | 22 |

Table 2: percentage of households sharing coffee brands (UK, 2014)

| | Category Penetration (%) | 81.4 | who also bought… | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Category Purchase Frequency | 9.4 | Caffeinated | | | | | Decaffeinated | | | | |
| | Buyers of... | Pen (%) | Nescafe Original I.Coffee | Nescafe Gold Blend Std | Douwe Egbert Pure Gold | Kenco Mllcno Whlbn Ins Cf | Nescafe CM Cappuccino | Kenco Decaf Coffee | Nescafe Orgnl Decaf I.Cfe | Kenco Mllcno Whlbn Dcf IC | Aldi Gold Decaff | Tesco Classic Gld Dcf I.C |
| Caffeinated | Nescafe Original I.Coffee | 18.6 | | 18 | 12 | 7 | 9 | 4 | 8 | 2 | 2 | 1 |
| Caffeinated | Nescafe Gold Blend Std | 11.7 | 28 | | 21 | 10 | 8 | 6 | 4 | 2 | 1 | 2 |
| Caffeinated | Douwe Egbert Pure Gold | 10.1 | 22 | 24 | | 14 | 8 | 7 | 3 | 3 | 2 | 2 |
| Caffeinated | Kenco Mllcno Whlbn Ins Cf | 9.0 | 15 | 14 | 15 | | 9 | 5 | 2 | 12 | 2 | 2 |
| Caffeinated | Nescafe CM Cappuccino | 6.9 | 24 | 14 | 12 | 12 | | 5 | 5 | 3 | 4 | 2 |
| Decaffeinated | Kenco Decaf Coffee | 5.0 | 16 | 14 | 13 | 9 | 7 | | 15 | 11 | 7 | 8 |
| Decaffeinated | Nescafe Orgnl Decaf I.Cfe | 3.4 | 42 | 13 | 10 | 7 | 9 | 22 | | 5 | 7 | 8 |
| Decaffeinated | Kenco Mllcno Whlbn Dcf IC | 2.5 | 11 | 10 | 13 | 44 | 7 | 21 | 7 | | 6 | 5 |
| Decaffeinated | Aldi Gold Decaff | 2.1 | 13 | 8 | 7 | 7 | 12 | 16 | 11 | 7 | | 12 |
| Decaffeinated | Tesco Classic Gld Dcf I.C | 2.1 | 13 | 10 | 10 | 9 | 6 | 19 | 13 | 6 | 12 | |
| | **Average Duplication** | | **20** | **14** | **13** | **13** | **8** | **12** | **8** | **6** | **5** | **5** |

Table 3: Partition Sharing Indexes coffee brands (UK, 2014)

| | Category Penetration (%) | 81.4 | who also bought… | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Category Purchase Frequency | 9.4 | Caffeinated | | | | | Decaffeinated | | | | |
| | Buyers of... | Pen (%) | Douwe Egbert Pure Gold | Kenco Mllcno Whlbn Ins Cf | Nescafe CM Cappuccino | Nescafe Gold Blend Std | Nescafe Original I.Coffee | Aldi Gold Decaff | Kenco Decaf Coffee | Kenco Mllcno Whlbn Dcf IC | Nescafe Orgnl Decaf I.Cfe | Tesco Classic Gld Dcf I.C |
| Caffeinated | Douwe Egbert Pure Gold | 10.1 | | 1.0 | 0.8 | 1.4 | 0.8 | 0.5 | 0.9 | 0.9 | 0.7 | 0.7 |
| Caffeinated | Kenco Mllcno Whlbn Ins Cf | 9.0 | 1.0 | | 0.9 | 0.8 | 0.6 | 0.5 | 0.7 | 3.4 | 0.5 | 0.7 |
| Caffeinated | Nescafe CM Cappuccino | 6.9 | 0.8 | 0.9 | | 0.8 | 0.9 | 1.3 | 0.7 | 0.7 | 0.9 | 0.6 |
| Caffeinated | Nescafe Gold Blend Std | 11.7 | 1.4 | 0.8 | 0.8 | | 1.1 | 0.5 | 0.8 | 0.6 | 0.8 | 0.6 |
| Caffeinated | Nescafe Original I.Coffee | 18.6 | 1.0 | 0.6 | 0.9 | 1.1 | | 0.5 | 0.6 | 0.4 | 1.6 | 0.5 |
| Caffeinated | Partition Sharing Index | | | | **0.92** | | | | | **0.82** | | |
| Decaffeinated | Aldi Gold Decaff | 2.1 | 0.5 | 0.5 | 1.3 | 0.5 | 0.5 | | 2.2 | 2.0 | 2.3 | 3.8 |
| Decaffeinated | Kenco Decaf Coffee | 5.0 | 0.9 | 0.7 | 0.7 | 0.8 | 0.6 | 2.2 | | 2.9 | 3.1 | 2.7 |
| Decaffeinated | Kenco Mllcno Whlbn Dcf IC | 2.5 | 0.9 | 3.4 | 0.7 | 0.6 | 0.4 | 2.0 | 2.9 | | 1.5 | 1.5 |
| Decaffeinated | Nescafe Orgnl Decaf I.Cfe | 3.4 | 0.7 | 0.5 | 0.9 | 0.8 | 1.6 | 2.3 | 3.1 | 1.5 | | 2.7 |
| Decaffeinated | Tesco Classic Gld Dcf I.C | 2.1 | 0.7 | 0.7 | 0.6 | 0.6 | 0.5 | 3.8 | 2.7 | 1.5 | 2.7 | |
| Decaffeinated | Partition Sharing Index | | | | **0.82** | | | | | **2.47** | | |

*Decaffeinated PSI = 2.47, Caffeinated PSI = 0.92, Intra-partition sharing index = 0.82*

Table 4: Summary of Partition Persistence (UK, 1998 to 2014)

| | | Coefficient of Variation | | Year One | | Year Two | | Year Three | |
|---|---|---|---|---|---|---|---|---|---|
| Category | Partition | Intra | Inter | Intra | Inter | Intra | Inter | Intra | Inter |
| Coffee (2010 to 2012) | Decaffeinated | 34.4* | 20.3* | 2.1 | 0.8 | 1.7 | 1.1 | 3.3 | 0.7 |
| Nappies (2012 to 2014) | Private Label | 23.1* | 4.4 | 1.8 | 0.8 | 1.4 | 0.8 | 1.2 | 0.8 |
| Colas (2010 to 2012) | Private Label | 20.4* | 3.0 | 2.8 | 0.9 | 2.6 | 0.9 | 3.8 | 0.9 |
| Deodorant (2008 to 2010) | Private Label | 16.4 | 1.2 | 2.7 | 0.9 | 1.9 | 0.9 | 2.4 | 0.9 |
| Coffee (2012 to 2014) | Decaffeinated | 14.6 | 6.6 | 3.3 | 0.7 | 2.9 | 0.8 | 2.5 | 0.8 |
| Colas (2012 to 2014) | Private Label | 12.4 | 2.6 | 3.8 | 0.9 | 3.0 | 0.9 | 3.6 | 0.9 |
| Toothpaste (2008 to 2010) | Private Label | 10.4 | 5.9 | 3.7 | 0.6 | 4.0 | 0.6 | 3.2 | 0.7 |
| Yoghurt (1998 to 2000) | Private Label | 10.3 | 3.8 | 1.2 | 0.9 | 1.3 | 0.9 | 1.5 | 0.9 |
| Nappies (2010 to 2012) | Private Label | 9.2 | 4.7 | 1.5 | 0.9 | 1.8 | 0.8 | 1.8 | 0.8 |
| Margarine (2008 to 2010) | Private Label | 8.1 | 6.8 | 1.5 | 1.0 | 1.3 | 0.9 | 1.4 | 0.9 |
| Deodorant (2008 to 2010) | Male Orientated | 2.2 | 2.2 | 1.3 | 1.1 | 1.3 | 1.1 | 1.4 | 1.1 |
| Yellow Fats (2008 to 2010) | Butter | 1.7 | 2.4 | 1.2 | 0.9 | 1.3 | 1.0 | 1.3 | 0.9 |
| Average | | 13.6 | 5.3 | 2.3 | 0.9 | 2.0 | 0.9 | 2.3 | 0.9 |

** CV = above the upper boundary*

## Appendix

Table 5: Partition Sharing Indexes coffee brands (UK, 2010 to 2013)

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Category Penetration (%) | 83.7 | who also bought… | | | | | | | | | | | | | |
| | Category Purchase Frequency | 9.0 | Caffeinated | | | | | | Decaffeinated | | | | | | | |
| **2010** | Buyers of... | Pen (%) | Kenco Really Rich | Kenco Really Smooth | Nescafe Cappuccino | Nescafe Gold Blend Std | Nescafe Original I.Coffee | | Kenco Decaf Coffee | Nescafe Orgnl Decaf I.Cfe | Nescafe Unswt Dcff Cppcno | Tesco ClassiGld Dcf I.C | Tesco ClsI.Coffee Decaf | | | |
| Caffeinated | Kenco Really Rich | 8.9 | | 2.0 | 1.0 | 1.2 | 0.9 | | 1.3 | 0.8 | 0.7 | 0.7 | 0.4 | | | |
| | Kenco Really Smooth | 10.7 | 2.0 | | 1.0 | 1.2 | 0.8 | | 1.2 | 0.6 | 0.8 | 0.6 | 0.3 | | | |
| | Nescafe Cappuccino | 7.9 | 1.0 | 1.0 | | 1.0 | 0.9 | | 0.7 | 0.7 | 3.1 | 0.8 | 0.5 | | | |
| | Nescafe Gold Blend Std | 17.0 | 1.2 | 1.2 | 1.0 | | 1.0 | | 0.7 | 0.7 | 0.8 | 0.4 | 0.3 | | | |
| | Nescafe Original I.Coffee | 21.2 | 0.9 | 0.8 | 0.9 | 1.0 | | | 0.5 | 1.3 | 0.8 | 0.5 | 0.6 | | | |
| | Partition Sharing Index | | | | **1.10** | | | | | | **0.80** | | | | | |
| Decaffeinated | Kenco Decaf Coffee | 5.0 | 1.3 | 1.2 | 0.7 | 0.7 | 0.5 | | | 2.6 | 1.7 | 2.4 | 1.2 | | | |
| | Nescafe Orgnl Decaf I.Cfe | 5.2 | 0.8 | 0.6 | 0.7 | 0.7 | 1.3 | | 2.6 | | 1.6 | 2.0 | 2.2 | | | |
| | Nescafe Unswt Dcff Cppcno | 2.2 | 0.7 | 0.8 | 3.1 | 0.8 | 0.8 | | 1.7 | 1.6 | | 1.3 | 0.8 | | | |
| | Tesco ClassiGld Dcf I.C | 3.7 | 0.7 | 0.6 | 0.8 | 0.4 | 0.5 | | 2.4 | 2.0 | 1.3 | | 5.3 | | | |
| | Tesco ClsI.Coffee Decaf | 1.6 | 0.4 | 0.3 | 0.5 | 0.3 | 0.6 | | 1.2 | 2.2 | 0.8 | 5.3 | | | | |
| | Partition Sharing Index | | | | **0.80** | | | | | | **2.11** | | | | | |
| | Category Penetration (%) | 82.9 | who also bought… | | | | | | | | | | | | | |
| | Category Purchase Frequency | 8.9 | Caffeinated | | | | | | Decaffeinated | | | | | | | |
| **2011** | Buyers of... | Pen (%) | Kenco Really Smooth | Nescafe Cappuccino | Nescafe Gold Blend Std | Nescafe Original I.Coffee | Tesco Gold I.Coffee | | Kenco Decaf Coffee | Kenco Eco Rich | Nescafe Decaff Cappuccino | Nescafe Orgnl Decaf I.Cfe | Tesco Classic Gld Dcf I.C | | | |
| Caffeinated | Kenco Really Smooth | 10.0 | | 0.8 | 1.2 | 0.9 | 1.1 | | 1.0 | 2.4 | 0.6 | 0.4 | 0.7 | | | |
| | Nescafe Cappuccino | 8.0 | 0.8 | | 0.9 | 0.9 | 0.9 | | 0.6 | 1.0 | 3.7 | 0.7 | 0.8 | | | |
| | Nescafe Gold Blend Std | 16.0 | 1.2 | 0.9 | | 0.9 | 1.1 | | 0.7 | 1.7 | 0.7 | 0.7 | 0.7 | | | |
| | Nescafe Original I.Coffee | 20.0 | 0.9 | 0.9 | 0.9 | | 0.7 | | 0.5 | 1.2 | 0.7 | 1.2 | 0.5 | | | |
| | Tesco Gold I.Coffee | 6.0 | 1.1 | 0.9 | 1.1 | 0.7 | | | 0.6 | 1.2 | 0.4 | 0.7 | 3.0 | | | |
| | Partition Sharing Index | | | | **0.93** | | | | | | **1.06** | | | | | |
| Decaffeinated | Kenco Decaf Coffee | 4.0 | 1.0 | 0.6 | 0.7 | 0.5 | 0.6 | | | 1.5 | 2.1 | 2.3 | 2.6 | | | |
| | Kenco Eco Rich | 3.0 | 2.4 | 1.0 | 1.7 | 1.2 | 1.2 | | 1.5 | | 0.5 | 0.8 | 0.9 | | | |
| | Nescafe Decaff Cappuccino | 2.0 | 0.6 | 3.7 | 0.7 | 0.7 | 0.4 | | 2.1 | 0.5 | | 1.7 | 2.6 | | | |
| | Nescafe Orgnl Decaf I.Cfe | 5.0 | 0.4 | 0.7 | 0.7 | 1.2 | 0.7 | | 2.3 | 0.8 | 1.7 | | 2.4 | | | |
| | Tesco Classic Gld Dcf I.C | 3.0 | 0.7 | 0.8 | 0.7 | 0.5 | 3.0 | | 2.6 | 0.9 | 2.6 | 2.4 | | | | |
| | Partition Sharing Index | | | | **1.06** | | | | | | **1.75** | | | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Category Penetration (%) | 82.0 | who also bought… | | | | | | | | | | | | |
| | Category Purchase Frequency | 9.3 | Caffeinated | | | | | | Decaffeinated | | | | | | |
| **2012** | Buyers of... | Pen (%) | Douwe Egbert Pure Gold | Kenco Mllcno Whlbn Ins Cf | Nescafe Gold Blend Std | Nescafe Original I.Coffee | Tesco Gold I.Coffee | | Asda Dcff Golden Roast | Kenco Decaf Coffee | Kenco Eco Decaf | Nescafe Orgnl Decaf I.Cfe | Tesco Classic Gld Dcf I.C | | |
| Caffeinated | Douwe Egbert Pure Gold | 10.2 | | 1.1 | 1.2 | 0.7 | 1.1 | | 0.4 | 0.6 | 0.7 | 0.6 | 0.7 | | |
| Caffeinated | Kenco Mllcno Whlbn Ins Cf | 8.4 | 1.1 | | 0.9 | 0.6 | 0.7 | | 0.5 | 0.9 | 0.9 | 0.7 | 0.7 | | |
| Caffeinated | Nescafe Gold Blend Std | 13.5 | 1.2 | 0.9 | | 0.9 | 0.9 | | 0.6 | 0.7 | 0.8 | 0.7 | 0.5 | | |
| Caffeinated | Nescafe Original I.Coffee | 19.6 | 0.7 | 0.6 | 0.9 | | 0.6 | | 0.5 | 0.5 | 0.6 | 1.3 | 0.4 | | |
| Caffeinated | Tesco Gold I.Coffee | 8.8 | 1.1 | 0.7 | 0.9 | 0.6 | | | 0.9 | 0.4 | 0.4 | 0.5 | 2.4 | | |
| Caffeinated | Partition Sharing Index | | | | **0.87** | | | | | | **0.72** | | | | |
| Decaffeinated | Asda Dcff Golden Roast | 1.8 | 0.4 | 0.5 | 0.6 | 0.5 | 0.9 | | | 2.1 | 2.4 | 2.3 | 4.2 | | |
| Decaffeinated | Kenco Decaf Coffee | 3.2 | 0.6 | 0.9 | 0.7 | 0.5 | 0.4 | | 2.1 | | 9.6 | 3.5 | 2.1 | | |
| Decaffeinated | Kenco Eco Decaf | 3.0 | 0.7 | 0.9 | 0.8 | 0.6 | 0.4 | | 2.4 | 9.6 | | 2.9 | 2.0 | | |
| Decaffeinated | Nescafe Orgnl Decaf I.Cfe | 4.3 | 0.6 | 0.7 | 0.7 | 1.3 | 0.5 | | 2.3 | 3.5 | 2.9 | | 2.2 | | |
| Decaffeinated | Tesco Classic Gld Dcf I.C | 3.5 | 0.7 | 0.7 | 0.5 | 0.4 | 2.4 | | 4.2 | 2.1 | 2.0 | 2.2 | | | |
| Decaffeinated | Partition Sharing Index | | | | **0.72** | | | | | | **3.32** | | | | |
| | Category Penetration (%) | 82.1 | who also bought… | | | | | | | | | | | | |
| | Category Purchase Frequency | 9.56 | Caffeinated | | | | | | Decaffeinated | | | | | | |
| **2013** | Buyers of... | Pen (%) | Douwe Egbert Pure Gold | Kenco Mllcno Whlbn Ins Cf | Nescafe CM Cappuccino | Nescafe Gold Blend Std | Nescafe Original I.Coffee | | Kenco Decaf Coffee | A Kenco Eco Decaf | Kenco Mllcno Whlbn Dcf | Nescafe Orgnl Decaf I.Cfe | Tesco Classic Gld Dcf I.C | | |
| Caffeinated | Douwe Egbert Pure Gold | 9.1 | | 1.0 | 0.8 | 1.3 | 0.8 | | 0.8 | 0.8 | 0.8 | 0.4 | 0.5 | | |
| Caffeinated | Kenco Mllcno Whlbn Ins Cf | 10.3 | 1.0 | | 0.8 | 0.7 | 0.5 | | 0.9 | 0.9 | 3.1 | 0.5 | 0.7 | | |
| Caffeinated | Nescafe CM Cappuccino | 6.3 | 0.8 | 0.8 | | 0.8 | 0.8 | | 0.6 | 0.5 | 0.6 | 0.6 | 0.7 | | |
| Caffeinated | Nescafe Gold Blend Std | 13.0 | 1.3 | 0.7 | 0.8 | | 0.9 | | 0.8 | 0.7 | 0.6 | 0.6 | 0.6 | | |
| Caffeinated | Nescafe Original I.Coffee | 19.0 | 0.8 | 0.5 | 0.8 | 0.9 | | | 0.5 | 0.4 | 0.5 | 1.2 | 0.5 | | |
| Caffeinated | Partition Sharing Index | | | | **0.85** | | | | | | **0.75** | | | | |
| Decaffeinated | Kenco Decaf Coffee | 3.9 | 0.8 | 0.9 | 0.6 | 0.8 | 0.5 | | | 8.2 | 2.9 | 3.0 | 2.4 | | |
| Decaffeinated | Kenco Eco Decaf | 3.0 | 0.8 | 0.9 | 0.5 | 0.7 | 0.4 | | 8.2 | | 3.3 | 2.5 | 1.7 | | |
| Decaffeinated | Kenco Mllcno Whlbn Dcf IC | 3.4 | 0.8 | 3.1 | 0.6 | 0.6 | 0.5 | | 2.9 | 3.3 | | 1.6 | 1.6 | | |
| Decaffeinated | Nescafe Orgnl Decaf I.Cfe | 3.5 | 0.4 | 0.5 | 0.6 | 0.6 | 1.2 | | 3.0 | 2.5 | 1.6 | | 2.3 | | |
| Decaffeinated | Tesco Classic Gld Dcf I.C | 2.7 | 0.5 | 0.7 | 0.7 | 0.6 | 0.5 | | 2.4 | 1.7 | 1.6 | 2.3 | | | |
| Decaffeinated | Partition Sharing Index | | | | **0.75** | | | | | | **2.95** | | | | |

**The Ehrenberg-Bass Institute University of South Australia and the Ehrenberg Centre for Research in Marketing London South Bank University thank Kantar World Panel for providing data to enable this research.**

## References

Anesbury Z, Greenacre L, Wilson A and Huang A. 2018a. Patterns of fruit and vegetable buying behaviour in the United States and India. *International Journal of Market Research* **60** (1): 14-31.

Anesbury Z, Nguyen Y, Bogomolova S. 2018b. Getting a 'sweet' deal: does healthfulness of a sub-brand influence consumer loyalty? *European Journal of Marketing,* **52** (9-10): 1802-1826.

Anesbury ZW, Jürkenbeck K, Bogomolov T and Bogomolova S. 2020. Analyzing proprietary, private label, and non-brands in fresh produce purchases. *International Journal of Market Research*: 1-23.

Banelis M, Riebe E, Rungie C. 2013. Empirical evidence of repertoire size. *Australasian Marketing Journal,* **21** (1): 59-65.

Bennett D. 2008. Brand Loyalty Dynamics—China's Television brands come of age. *Australasian Marketing Journal,* **16** (2): 39-50.

Bennett D, Graham C. 2010. Is loyalty driving growth for the brand in front? A two-purchase analysis of car category dynamics in Thailand. *Journal of Strategic Marketing,* **18** (7): 573-585.

Bongers M, Hofmeyr J. 2010. Why modeling averages is not good enough - a critique of Double Jeopardy. *Journal of Advertising Research,* **50** (3): 323-333.

Bound J, Ehrenberg A. 1997. Private Label Purchasing. *Admap,* **32** (7): 17-19.

Bound JA, Ehrenberg A. 1989. Significant sameness. *Journal of the Royal Statistical Society,* **152**: 241-247.

Brewis-Levie M, Harris P. 2000. An empirical analysis of buying behaviour in UK high street womenswear retailing using the Dirichlet model. *The International Review of Retail, Distribution and Consumer Research,* **10** (1): 41-57.

Brown CE. 1998. Coefficient of Variation, in *Applied Multivariate Statistics in Geohydrology and Related Sciences,* Springer Berlin Heidelberg: Berlin, Heidelberg; 155-157.

Dall'Olmo Riley F, Ehrenberg A, Castleberry SB, Barwise TP and Barnard NR. 1997. The variability of attitudinal repeat-rates. *International Journal of Research in Marketing,* **14** (5): 437-450.

Danaher PJ, Dagger TS. 2012. The 38-Percent Solution: Empirical Generalizations for Repeat Viewing of Television Programs. *Journal of Advertising Research,* **52** (2).

Dawes J. 2008. Regularities in buyer behaviour and brand performance; The case of Australian beer. *The Journal of Brand Management,* **15** (3): 198-208.

Dawes J. 2009. Brand loyalty in the UK sportswear market. *International Journal of Market Research,* **51** (4): 449-463.

Dawes J. 2014. Cigarette brand loyalty and purchase patterns: an examination using US consumer panel data. *Journal of Business Research,* **67** (9): 1933-1943.

Dawes J. 2020. The Natural Monopoly effect in brand purchasing: Do big brands really appeal to lighter category buyers? *Australasian Marketing Journal (AMJ),* **28** (2): 90-99.

Dawes J, Nenycz-Thiel M. 2013. Analyzing the intensity of private label competition across retailers. *Journal of Business Research,* **66** (1): 60-66.

Dawes J, Nenycz-Thiel M, Nehring A 2010. How do private labels compete? *6th Thought Leaders International Conference in Brand Management* Lugano, Switzerland.

Dawes JG. 2016. Testing the robustness of brand partitions identified from purchase duplication analysis. *Journal of Marketing Management,* **32** (7): 695-715.

Day GS, Shocker AD, Srivastava RK. 1979. Customer-Oriented Approaches to Identifying Product-Markets. *Journal of Marketing,* **43** (4): 8-19.

Dekimpe MG, Hanssens DM. 1995. Empirical Generalizations About Market Evolution and Stationarity. *Marketing Science,* **14** (No. 3, Part 2): G109-G121.
Ehrenberg A. 1988. *Repeat-buying: Facts, theory and applications.* Oxford University Press: London.
Ehrenberg A. 1997. In Search of Holy Grails: Two Comments. *Journal of Advertising Research,* **37**: 9-12.
Ehrenberg A, Barnard NR, Sharp B. 2000. Decision models or descriptive models? *International Journal of Research in Marketing,* **17** (2-3): 147-158.
Ehrenberg A, Bound J 1999. Customer retention and switching in the car market. *Report 6 for Corporate Sponsors.* Adelaide: Ehrenberg-Bass Institute for Marketing Science.
Ehrenberg A, Goodhardt G. 1970. A model of multi-brand buying. *Journal of Marketing Research,* **7**: 77-84.
Ehrenberg A, Goodhardt G, Barwise TP. 1990. Double Jeopardy revisited. *Journal of Marketing,* **54** (3): 82-91.
Ehrenberg A, Pouilleau B. 1992. The Analysis of a Contingency Table: the Pattern of Car Switching. *Journal of Empirical Generalisations in Marketing Science,* **14**: 1-6.
Ehrenberg A, Uncles MD 1999. Understanding Dirichlet-type markets. *Report 1 for Corporate Sponsors.* Adelaide: Ehrenberg-Bass Institute for Marketing Science.
Ehrenberg ASC. 1959. The pattern of consumer purchases. *Applied Statistics,* **8** (1): 26-41.
Ehrenberg ASC, Uncles MD, Goodhardt GJ. 2004. Understanding brand performance measures: using dirichlet benchmarks. *Journal of Business Research,* **57** (12): 1307-1325.
Ellis K, Uncles M. 1991. How private labels affect consumer choice. *British Food Journal,* **93** (No. 9): 41-49.
Fader PS, Schmittlein DC. 1993. Excess behavioral loyalty for high-share brands: deviations from the Dirichlet model for repeat purchasing. *Journal of Marketing Research,* **30** (4): 478-493.
Fraser C, Bradford JW. 1983. Competitive Market Structure Analysis: Principal Partitioning of Revealed Substitutabilities. *Journal of Consumer Research,* **10**: 15-31.
Goodhardt G, Ehrenberg A. 1969a. Duplication of viewing between and within channels. *Journal of Marketing Research,* **6** (2): 169-178.
Goodhardt GJ. 1966. Constant in duplicated television viewing. *Nature,* **212** (5070): 1616.
Goodhardt GJ, Ehrenberg A, Chatfield C. 1984. The Dirichlet: A comprehensive model of buying behaviour. *Journal of the Royal Statistical Society,* **147** (5): 621-643.
Goodhardt GJ, Ehrenberg ASC. 1969b. Duplication of television viewing between and within channels. *Journal of Marketing Research,* **6** (2): 169-178.
Graham C, Bennett D, Franke K, Henfrey CL and Nagy-Hamada M. 2017. Double Jeopardy–50 years on. Reviving a forgotten tool that still predicts brand loyalty. *Australasian Marketing Journal (AMJ),* **25** (4): 278-287.
Graham CDA. 2009. What's the point of Marketing anyway? The prevalence, temporal extent and implications of long-term market share equilibrium. *Journal of Marketing Management,* **25** (9-10): 867-874.
Grand View Research 2020. Decaffeinated Coffee Market Size, Share & Trends Analysis Report By Product (Roasted, Raw), By Bean Species (Arabica, Robusta), By Distribution Channel, By Region, And Segment Forecasts, 2020-2027. San Francisco, CA: Grand View Research.
Habel C, Lockshin L. 2013. Realizing the value of extensive replication: A theoretically robust portrayal of double jeopardy. *Journal of Business Research,* **66** (9): 1448-1456.
Hammond K, Ehrenberg A, Goodhardt GJ. 1996. Market segmentation for competitive brands. *European Journal of Marketing,* **30** (12): 39-49.
Hand C, Singh J. 2014. Segmenting the betting market in England. *International Journal of Market Research,* **56** (1): 111-127.
Kantar. 2015. Kantar Worldpanel: Consumer panels. Available at http://www.kantarworldpanel.com/global/Consumer-Panels [Accessed].

Keng KA, Ehrenberg A. 1984. Patterns of store choice. *Journal of Marketing Research,* **21** (4): 399-409.
Keng KA, Uncles M, Ehrenberg A and Barnard N. 1998. Competitive brand-choice and store-choice among Japanese consumers. *Journal of Product & Brand Management,* **7** (6): 481 - 494.
Kennedy R, McColl B. 2012. Brand growth at Mars, Inc.: How the global marketer embraced Ehrenberg's science with creativity. *Journal of Advertising Research,* **52** (2): 270-276.
Kooyman C, Wright MJ. 2017. Double jeopardy benchmarks for political polls. *Australasian Marketing Journal*.
Lam D. 2006. Applicability of the Duplication of Purchase Law to Gaming. *UNLV Gaming Research & Review Journal,* **10** (2): 55-62.
Lam D, Ozorio B. 2013. Duplication of Purchase Law in the gaming entertainment industry—A transnational investigation. *International Journal of Hospitality Management,* **33**: 203-207.
Lee R, Rungie C, Wright M. 2011. Regularities in the consumption of a subscription service. *Journal of Product & Brand Management,* **20** (3): 182-189.
Lees G, Winchester M. 2014. Do customer profiles change over time? An investigation of the success of targeting consumers of Australia's top 10 banks–2009 and 2011. *Journal of Financial Services Marketing,* **19** (1): 4-16.
Lees G, Winchester M, De Silva S. 2016. Demographic product segmentation in financial services products in Australia and New Zealand. *Journal of Financial Services Marketing,* **21** (3): 240-250.
Lees G, Wright M. Year. Does the duplication of viewing law apply to radio listening? *In:* Proceedings of the Australian & New Zealand Marketing Academy Conference, 2009 Melbourne, Australia.
Lees G, Wright M. 2013. Does the duplication of viewing law apply to radio listening? *European Journal of Marketing,* **47** (3/4): 674-685.
Ma B, Zhang L, Li F and Wang G. 2010. The effects of product-harm crisis on brand performance. *International Journal of Market Research,* **52** (4): 443-458.
Mansfield A, Romaniuk J. Year. How do Tourism Destinations Compete? An Application of the Duplication of Purchase Law. *In:* EMAC, 2003 Glasgow. 1-6.
Mansfield A, Romaniuk J, Sharp B 2003. Competition Among International Tourist Destinations: Applying the Duplication of Purchase Law. *ANZMAC.* Adelaide.
McCabe J, Stern P, Dacko SG. 2012. The power of before and after: How the Dirichlet can analyze the sales impact of a promotional activity. *Journal of Advertising Research,* **52** (2).
McPhee WN. 1963. *Formal theories of mass behaviour.* The Free Press of Glencoe*:* New York.
Nenycz-Thiel M, Romaniuk J. 2014. The real difference between consumers' perceptions of private labels and national brands. *Journal of Consumer Behaviour,* **13** (4): 262-269.
Pare V, Dawes J. 2011. The persistence of excess brand loyalty over multiple years. *Marketing Letters,* **21** (2): 163-175.
Romaniuk J 2005. How do brands compete for consideration? a duplication analysis approach. *European Marketing Academy Conference.* Bocconi University, Italy.
Romaniuk J, Sharp B. 2016. *How brands grow: Part 2.* Oxford University Press*:* South Melbourne.
Rungie C, Goodhardt GJ. 2004. Calculation of theoretical brand performance measures from the Dirichlet model. *Marketing Bulletin,* **15**.
Scriven J, Bound J. Year. A Discussion of Dirichlet Deviations. *In:* Jim Wiley, ed. Australian & New Zealand Marketing Academy Conference, 2004 Wellington, New Zealand. School of Marketing and International Business, Victoria University of Wellington.
Scriven J, Bound J, Graham C. 2017. Making sense of common Dirichlet deviations. *Australasian Marketing Journal (AMJ),* **25** (4): 294-308.
Scriven J, Danenberg N 2010. Understanding How Brands Compete: A Guide to Duplication of Purchase Analysis. *Report 53 for Corporate Sponsors.* Adelaide: Ehrenberg-Bass Institute for Marketing Science.

Scriven J, Perez-Bustamante Yabar DC, Clemente M and Bennett D. 2014. The competitive landscape for leisure: Why wide appeal matters. *International Journal of Market Research,* **57** (2): 277-298.
Sharp A, Sharp B, Redford N 2003. Positioning & Partitioning- A replication & extension. *ANZMAC.* Adelaide.
Sharp B. 2010. How brands grow, in *How Brands Grow,* Byron Sharp (ed.) Oxford University Press*:* South Melbourne, Australia; 16-27.
Sharp B, Sharp A. 1997. Loyalty Programs and Their Impact on Repeat-Purchase Loyalty Patterns. *International Journal of Research in Marketing,* **14** (5): 473-486.
Sharp B, Wright M, Dawes J, Driesener C, Meyer-Waarden L, Stocchi L and Stern P. 2012. It's a Dirichlet world: Modeling individuals' loyalties reveals how brands compete, grow, and decline. *Journal of Advertising Research,* **52** (2): 203-213.
Singh J, Ehrenberg A, Goodhardt G. 2008. Measuring customer loyalty to product variants. *International Journal of Market Research,* **50** (4): 513-532.
Sjostrom T, Corsi AM, Driesener C and Chrysochou P. 2014. Are food brands that carry light claims different? *Journal of Brand Management,* **21** (4): 325-341.
Srivastava R, Leone RP, Shocker AD. 1981. Market Structure Analysis: Hierarchical Clustering of Products Based on Substitution-in-Use. *Journal of Marketing,* **45**: 38-48.
Stocchi L, Driesener C, Nenycz-Thiel M. 2015. Brand image and brand loyalty: Do they show the same deviations from a common underlying pattern? *Journal of Consumer Behaviour*.
Stocchi L, Pare V, Fuller R and Wright M. 2017. The Natural Monopoly effect in brand image associations. *Australasian Marketing Journal (AMJ),* **25**: 309-316.
Stocchi L, Wright M. Year. Temporal stability and aggregation bias in the NBD-dirichlet parameters. *In:* EMAC, 2010 Copenhagen.
Tanusondjaja A, Driesener C, Banelis M, Kennedy R and Lion S 2014. Duplication of Purchase Automation Software (DOPAS) v5.0. Adelaide: Ehrenberg-Bass Institute
Mars Inc.
Tanusondjaja A, Nenycz-Thiel M, Dawes J and Kennedy R. 2018. Portfolios: Patterns in brand penetration, market share, and hero product variants. *Journal of Retailing and Consumer Services,* **41**: 211-217.
Trinh G. 2014. Predicting variation in repertoire size with the NBD model. *Australasian Marketing Journal,* **22** (2): 111-116.
Trinh G, Anesbury Z, Driesener C. 2017. Has behavioural loyalty to online supermarkets declined? *Australasian Marketing Journal (AMJ),* **25** (4): 326-333.
Trinh GT, Anesbury ZW. 2015. An investigation of variation in brand growth and decline across categories. *International Journal of Market Research,* **57** (3): 347-356.
UCLA: Statistical Consulting Group. 2021. FAQ: What is the coefficient of variation? Available at https://stats.idre.ucla.edu/other/mult-pkg/faq/general/faq-what-is-the-coefficient-of-variation/ [Accessed on 29 June 2021].
Uncles, Kwok S. 2008. Generalizing patterns of store-type patronage: An analysis across major Chinese cities. *The International Review of Retail, Distribution and Consumer Research,* **18** (5): 473-493.
Uncles, Kwok S. 2009. Patterns of store patronage in urban China. *Journal of Business Research,* **62** (1): 68-81.
Uncles M, Hammond K. 1995. Grocery Store Patronage. *The International Review of Retail, Distribution & Consumer Research,* **5** (3): 287-302.
Uncles MD, Ehrenberg A, Hammond K. 1995. Patterns of buyer behavior: Regularities, models, and extensions. *Marketing Science,* **14** (3): G71-G78.
Uncles MD, Ellis K. 1989. The Buying of Own Labels. *European Journal of Marketing,* **23** (No. 3): 47-70.
Urban G, L, Johnson PL, Hauser JR. 1984. Testing Competitive Market Structures. *Marketing Science,* **3** (2): 83-112.

Vaughan KM. 2020. *Do brands that grow advertise differently to those that do not?* Doctor of Philosophy, University of South Australia.
Wilson AL, Nguyen C, Bogomolova S, Sharp B and Olds T. 2019. Analysing how physical activity competes: a cross-disciplinary application of the Duplication of Behaviour Law. *International Journal of Behavioral Nutrition and Physical Activity,* **16** (1): 1-13.
Wilson D, Winchester M. 2019. Extending the double jeopardy and duplication of purchase laws to the wine market. *International Journal of Wine Business Research,* **31** (2).
Wright M, Riebe E. 2010. Double jeopardy in brand defection. *European Journal of Marketing,* **44** (6): 860-873.
Wright M, Sharp A. 2001. The effect of a new brand entrant on a market. *Journal of Empirical Generalisations in Marketing Science,* **6**: 15-29.
Wright M, Sharp A, Sharp B. 1998. Are Australasian brands different? *Journal of Brand and Product Management,* **7** (6): 465-480.
Wright M, Sharp A, Sharp B. 2002. Market statistics for the dirichlet model: Using the juster scale to replace panel data. *International Journal of Research in Marketing,* **19** (1): 81 - 90.
Wrigley N, Dunn R. 1984a. Stochastic panel-data models of urban shopping behaviour: 3. The interaction of store choice and brand choice. *Environment and Planning A,* **16** (9): 1221-1236.
Wrigley N, Dunn R. 1984b. Stochastic Panel-Data Models of Urban Shopping Behaviour: 2. Multistore Purchasing Patterns and the Dirichlet Model. *Environment and Planning A,* **16**: 759-778.