

Testing the Robustness of Brand Partitions identified from Purchase Duplication

Analysis

Published in: Journal of Marketing Management 2016

John G. Dawes
Ehrenberg-Bass Institute for Marketing Science
University of South Australia
Adelaide, SA
Australia
E John.Dawes@marketingscience.info

Website <http://johndawes.info/>

Article Classification: Research paper

Keywords: Market structure, partitions, sub-brands.

Author Biography

John Dawes is an Associate Professor and Senior Researcher at the Ehrenberg-Bass Institute for Marketing Science. His research interests are in competitive market structure, brand performance metrics and the effects of price promotions on buyer behaviour.

Testing the Robustness of Brand Partitions identified from Purchase Duplication

Analysis

ABSTRACT

Purchase Duplication analysis examines the extent to which buyers of any brand A also buy other brands B, C, D, and so on. A generalized finding from its use is that brands share their buyers with other brands approximately in-line with the size of those other brands. The approach is widely used by analysts and managers. One important use of the method is to identify *partitions* – brands that share buyers at a higher than expected rate. Partitions may form among competitor brands, but also among ‘same name’ or sub-brands that share a parent name (e.g. Coke, Diet Coke). A Partition among same-name brands means they are cannibalizing each other. Whether one’s focus is on cannibalization within a portfolio, identifying close competitors, or to generally understand market structure, duplication analysis can provide insights. However, there are two potential confounds to its use: family buying, and buying multiple brands on the same occasion. This study tests if these two factors confound the use of purchase duplications, using data from twelve grocery categories. The principal finding is that the identification of partitions is robust to these confounds. The study also finds partitions among same-name brands are common. Likewise those same-brand-name partitions are not due to family buying or same-occasion multi-brand buying.

Keywords: Brand-switching, Purchase Duplication, Partitions, Cannibalization, Brand Portfolio.

Summary Statement of Contribution: The study shows that partitions identified from purchase duplication analysis are not artefacts of family buying or same-occasion multi-brand purchasing. It is also shown that partitions are prevalent among brands selling under a common range name.

INTRODUCTION

The extent to which buyers of any particular brand A in a category also buy competitor brands B, C, D etc. has been of recurring interest for decades (e.g., Frank, 1962, Ehrenberg, 1965). There are several phrases to describe the phenomena, namely: purchase duplication, brand cross-purchasing or brand switching. This study generally uses the term *purchase duplication*, and uses a specific method called ‘purchase duplication analysis’ to address a series of research questions. The word ‘duplication’ refers to the extent that buyers of A are duplicated, in other words also appear in the buyer base of other brands. A generalized empirical finding is that the proportion of A’s buyers who also buy B is highly predictable from the penetration of brand B and the overall amount of cross-purchasing in the category. The penetration of a brand is simply the proportion of households that buy it at least once in a period (Ehrenberg et al., 2004). This predictability of purchase duplication from brand penetration means there are ‘norms’ or expected levels of duplication between brands. Consequently, it is possible to identify whether the actual level of duplication between pairs or groups of brands is higher or lower than expected. Groups of brands with higher than expected levels of duplication are called ‘partitions’ (e.g. Carpenter and Lehmann, 1985) and are inferred as being highly substitutable and more sensitive to each other’s marketing activity. Partitions may therefore guide managers in understanding their brand’s competition. Purchase duplication analysis is widely used in industry, and has been the basis for many studies in the academic literature. In many cases the brands that form a partition are competitors, but many corporations now own several distinct brands in a product category; or sell sub-brands that share a parent brand name (e.g. Suave, Suave Naturals shampoo). Sub-brands with a common name may be susceptible to high rates of purchase duplication, because brand name familiarity is a strong purchase driver (e.g. Lane and Jacobson, 1995). Therefore, same-name brands may suffer from undue cannibalization (Lomax et al., 1996). Managers are likely to be interested in

identifying the extent of cannibalization among their own brands, and in whether their brand competes intensely with certain other brands. Purchase duplication analysis is a tool to investigate these issues, by identifying partitions among competing brands, or among one's own portfolio of brands. However, there are two possible confounds to its use. The first potential confound is buying different brands for family members with diverse tastes.

Observing that an undue number of brand A buyers tend to also buy brand C might not denote a strong competitive relationship between them, because A is bought for certain family members and C is bought for others. Therefore the two brands are not actually competing intensely. The second confound is that many grocery shopping occasions entail the purchase of multiple items in the same category (e.g. Walsh, 1995). It may be that a high rate of purchase duplication between brand A and C is because they are being bought together on the same shopping trip. If items are bought together then the purchase of one is not necessarily inhibiting the purchase of the other. Indeed, if two items tend to be purchased together it could be they have appeal as a pair. Therefore if sales increase for one of them the effect on the other may be beneficial, not detrimental.

This study tests whether these two phenomena, family buying and same-occasion multi-brand purchasing, do confound the identification of brand partitions. The study examines this question for competitive brands, as well as for brands sharing a common range name. The analysis uses ten panel datasets from the IRI academic database (Bronnenberg et al., 2008), supplemented with two UK datasets [provided to the author by Kantar](#) (www.kantarworldpanel). The study makes several contributions to literature on brand competition. First, it shows that partitions identified from purchase duplication analysis are generally robust to the possible confounds of family buying and same-occasion multi-brand purchasing. Second, it identifies that partitions do often form between same-name brands.

Third, the study outlines a simple method to extend the purchase duplication approach to yield richer insights into brand competition.

CONSUMER BRAND BUYING

In markets such as consumer packaged goods sold predominantly through supermarkets, it has long been known that buyers typically have a *repertoire* of brands they buy in a time period such as a year. This repertoire is usually fairly small, comprising 2 to 3 brands – far fewer than the total number of brands available. For example Banelis, Riebe and Rungie (2013) report an average 12-month repertoire of 2.0 and 2.4 brands using two extensive consumer goods databases. Repertoire size is contingent on the time period analyzed, is higher in frequently bought categories (Banelis et al., 2013), and is higher among frequently-purchasing households (Ehrenberg, 2000 Ch .9). If buyers buy from a repertoire, then the buyers of any brand A may buy one or several other brands B, C, D etc. in a time period. In other words, there is cross-purchasing or purchase duplication of these brands by consumers. Much academic and manager interest centers on understanding *which* of these other brands (in the same category) are bought. While any individual household's brand repertoire is idiosyncratic, a recurring question in the literature is the overall extent to which a focal brand A's buyers cross-purchase other brands. The reason is that cross-purchasing patterns can indicate the extent of substitutability between brands or products. Literature from this field is now reviewed.

LITERATURE REVIEW

Cross-Brand Purchasing and a Law-Like Pattern

Literature on the cross-purchasing of brands uses several terms that require definition. First, the term *purchase duplication* means that a particular household may be ‘duplicated’, that is, appear as a buyer of multiple brands in a time period. It is common to report the extent of this purchase duplication in the form “X percent of brand A’s buyers also bought brand B in a 52 week period”. Next, *brand switching* (e.g. Colombo and Morrison, 1989) is a closely related term meaning a buyer of brand A then buys say, brand B on their next purchase occasion. They are said to have ‘switched’ from A to B. The switch from A to B does not necessarily indicate a change in underlying preference for either brand; it simply reflects that consumers tend to switch around within a repertoire of brands over several purchases. Brand switching more explicitly considers the sequence of consumer purchases (*A then B* or *C*) while purchase duplication does not. In practice, for markets such as the ones considered here which exhibit reasonably stable market shares, whether the sequence is brand A then B or B then A is immaterial. This paper subsequently uses the terms purchase duplication or brand switching interchangeably. Pertinent literature using both methods is now discussed. The initial focus is on findings, the managerial implications are canvassed later.

Ehrenberg (2000) in the classic treatise on repeat-buying reported two empirical patterns in relation to purchase duplication. Firstly, the proportions of various other brand’s buyers buying a focal brand tend to be rather *similar* (e.g. if 50% of A buyers also bought C, then approximately 50% of brand B’s buyers would also buy C). Second, that the differences in the extent of cross-purchasing brands – that is, how many brand A buyers also bought B, C, D and so on was “largely attributable to the different penetration of each brand... (i.e. the percentage buying)” (Ehrenberg, 2000 p. 177-178). In simple terms, a large proportion of the

buyers of any particular brand will also buy large brands, and a small proportion will also buy small brands.

Ehrenberg's finding that brands share buyers with each other in-line with their penetration has been replicated and extended in many packaged goods markets and more widely. For example, Bass (1974) showed the extent of switching from soft drink brand A to other brands B, C, D etc. was overall in-line with the penetration of the other brand. Examples of broader findings are that supermarket shoppers cross-purchase other supermarkets in-line with the latter's penetration (Keng and Ehrenberg, 1984, Uncles and Ehrenberg, 1990a). Similar findings have been reported for, among other things, motor vehicles (Colombo et al., 2000), quick service restaurants & takeaway food (Bennett and Ehrenberg, 2001, Lynn, 2013), radio stations (Lees and Wright, 2012), TV channels and shows (Goodhardt and Ehrenberg, 1969, Ehrenberg and Goodhardt, 1969), sportswear (Dawes, 2009), tourism destinations (Dawes et al., 2009) and industrial purchasing, such as aviation fuel (Uncles and Ehrenberg, 1990b).

The predictable association between duplication (or switching) in line with brand penetration has been formalised as an algebraic expression called the Duplication of Purchase Law (DoP Law). The DoP Law is expressed as $b_{X,Y} = Db_X$ (Ehrenberg, 2000 p. 193). In this expression, $b_{X,Y}$ refers to the proportion of brand Y buyers who also buy X and is proportional to brand X's penetration b_X and also to D, the Duplication coefficient, which reflects the total amount of purchase duplication or switching that occurs in the product field.

An example of Purchase Duplication Analysis, with attendant calculations, is shown below as Table 1 for illustration. The data are from the pasta sauce category in the IRI academic dataset (Bronnenberg et al., 2008).

Table 1 Illustrative Duplication of Purchase Analysis (52 weeks) – Pasta Sauce, US

Brand	% buying at all (penetration)	Ragu	Prego	Rag O	Fran	Ragu C	Class	Bari	Delm
Ragu	32	-	41	44	40	47	19	17	21
Prego	30	43	-	36	40	29	21	20	18
Ragu Old World	30	47	37	-	36	30	14	15	17
Francesco	28	47	44	38	-	34	25	21	21
Ragu Chunky	21	72	42	42	45	-	21	18	21
Classico	17	37	37	25	40	26	-	30	14
Barilla	15	37	40	30	39	25	34	-	15
Delmonte	14	48	39	36	41	31	17	15	-
Average Duplication		47	40	36	40	32	21	20	18
		➔							
% buying at all (penetration)		32	30	30	28	21	17	15	14
Average Penetration	23								
Average Duplication	32								
Duplication coefficient *	1.4								
Estimated Duplication (1.4 x Penetration)		43	41	41	38	29	23	20	19

* Duplication coefficient calculated as average duplication (32) divided by average penetration (23)

Table 1 shows the top eight brands, which collectively have over 80% market share. Data covers 52 weeks in year 1 (2001) of the IRI data. The analysis is at the brand level, which comprises mainly brands sold under different names, but Ragu has three brands: Ragu, Ragu Chunky and Ragu Old World. It may be debatable whether these are brands sold under a range, or simply variants sold under a brand name. However, they are consistent with the definition of a sub-brand as a brand possessing a parent name along with an additional descriptive term (e.g., Aaker, 2004, Petromilli et al., 2002). Also, IRI lists these three items as brands, and each of them offers its own size and flavour variants.

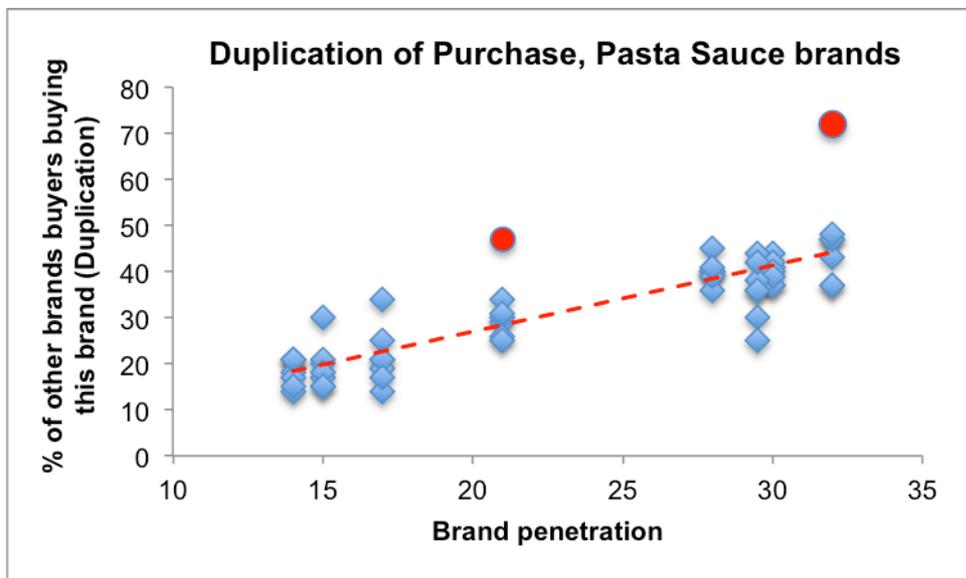
Key terms in the table are:

<i>Penetration</i>	The proportion of panel buyers who bought the brand at least once in the 52-week period.
<i>Duplication</i>	The proportion of one brand's buyers who buy another particular brand. Duplication can be averaged across brands.
<i>Duplication coefficient</i>	Average Duplication divided by average Penetration.

The brands are arranged in descending penetration order in both rows and columns. This arrangement makes the duplication of purchase law pattern easy to see. For example we see the largest brand is Ragu with 32% of households in the panel buying it at least once (i.e. 32% penetration). Looking across the 'Ragu' row, we see that of the Ragu buyers, 41% also bought Prego, 44% also bought Ragu Old World - down to 17% also buying Barilla and 21% buying Delmonte. Taking an average of the duplications in each brand column results in figures for Ragu of 47, down to 18 for the smallest brand, Delmonte. Looking across the row titled 'Average Duplication' from left to right it is quite apparent the levels of purchase duplication decline in line with the descending order of brand size, indicated in the '% buying at all (Penetration)' row. This pattern shows the data are well approximated by the Duplication of Purchase law.

Next, we can compute the duplication coefficient for these data, as average duplication/average penetration. This calculation gives a figure of 1.4 which indicates that on average, the purchase duplication, namely the % of any brand A's buyers who also buy B, is 1.4 times the penetration of B. The duplication coefficient therefore has a straightforward interpretation. The fitted estimates from this simple arithmetic model are shown in the bottom row of the table. The fit is good. The AAE, or Average Absolute Error between the fitted estimates and all duplications is 4.4 points. The correlation between the duplication figures and brand penetrations is $r=0.84$ and is graphed in Figure 1. The graph shows two observations with markedly high duplications as circles. These observations indicate a strong partition between two of the Ragu brands, which is discussed later.

Figure 1. Duplications among Pasta Sauce Brands



Exceptions to the General Pattern - Partitions

While the DoP law underlines the strong association between brand penetration and cross-brand buying, there are exceptions to the overall pattern. That is, some brands or product types have higher levels of cross-purchasing or duplication than would be expected given the DoP Law. Ehrenberg (2000) noted such an example between two unnamed brands but did not investigate it closely. Products or brands with unusually high duplication generally share a functional similarity. For example, in an analysis of switching among soft drinks, there were higher rates of switching within diet soft drinks than from diet to full-sugar soft drinks (Bass, 1974). Colombo, Ehrenberg and Sabavala (2000) showed higher switching rates within groups of high-priced and European car brands. Other examples are high rates of switching among menthol cigarette brands (Carter and Silverman, 2004), and among coffee brands with similar formulations (Grover and Srinivasan, 1987). In the pasta sauce example above, the partition is between same-name brands. The name generally given to a group of brands with high within-group and lower across-group duplication or switching is a *partition* (e.g. Kalwani and Morrison, 1977). The managerial inferences associated with DoP or brand-switching analysis, the DoP law, and the identification of partitions are now discussed.

INFERENCES FROM THE DUPLICATION METHOD

The purchase duplication method and DoP law, and associated methods such as brand-switching analysis, inform the manager or analyst simply as to the proportions of households who cross-buy certain brands or products. They do not state or make claim as to the meaning of the cross-brand buying that underlies them, nor what the inferences should be from it. However, users use the duplication (or switching) method under certain assumptions, and make inferences from the outcomes of the method. First, there is an underlying assumption

that the group of entities (brands, products) *compete against* each other (e.g., Cooper and Inoue, 1996, [Jeuland, 1979](#)). That is, the brands are contesting for a share of the purchases of consumers in the market; a purchase of brand A by a consumer means brands B, C, or D loses that purchase and its attendant revenue. Note that the purchase duplication approach makes no assumption about how consumers might *evaluate* brands, nor that longer-term propensities to buy are altered by any one purchase.

Next, cross-purchasing rates are used to infer which other brands the buyers of brand A purchase as substitutes for A. This assumption appears reasonable, because the analyzed entities are usually in the same product class or category, for example brands of cheese, deodorant, toothpaste or soft drinks. By definition, a product category comprises items that are functionally similar and fulfil similar needs, therefore those items are usually quite substitutable (Srivastava et al., 1981, Srivastava et al., 1984). If there is no ‘structure’ to a market, which would be manifest as brands sharing buyers closely in line with their penetration, the inference is that all brands are equally substitutable. That is not to say the brands are commodities with no differentiation, but rather they are all *as* differentiated – or substitutable – as each other, and so each brand competes equally against each other brand in the market. A normative implication of this scenario is that the brand’s performance should be evaluated against the entire market not just against brands sharing functional similarities (adapted from Rubinson, Vanhohacker and Bass 1980). Such an insight is not necessarily intuitive, as brand managers may use heuristics such as considering their key competitors as those brands with say, similar brand image or formulation, which could underestimate the extent or breadth of competition in their market.

Partitions

Next we consider the interpretation of groups of brands with higher than expected purchase duplication or switching within the group. The phrase ‘higher than expected’ means the group of brands have higher duplication than would be expected given (a) their respective penetrations, and (b) the overall level of purchase duplication in the market. This heightened level of within-group switching indicates the brands in the group are more highly substitutable with each other than they are with other brands. If brands in a partition are more highly substitutable with each other, it follows that they are more sensitive to each other’s marketing activity. That is, gains by one brand in the partition will come unduly from the other brands inside the partition and brands outside the partition will suffer less (e.g. Dawes and Nenycz-Thiel, 2013). Identifying partitions is therefore an important aspect of competitive analysis.

CHALLENGES, CONFOUNDS AND RESEARCH QUESTIONS

While there appear to be many advantages and applications of the purchase duplication/switching approach, there are two potential confounds to its successful use and interpretation.

Confound 1: Family Buying

First, unusually high levels of purchase duplication or brand switching may confound partitions - interpretable as brands contesting heavily for consumers - with the purchasing of different brands for the possibly varied tastes and needs of a family (Day et al., 1979). For example, a high-fibre cereal brand might be purchased for one household member who is health conscious while a high-sugar brand is purchased for young children. If this pattern

were repeated over many households one could falsely conclude that the high fibre and high sugar brands compete particularly intensely. The potential for such confounds has been raised in past work (e.g., Kahn et al., 1986, Kannan and Wright, 1991).

A solution to the potential confound of family buying is to analyze inter-purchase times (e.g., Fraser and Bradford, 1983). The basis of using inter-purchase times is that if brands are bought for different purposes, such as diverse family needs, their inter-purchase times should be independent, whereas brands bought as substitutes for each other will have correlated inter-purchase times. The inter-purchase time approach has much to commend it, however, applications of it report the outcomes are contingent on the nuances of the method (e.g. Grover and Rao, 1988). Also, Fraser & Bradford noted their approach suffers from potential ambiguity in interpretation due to the use of principal components analysis (1983, p. 28). By contrast, the duplication approach has a very straightforward interpretation. Also, the duplication approach is very widely used in industry (Europanel, 2015, Kantar, 2012) as well as academic research. Therefore, there is a good rationale to make a simple adaptation to it in order to address the question of family buying. The adaptation is to examine the purchasing of only single-person households. If partitions that appear in full-panel data tend to dissipate when only single-person households are examined, this suggests the partition is an artefact of family buying. If partitions still appear in such households, it would represent a validation of the presence of market partitions, and so managers could have more confidence in the results from duplication analysis. Evidence about this issue would be very useful for managers and researchers examining brand competition in packaged goods markets. However, no studies have addressed it. Therefore, the first research question is:

RQ1. Are partitions identified from all-household data still apparent when purchase duplication analysis is confined to only 1-person households?

Confound 2: buying multiple brands together

A second potential confound that could occur in the interpretation of purchase duplications is the extent to which certain brands in the same category are bought *together*. Several studies point to the incidence of multi-brand or multi-item purchasing at the same occasion (e.g., Dubé, 2004, Walsh, 1995). This phenomenon raises the question whether partitions might actually reflect same-occasion buying (Day et al., 1979) – for example, shoppers buying two different shampoo brands at the same time. If partitions reflect brands being bought *together*, it means a somewhat different interpretation for competitive structure. Consider the conventional interpretation of a partition: Brands A and B are substituted for each other over successive purchase occasions more than with other brands. Therefore, they likely share some important attribute, so when buyers desire that attribute they consider A and B and not other brands (Grover and Dillon, 1985). It follows that brands A and B contest heavily for customers, and if A wins more sales (i.e. it gains in penetration) it will be unduly at the expense of B and vice versa. However, if partitioned brands A and B tend to be bought *together*, the interpretation for competitive structure is different. First, it means these same-occasion purchases of A and B are bought by people who buy two items in the category together. Arguably, some buyers are buying A and B instead of two A or two B. Therefore, it could be posited that they still compete for a share of those shopper's category requirements. However, same-occasion buying of A and B implies buying A is not fully at the expense of B. Indeed, if there is a tendency to buy brand A and B together this implies there is some attraction or utility of those items *as a pair*. A sales gain by one of them might therefore not necessarily hurt the other, whereas the conventional interpretation of competitive interrelationships is that a gain by one competitor is likely to be at the expense of another (e.g., Cooper and Inoue, 1996). Therefore, relying on purchase duplications to infer competitive

relationships may have some limitations if the category exhibits appreciable same-occasion purchasing of multiple brands. As stated earlier, there is wide use of duplication or switching analysis in academia and industry, with managerial decisions being based on identified partitions. Therefore the question as to whether same-occasion brand purchasing poses a confound to this activity is worthwhile. Consequently, the next research question is:

RQ2. How much same-occasion multi-brand buying typically occurs in grocery categories?

If there *is* an appreciable amount of same-occasion multi-brand buying, the question turns to whether it may hinder the correct identification of market structure. A straightforward test of whether partitions are caused by same-occasion multi-brand buying is to compare the prevalence or strength of partitions seen in all-purchase data, to that seen when same-occasion purchasing is excluded from the analysis (that is, analyze only the first brand bought per occasion, in household's purchase histories). If partitions are quite similar when same-occasion is excluded, the manager or analyst will be more certain the partitions reflect competitive inter-relationships between brands. Therefore, RQ3 is:

RQ3. Are brand partitions still present if same-occasion brand purchasing is excluded?

Same-Name Brands

RQs 1 to 3 address issues about the interpretation of purchase duplication analysis. As mentioned earlier, the brands of interest in such analysis can be competitor brands. However, the brands of interest may also be those within one's own portfolio. Many corporations own multiple brands in a product category, or sell sub-brands that share a common name. For example, Coke and Diet Coke are arguably both brands in their own right. Other examples are Kemp's and Kemp's Smart Milk (www.kemps.com) Suave and Suave Naturals shampoo

(www.suave.com). For convenience these are referred to as same-name brands. Brand portfolio management literature (e.g., Hilleke and Butscher, 1997, Mason and Milne, 1994) emphasizes that it is desirable to minimize cannibalization by offering products or brands with different features to attract different buyer bases. And indeed, since partitions are often based on functional features (e.g., Kannan and Sanchez, 1994) then having a range of entities with functional differences should inhibit cannibalization from cross-purchasing. A related strategy by some corporations is to offer multiple brands with different names in a category, for example P&G offers Pantene, Head & Shoulders, Vidal Sasson, and Pert shampoos (www.PG.com) - presumably to cover heterogeneous market needs, and minimize cannibalization. Other corporations, as stated, offer same-name brands or sub-brands. Minimizing cannibalization from cross-purchasing may be difficult when one has sub-brands sold under the same name, even if they are functionally different. The reason is that brand name familiarity (Laroche et al., 1996) may make entities that share a common name attractive to the same group of buyers. Indeed, evidence shows line extensions tend to suffer from excessive cannibalization (Lomax and McWilliam, 2001). However, there is little in the way of norms or numerical expectations as to the extent of cross-purchasing for same-name brands compared to other brands in a category. Again, this issue is of practical importance to managers of multi-brand portfolios. Therefore,

RQ4. Are there higher rates of purchase duplication among same-name brands compared to other brands in a category?

If there *are* higher rates of cross-purchasing among brands sharing a common range name, two questions arise - are the rates partially due to those same-name brands being purchased together, and are they possibly due to family purchasing? These questions are addressed by

comparing brand partitions derived from entire category data to subsets (a) excluding same-occasion purchases, and (b) including only single-person households.

DATA AND ANALYSIS

The analysis uses several data sources in an effort to yield generalizable results. Data from ten US categories were sourced from the IRI academic datasets (Bronnenberg et al., 2008, IRI, 2013), complemented with two UK datasets (cat food, rice) provided by Kantar. The IRI datasets cover two US cities, but due to the fact many brands are not available in both, for nine of the ten US categories data from one city is used. Analysis of the tenth IRI category, toothpaste, uses both cities because all the same brands are present in both.

The categories are diverse, covering food and non-food products, as well as a range of category purchase frequency (i.e. 22 times per year for milk, to 3.1 for toothpaste) as summarized in Table 2. The twelve categories all had two or three leading brands sold under a common range name, excepting laundry detergent. That category was still analyzed to identify whether results for RQ 1-3 were the same as the other categories with same-name brands.

All households that met the IRI or Kantar standard for regular reporting were included. A group of the top brands comprising at least 75% market share in each market were used. The number of brands was not exactly the same in each category because in some cases, such as milk, purchase levels past the sixth-ranked brand became too small to properly analyze.

Note the IRI datasets cover purchases made in supermarket, drug store and mass-market retailer channels but do not cover convenience store purchases. The largest selling same-name brands were selected in each category to ensure there were adequate purchases to analyze same-name brand buying.

Table 2. Descriptive Statistics

Category	% of households buying category in 52 weeks	Average category purchase occasions per year	# brands examined	Brands sold under same range name*
Milk	99	22	6	Kemp's, Kemp's Smart Milk
Carbonated Beverages	97	15	10	Coke, Diet Coke
Frozen Pizza	90	5.6	10	Jack's Original, Jacks Natural; Roma, Roma Magic
Beer	87	4.1	14	Miller, Miller Lite, Miller Hi Life; Budweiser, Bud Lite
Yoghurt	85	8.3	9	Kemps, Kemps Natural
Toothpaste	81	3.1	9	Colgate, Colgate Total, Colgate Whitening Crest, Crest Whitening, Crest Pro-Namel
Deodorant	75	3.8	8	Secret, Secret Platinum
Rice	75	3.5	13	Uncle Bens, Uncle Ben's Express
Shampoo	73	4.3	8	Suave, Suave Naturals
Laundry Detergent	72	4.6	13	n/a
Pasta Sauce	68	5.8	8	Ragu, Ragu Chunky, Ragu Old World
Cat Food	67	12.2	16	Tesco, Tesco Finest; Gourmet Gold, Gourmet Solitaire

* Selected larger brands with adequate purchases for analysis.

Analysis Method

First, purchase duplication tables were constructed for each category. This initial construction used all purchasing data in each respective category - using all brands, all purchases, and all households. Duplication coefficients were then calculated for each category. Pairs or groups of brands with unusually high levels of duplication were identified as partitions. These tentatively identified partitions were tested to verify that they appeared again in the following year, and were tested for statistical significance at the $p=0.05$ level (one-tailed test)¹.

Purchase Duplication coefficients were then calculated for each category overall; and for any of the confirmed partitioned brands in each category. This procedure was then repeated for two subsets of the data – single-person households to address RQ1; and excluding same-occasion purchases, to address RQ3. For the latter, the method was to take out all purchases other than the first brand from the category purchased by the household, on the day. RQ2 was assessed by calculating the extent to which shoppers (all households) bought multiple items and multiple brands in the same category, on the same occasion. RQ4 was answered by examining whether same-name brands tended to form partitions.

¹ The partition for the Miller beer sub-brands was significant only at the $p=0.10$ level in any year but was present in the initial analysis and for the following three years.

RESULTS

RQ1: Partitions and family purchasing.

To address RQ1, we examine the purchase duplication coefficients for partitioned brands, derived from (a) all households and (b) only single-person households. The relevant figures to address RQ1 are in Table 3, columns 4 and 6. It is noteworthy that most of the partitions in Table 3 comprise same-name brands.

Table 3 shows that in all 12 categories, the partitions identified in all-household data (column 4) are also seen in single-household data (column 6). In two cases the partition is actually stronger among single person households than the whole sample. For example, the Duplication coefficient for Ragu and Ragu Chunky is 2.2², and among single person households it is higher at 2.7. In the Beer category, for Milwaukee and Old Milwaukee brands the coefficient for this pair among the whole sample is 4.0, among 1-person households it is 4.7. The same effect is apparent for one of the pairs of same-name Pizza brands, namely Roma/Roma Magic; and there is a slightly higher coefficient for the same-name Shampoo brands among the 1-person households. These results suggest that single-person households tend to have smaller repertoires overall (since they likely have smaller category requirements), but that they shuffle or switch around among brands sharing the same name to a comparatively larger extent than bigger households. It is intriguing that Milwaukee and Old Milwaukee form a partition, since they belong to different corporations. This may be an example of what could be called co-incidental brand name loyalty. In summary, there is

² There are three Ragu brands, but the partition is more apparent between Ragu and Ragu Chunky. When we calculate the duplication coefficient for the three Ragu brands (Ragu, Ragu Chunky, Ragu Old World) the result is 1.7; among 1-person households it is 1.4. Both these figures are higher than for the entire market (1.2 all households and 1.1 among 1-person households). Therefore the same-name partition holds when all three Ragu brands are used, and it holds among 1-person households.

positive support for RQ1 – partitions that appear in all-household data also appear in single-person data in every case analyzed, and so partitions are apparently not due to family buying.

Table 3. Comparing Purchase Duplication Coefficients

1	2	3	4	5	6	7	8
Duplication Coefficients for ...							
Category	<i>Partitioned brands</i>	All Brands, all purchases, all <u>Households</u>	Partitioned brands, all purchases, all <u>Households</u>	All Brands all purchases, 1-person <u>Households</u>	Partitioned brands all purchases, 1-person <u>Households</u>	All brands all <u>Households</u> , only consecutive occasion purchases	Partitioned brands all <u>Households</u> , only consecutive occasion purchases
Milk	MG, Kemp's Smart	1.1	1.3	1.0	1.3	1.1	1.4
<u>Carbonated Beverages</u>	Adirondack, Polar	1.1	1.4	1.2	1.4	1.1	1.4
Frozen Pizza	Roma, Roma Magic;	1.8	2.5	1.8	3.1	1.7	2.0
	Jack's Original, Jack's Natural	1.8	2.4	1.8	2.2	1.7	1.7
Beer	Old Milwaukee, Milwaukee*	1.4	4.0	1.3	4.7	0.9	2.9
	Miller, Miller Lite, Miller HL	1.4	1.5	1.3	1.6	0.9	1.0
Yoghurt	Kemp's, Kemp's Sugar Free	2.2	4.0	2.5	4.1	2.2	3.8
Toothpaste	Colgate, Colgate Whitening, Colgate Total.	1.3	1.9	1.2	1.5	1.2	1.6
	Crest, Crest Whitening, Crest Pro-namel	1.3	2.1	1.2	2.2	1.2	1.9
Deodorant	Secret, Secret Platinum	1.2	1.9	1.1	1.9	1.1	1.7
Rice	Uncle Ben's, Uncle Ben's Express	1.0	1.5	0.9	1.2	1.0	1.5
Shampoo	Suave, Suave Naturals	1.7	2.7	1.5	2.9	1.5	2.0
Laundry Detergent	Ajax, Xtra	1.6	2.8	1.5	2.8	1.5	2.9
Pasta Sauce	Ragu, Ragu Chunky	1.4	2.2	1.4	2.7	1.2	2.1
Cat Food (UK)	Gourmet Gold, Gourmet Solitaire	1.9	6.9	1.8	7.3	1.8	6.7
	Tesco, Tesco Finest	1.9	3.3	1.8	2.8	1.8	3.2
Average		1.5	2.7	1.4	2.7	1.3	2.4

* these two brands are owned by different corporations

RQ2: Same occasion buying.

Table 4 indicates the extent to which multiple brands are bought on a same shopping occasion in these twelve categories. Data showing the extent to which multiple *items* are purchased is also included to contextualize the results. The table is again ordered by category penetration to retain comparability with the earlier tables. It shows that a considerable proportion of grocery purchases comprise more than one item per category. Note that an ‘item’ is a discrete entity, for example one bottle of shampoo or a six-pack of soft drink cans is one item.

However, there is a far lower proportion of purchases comprising multiple brands bought together compared to items bought together – suggesting most multi-item purchasing is of the same brand. Note, ‘same brand’ here means brand, not range, so for example buying Coke and Diet Coke together would be counted as buying two brands.

Table 4. Proportions of shoppers buying multiple items & brands on a shopping occasion

Category	% Households buying category in 52 weeks	% of purchases that comprise multiple <i>items</i> from the category purchased together*	% of purchases that comprise multiple different <i>brands</i> from the category purchased together
Milk	99	40	7
Carbonated Beverages	97	33	17
Frozen Pizza	90	67	15
Beer	87	22	5
Yoghurt	85	44	6
Toothpaste	81	30	6
Deodorant	75	3	1
Rice	75	25	2
Shampoo	73	27	6
Laundry Detergent	72	19	2
Pasta Sauce	68	45	7
Cat Food	67	58	11
Average	81	34	8

* Figures do not include multi-item packs such as 6-packs of cat food or soft drink

The results in Table 4 show a reasonable extent of buying multiple brands on the same occasion. This suggests that partitions among same-name brands could be at least partly due to same-occasion buying, although it would seem less likely for deodorant or rice with low rates of such behavior. We now therefore examine RQ3 relating to partitions and same-occasion buying.

RQ3: Partitions and Same Occasion Buying

To address RQ3, we return to examine Table 3 that enables a direct comparison of the partitioned brand duplication coefficients when all purchases are analyzed (column 4), compared to when same-occasion purchases are excluded (column 8).

We see the partition duplication coefficients when same-occasion purchases are excluded are lower in 12 cases, the same in two, and slightly higher in two. Overall, the average duplication coefficient is 2.4 when same-occasion purchases are excluded (column 8), compared to 2.7 (column 4) when all occasions are considered, which is not a large difference. It appears that same-occasion buying does tend to inflate the purchase duplication coefficient, but not by very much. More importantly, the partitions that are apparent in all-occasion data are still very visible when same-occasions are excluded. For example, Kemp's and Kemp's Sugar Free Yoghurt form a clear partition with a duplication coefficient of 4.0 compared to the market overall figure of 2.2 (columns 3 and 4). When only consecutive purchasing occasions, made in different weeks, are included, the partition figure for those two brands is 3.8 compared to 2.2 for the market (columns 7 and 8). In all twelve categories, the partitions in all-occasion data are still seen in the data for which same occasion purchases are excluded (column 8). There is one exception, in the frozen pizza category. In that category there are two partitioned same-name brands, and for one of them, Jack's Original/Jack's Natural, the

partition is not apparent when we analyze only consecutive (i.e. excluding same-occasion) purchases. The overall conclusion is that partitions are generally not attributable to same-occasion buying. That said, the presence of one exception suggests that if one wishes to determine if certain brands are partitioned, particularly in categories where there is considerable same-occasion purchasing, it would be prudent to conduct the analysis using all purchases and a subset excluding same-occasion purchases.

RQ 4: Same-Name Cross-Purchasing

The focus now turns to RQ4, specifically regarding same-name brand purchase duplication. Table 3 shows the duplication coefficients for 52 weeks for each category overall, and also for any brands that form a partition. Laundry detergent is excluded from this comparison since it had no same-name brands. In nine of the eleven other categories, there is heightened purchase duplication, or cross-purchasing, among same-name brands such as Ragu and Ragu Chunky or Suave and Suave Naturals. In one case, beer, there is a same-name partition among competitor brands that share a common name (Milwaukee) but have different ownership. That partition is in addition to the one formed by the Miller sub-brands. In a few cases there was not a partition among same-name brands. There was no partition between Budweiser and Bud Lite; or Coke and Diet Coke, nor between Kemp's and Kemp's Smart Milk. Indeed, in the milk category the most apparent partition was formed by different brands, Kemp's Smart Milk and MG. A tentative explanation is that these brands have an added vitamin/low fat formulation. Lastly, there is a carbonated beverages partition between Adirondacks and Polar, both of which sell at approximately 30% less than other manufacturer brands, suggesting a low price partition. Overall, the answer to RQ4 is: yes, in most categories there are markedly higher levels of purchase duplication among brands that share a common name (either a parent brand, or in the beer case here, an incidental use of the same

name by competitors) - in nine of eleven categories. However, unusually high same-name purchase duplication is not universal. It did not appear at all in two of the eleven categories with same-name brands, namely Milk and Carbonated Beverages; and did not appear for one pair of beer sub-brands.

To conclude the analysis section, one other test was conducted to ascertain if common distribution might also confound the accurate identification of partitions. For example, if a retailer stocks one brand originating from a particular manufacturer, it is likely to stock another from that same manufacturer. If those brand items are available in one retailer and not another, they will naturally partition together, but the partition will be merely due to them being available together, and only in some stores (e.g., see Ellis and Uncles, 1991). This potential confound was checked by examining whether partitioned brands tended to be sold in some retail outlets and not others. The check showed that this was not a concern for the present study, with partitioned brands being available widely.

A summary of the research questions and results are summarized in Table 5.

Table 5 Summary of Research Questions and Results

RQ	Question	Finding
1	Are partitions from market-wide data still apparent when purchase duplication analysis is confined to 1-person households?	Yes. Same partitions still appear in analysis of single person households in all cases.
2	How much same-occasion multi-brand buying typically occurs in grocery categories?	Quite low overall, 8% over these 12 categories. But higher in two categories: 17% in Carbonated Beverages, 15% in Frozen Pizza.
3	Are brand partitions still present if same-occasion brand purchasing is excluded?	Yes. In 15 of 16 cases, brand partitions identified in all-market data were still evident when same-occasion brand purchasing is excluded.
4	Are there often higher rates of purchase duplication among same-name brands compared to other brands in the same market?	Yes. Brands sold under the same name showed high rates of purchase duplication in 9 of 11 categories, suggesting they do often cannibalize.

DISCUSSION, CONCLUSION, DIRECTIONS FOR FUTURE RESEARCH

The results offer support for the use of the purchase duplication method to discern competitive market structure and partitions. It does seem appropriate to infer that brands with higher than expected levels of purchase duplication are indeed competing against each other more intensely, for two reasons. First, partitions seen using data on purchases by all households are also seen when only 1-person households are included, in all twelve categories used here. This finding suggests partitions are not due to buying particular combinations of brands to cover heterogeneous family needs. Second, the same partitions that are seen in all-purchases analyses (*including* any same-occasion purchases of multiple brands) are consistently seen when we examine the data *excluding* those same-occasion purchases – with one exception, namely Jack’s Original and Jack’s Natural Pizza. This second finding suggests partitions are generally not due to buying certain brands at the same time. It follows that brand partitions afford a useful insight into competitive intensity between brands in a category. Therefore, managers should feel confident that the DoP approach can be used to identify groups of brands that compete heavily against each other. That said, for categories such as Frozen Pizza where there is considerable purchasing of multiple items, sub-brands or brands of the same category at a shopping occasion, an additional piece of analysis is recommended: run the duplication analysis on a subset of purchases that only include the first brand purchased on the shopping trip. This analysis will confirm if the partition is an artefact of households buying certain brands together.

The other major finding is that partitions are common among brands sold under a range or parent brand name, such as Kemp’s and Kemp’s Sugar Free Yoghurt; or Suave and Suave Naturals shampoo. This finding is not necessarily intuitive. While they share a common

name, these brands usually have an overt functional or formulation difference. At face value those differences suggest the brands should appeal to different buyer groups, but it appears they do not, with same-name partitions seen in 9 of 11 categories that had such brands to analyze. The implications for marketing managers in packaged goods categories are that it seems difficult or certainly uncommon for sub-brands to appeal to different buyer groups. Indeed, sub-brands or same-name brands share buyers to a greater extent than they should. Therefore, if a goal is to launch a new item to reach current non-buyers, while using an established range name can assist market acceptance, a shortcoming is the high likelihood of it partitioning and cannibalizing current brands with the same parent name. For retailers, the results imply they should closely scrutinize claims by brand manufacturers that a new sub-brand should be stocked because it will appeal to a new or different user group.

Next, the results may give some sense of the expected level of same-name partitioning to brand managers. The same-name brands that did form partitions had approximately 80% higher rates of duplication in this study. A brand manager with a suite of same-name brands who might potentially worry about a 50% higher rate of duplication between them could take some comfort from this finding, while a manager who notices a 100% higher rate of duplication could arguably consider it to be problematic and investigate further.

Future Work

The present study focused on whether partitions – among competitor brands or among a set of same-name brands – were robust to certain confounds. The findings suggest an opportunity for further work on same-name brands. More specifically, to examine how high levels of purchase duplications among same name brands are related to their loyalty metrics. If certain same-name brands - such as Suave and Suave Naturals, for example - tend to show

heightened cross-purchasing with each other, is there any beneficial effect on the loyalty metrics for the parent brand or range? The logic is as follows: suppose two sub-brands exhibit a higher than normal rate of duplication or cross-purchasing. If the brand or range comprising those sub-brands has higher than expected loyalty levels, it indicates the high cross-purchasing between the two brands may be *beneficial*, in the sense that the two sub-brands as a pair help keep a high share of their buyers' category purchasing. If the combined range does not have higher than expected loyalty, then one could infer that the two sub-brands are being excessively substituted for each other. In the latter case, the brand portfolio is inefficient. This future work can utilize the inbuilt links between purchase duplication and loyalty metrics (Ehrenberg, 2000, Ehrenberg et al., 2004) that are part of the NBD-Dirichlet model (Goodhardt et al., 1984). The NBD-Dirichlet is a stochastic model of purchase behaviour that takes parsimonious inputs (category penetration, purchase frequency, and brand market shares) and produces accurate estimates of brand penetration, loyalty and purchase duplication. The NBD-Dirichlet model could be used in future work on same-name brands to produce their expected level of purchase duplications and repeat-purchase loyalty, against which actual levels could be compared. This approach would give additional insight about the efficiency of sub-brand portfolios.

The other avenue for future work is to more fully examine why some same-name brands show a heightened extent of cross-purchasing, but others do not. It seems that there may be some functional differences that discourage or dampen such cross-brand purchasing. Briefly speculated on in the present study were price tier differences, and overt functional differences such as sugar / artificial sweetener in soft drinks (as per Bass, 1974). Future work could identify the extent to which these and other factors are linked to higher or lower levels of sub-brand cannibalization.

Several limitations of the study must be acknowledged. While the study used twelve categories, they were primarily from one US panel, with the remainder from the Kantar UK panel. Therefore the results are all based on data from developed western markets and are silent as to emerging markets. A considerable amount of work has been done to examine how regularities in brand and retailer metrics based on the work of Ehrenberg and colleagues (e.g. Chatfield et al., 1966, Goodhardt et al., 1984, Ehrenberg, 2000) generalize to emerging market economies (e.g. Keng et al., 1998, Uncles and Kwok, 2009, Uncles et al., 2010). The approach used in the present study, which borrows from that research tradition, could also be applied to non-western markets to again test the robustness of partitions identified from the duplication method, and to examine the extent to which same-name brands form partitions. Another limitation is that the study examined only one pair of Private Label (PL) sub brands, Tesco and Tesco Finest in the UK cat food category. The reason was that there were no large PLs with multiple sub-brands in the other categories analyzed. However, future work could seek data for which there are such PLs, because the question of cannibalization among sub-brands is likely to be of interest to retailers. Moreover, several studies have reported unusually high repeat-purchase loyalty for PLs (e.g. Bound and Ehrenberg, 1997, Uncles, 2011) and future work, as outlined above, could examine the potential link between this high loyalty and high rates of PL sub-brand purchase duplication.

Finally, the categories examined here covered food, beverage and personal care, but there are many more categories that could be examined. It would be very desirable to find more categories with several sets of same-name brands to test if partitions form among some, and not others. Also, it would be desirable to specifically examine soft drinks and beer in any future work, for these were categories in which the Coke and Budweiser brands did not form

partitions. This approach could be particularly useful to identify brand level factors linked to partitioning and cannibalization.

Appendix 1.

The statistical significance of partitions was assessed using the following procedure (based on approaches such as Stephenson et al., 2010). Suppose there are five brands, A, B, C, D, E, and the sample data suggest C and D are partitioned on the basis that the rate of cross-purchasing C & D is, for instance, 5 percentage points higher than it is for either A & D; B & D; and E & D. A one-tailed test is appropriate. 1,000 bootstrap resamples are run and the proportion of times the rate of cross-purchasing C & D is equal to or higher than observed for A & D, B & D, and E & D in the sample is noted. If the proportion of times the cross-purchasing of C & D is higher than those other brand combinations is $\geq 95\%$, the higher rate of cross-purchasing C & D is unlikely if there is no partition. In which case, the null hypothesis of no partition would be rejected and C & D are judged to be partitioned brands.

I thank SymphonyIRI and Kantar for making the data available. All estimates or analyses in this paper based on SymphonyIRI Group, Inc. and Kantar data are by the author and not SymphonyIRI Group, Inc. or Kantar.

References

- Aaker, DA (2004), "Leveraging the corporate brand", *California Management Review*, 46, 3, 6-18 <http://faculty.mu.edu.sa/public/uploads/1358445385.4558brand96.pdf>
- Banelis, M., Riebe, E. & Rungie, C. M. (2013), "Empirical evidence of repertoire size", *Australasian Marketing Journal*, 21, 1, 59-65 DOI [10.1016/j.ausmj.2012.11.001](https://doi.org/10.1016/j.ausmj.2012.11.001)
- Bass, Frank M. (1974), "The Theory of Stochastic Preference and Brand Switching", *Journal of Marketing Research*, 11, February, 1-20 <http://www.jstor.org/stable/3150989>
- Bennett, Dag & Ehrenberg, Andrew. (Year), "A Lot Can Be Revealed by a Little Data: Two Purchase Analysis of Fast Food Buying". In: CHETTY, S. & COLLINS, B., eds.) ANZMAC conference proceedings, 2001, Auckland, New Zealand, Massey University.
https://www.researchgate.net/publication/237811503_A_LOT_CAN_BE_REVEALED_BY_A_LITTLE_DATA_TWO_PURCHASE_ANALYSIS_OF_FAST_FOOD_BUYING
- Bound, John & Ehrenberg, Andrew (1997), "Private Label Purchasing", *Admap*, 32, 7, 17-19
- Bronnenberg, B. J., Kruger, M. W. & Mela, C. F. (2008), "The IRI marketing data set", *Marketing Science*, 27, 4, 745-48 . <http://dx.doi.org/10.1287/mksc.1080.0450>
- Carpenter, G. & Lehmann, D. (1985), "A Model of Marketing Mix, Brand Switching and Competition", *JMR*, 22, 318-29 <http://www.jstor.org/stable/3151428>
- Carter, John & Silverman, Fred (2004), "An empirical approach to market partitioning: Application to the cigarette market", *Journal of Targeting, Measurement and Analysis for Marketing*, 12, 4, 366-378 DOI [10.1057/palgrave.jt.5740123](https://doi.org/10.1057/palgrave.jt.5740123)
- Chatfield, C., Ehrenberg, Andrew & Goodhardt, Gerald (1966), "Progress on a simplified model of stationary purchasing behaviour", *The Journal of the Royal Statistical Society Series A (General)*, 129, Part 3, 317-367 DOI [10.2307/2343502](https://doi.org/10.2307/2343502)
- Colombo, Richard, Ehrenberg, Andrew & Sabavala, Darius (2000), "Diversity in analyzing brand-switching tables: The car challenge", *Canadian Journal of Marketing Research*, 19, 23-36 <http://www.empgens.com/ArticlesHome/styled-2/CarChallenge.html>
- Colombo, Richard & Morrison, Donald G (1989), "A Brand Switching Model With Implications for Marketing Strategies", *Marketing Science*, 8, 1, 89-99 <http://www.jstor.org/stable/184107>
- Cooper, Lee G. & Inoue, Akihiro (1996), "Building Market Structures From Consumer Preferences", *Journal of Marketing Research*, 33, August, 239-306 DOI [10.2307/3152126](https://doi.org/10.2307/3152126)
- Dawes, John (2009), "Brand loyalty in the UK sportswear market", *International Journal of Market Research*, 51, 4, 449-463 <http://dx.doi.org/10.2501/S1470785309200670>
- Dawes, John & Nenycz-Thiel, Magda (2013), "Analyzing the Intensity of Private Label Competition Across Retailers", *Journal of Business Research*, 66, 1, 60-66 DOI [10.1016/j.jbusres.2011.07.023](https://doi.org/10.1016/j.jbusres.2011.07.023)
- Dawes, John, Romaniuk, Jenni & Mansfield, Annabel (2009), "Generalized pattern in competition among tourism destinations", *International Journal of Culture, Tourism and Hospitality Research*, 3, 33-53. DOI: [10.1108/17506180910940333](https://doi.org/10.1108/17506180910940333)
- Day, George S., Shocker, Allan D. & Srivastava, Rajendra K. (1979), "Customer-Oriented Approaches to Identifying Product-Markets", *Journal of Marketing*, 43, Fall, 8-19 DOI [10.2307/1250266](https://doi.org/10.2307/1250266)

- Dubé, Jean-Pierre (2004), "Multiple discreteness and product differentiation: Demand for carbonated soft drinks", *Marketing Science*, 23, 1, 66-81
<http://www.jstor.org/stable/30036657>
- Ehrenberg, Andrew (1965), "An Appraisal of Markov Brand-Switching Models", *Journal of Marketing Research*, 2, November, 347-362 DOI [10.2307/3149481](https://doi.org/10.2307/3149481)
- Ehrenberg, Andrew (2000), "Repeat-Buying: facts, theory and applications", *Journal of Empirical Generalisations in Marketing Science*, 5, 392-770
<http://www.empgens.com/ArticlesHome/Articles.html>
- Ehrenberg, Andrew & Goodhardt, Gerald (1969), "Practical applications of the duplication of viewing law", *Journal of the Market Research Society*, 11, 1, 6-24
- Ehrenberg, Andrew, Uncles, Mark D & Goodhardt, Gerald G (2004), "Understanding brand performance measures: Using Dirichlet benchmarks", *Journal of Business Research*, 57, 12, 1307-1325 DOI [10.1016/j.jbusres.2002.11.001](https://doi.org/10.1016/j.jbusres.2002.11.001)
- Ellis, Katrina & Uncles, Mark (1991), "How private labels affect consumer choice", *British Food Journal*, 93, No. 9, 41-49 DOI [10.1108/00070709110007468](https://doi.org/10.1108/00070709110007468)
- Europanel, (2015), "Consumer insights" [Online], <http://www.europanel.com/consumer.php>,
- Frank, Ronald (1962), "Brand Choice as a Probability Process", *Journal of Business*, 35, 43-56 <http://www.jstor.org/stable/2351080>
- Fraser, Cynthia & Bradford, John W (1983), "Competitive Market Structure Analysis: Principal Partitioning of Revealed Substitutabilities", *Journal of Consumer Research*, 10, 15-31 <http://www.jstor.org/stable/2488853>
- Goodhardt, Gerald & Ehrenberg, Andrew (1969), "Duplication of television viewing between and within channels", *Journal of Marketing Research*, 6, May, 169-178 DOI [10.2307/3149668](https://doi.org/10.2307/3149668)
- Goodhardt, Gerald J, Ehrenberg, Andrew & Chatfield, Christopher (1984), "The Dirichlet: A comprehensive model of buying behaviour", *Journal of the Royal Statistical Society*, 147, 5, 621-655 DOI [10.2307/2981696](https://doi.org/10.2307/2981696)
- Grover, Rajiv & Dillon, William R (1985), "A Probabilistic Model for Testing Hypothesized Hierarchical Market Structures", *Marketing Science*, 4, 4
<http://www.jstor.org/stable/184059>
- Grover, Rajiv & Rao, Vithala (1988), "Inferring Competitive Market Structure Based on a Model of Interpurchase Intervals", *International Journal of Research in Marketing*, 5, 55-72 DOI [10.1016/0167-8116\(88\)90016-X](https://doi.org/10.1016/0167-8116(88)90016-X)
- Grover, Rajiv & Srinivasan, V. (1987), "A Simultaneous Approach to Market Segmentation and Market Structuring", *Journal of Marketing Research*, 24, May, 139-153 DOI [10.2307/3151504](https://doi.org/10.2307/3151504)
- Hilleke, Klaus & Butscher, Stephan (1997), "How to Use a Two-Product Strategy against Low-Price Competition", *Pricing Strategy & Practice*, 5, 3, 108-115 DOI [10.1108/09684909710171882](https://doi.org/10.1108/09684909710171882)
- IRI, (2013), "IRI academic data set" [Online], Online, IRI Worldwide,
<http://www.iriworldwide.com/solutions/Academic-Data-Set>,
- Jeuland, A. (1979), "The Interaction Effect of Preference and Availability on Brand Switching and Market Share", *Management Science*, 25, 10, 953-965.
<http://www.jstor.org/stable/2630757>
- Kahn, Barbara E., Kalwani, Manohar U. & Morrison, Donald G. (1986), "Measuring Variety-Seeking and Reinforcement Behaviors Using Panel Data", *Journal of Marketing Research*, 23, May, 89-100 DOI [10.2307/3151656](https://doi.org/10.2307/3151656)
- Kalwani, Manohar U & Morrison, Donald G (1977), "A Parsimonious Description of the Hendry System", *Management Science*, 23, 5, 467-477
<http://www.jstor.org/stable/2629980>

- Kannan, P. K & Sanchez, Susan M. (1994), "Competitive market structures: A subset selection analysis", *Management Science*, 40, 11, 1484-1499
<http://www.jstor.org/stable/2632932>
- Kannan, PK & Wright, Gordon P (1991), "Modeling and Testing Structured Markets: A Nested Logit Approach", *Marketing Science*, 10, 1, 58-82
<http://www.jstor.org/stable/183875>
- Kantar, (2012), "Kantar Shopcom Metrics"
http://www.kantarshopcom.com/assets/content/downloads/Kantar_Shopcom_Metrics_and_Measurement_Sourcebook_v_2.8.2012.pdf
- Keng, Kau Ah & Ehrenberg, Andrew (1984), "Patterns of store choice", *Journal of Marketing Research*, 21, November, 399-409 DOI [10.2307/3151466](https://doi.org/10.2307/3151466)
- Keng, Kau Ah, Uncles, Mark, Ehrenberg, Andrew & Barnard, Neil (1998), "Competitive brand-choice and store-choice among Japanese consumers", *Journal of Product & Brand Management*, 7, 6, 481 - 494 DOI [10.1108/10610429810244657](https://doi.org/10.1108/10610429810244657)
- Lane, Vicki & Jacobson, Robert (1995), "Stock Market Reactions to Brand Extension Announcements: The Effects of Brand Attitude and Familiarity", *Journal of Marketing*, 59, January, 63-77 DOI [10.2307/1252015](https://doi.org/10.2307/1252015)
- Laroche, Michel, Kim, Chankon & Zhou, Lianxi (1996), "Brand familiarity and confidence as determinants of purchase intention: an empirical test in a multiple brand context", *Journal of Business Research*, 37, 2, 115-120 DOI [10.1016/0148-2963\(96\)00056-2](https://doi.org/10.1016/0148-2963(96)00056-2)
- Lees, Gavin & Wright, Malcom (2012), "Does the Duplication of Viewing Law Apply to Radio Listening?", *European Journal of Marketing*, 47, 3/4, 674-685 DOI [10.1108/03090561311297535](https://doi.org/10.1108/03090561311297535)
- Lomax, Wendy, Hammond, Kathy, East, Robert & Clemente, Maria (1996), "The Measurement of Cannibalization", *Marketing Intelligence & Planning*, 14, No. 7, 20-28 DOI [10.1108/02634509610152673](https://doi.org/10.1108/02634509610152673)
- Lomax, Wendy & McWilliam, Gil (2001), "Consumer Response to Line Extensions: Trial and Cannibalisation Effects", *Journal of Marketing Management*, 17, 391-406 DOI [10.1362/0267257012652159](https://doi.org/10.1362/0267257012652159)
- Lynn, Michael (2013), "Lessons from Duplication of Purchase Data", *Cornell Hospitality Report*, 13, 3, 4-16
<http://scholarship.sha.cornell.edu/cgi/viewcontent.cgi?article=1091&context=chrpubs>
- Mason, Charlotte H & Milne, George R. (1994), "An Approach for Identifying Cannibalization within Product Line Extensions and Multi-Brand Strategies", *Journal of Business Research*, 31, 163-170 DOI [10.1016/0148-2963\(94\)90080-9](https://doi.org/10.1016/0148-2963(94)90080-9)
- Petromilli, Michael, Morrison, Dan & Million, Michael (2002), "Brand architecture: building brand portfolio value", *Strategy & leadership*, 30, 5, 22-28 DOI [10.1108/10878570210442524](https://doi.org/10.1108/10878570210442524)
- Rubinson, Joel R, Vanhonacker, Wilfried R & Bass, Frank M (1980), "On A Parsimonious Description of the Hendry System", *Management Science*, 26, 2, 215-226 DOI <http://www.jstor.org/stable/2629980>
- Srivastava, Rajendra, Leone, Robert P. & Shocker, Allan D. (1981), "Market Structure Analysis: Hierarchical Clustering of Products Based on Substitution-in-Use", *Journal of Marketing*, 45, 38-48 DOI [10.2307/1251540](https://doi.org/10.2307/1251540)
- Srivastava, Rajesh, Alpert, Mark I. & Shocker, Allan D. (1984), "A Customer-oriented Approach for Determining Market Structures", *Journal of Marketing*, 48, 32-45 DOI [10.2307/1251212](https://doi.org/10.2307/1251212)
- Stephenson, Robert W., Froelich, Amy G. & Duckworth, William M., (2010), "Using resampling to compare two proportions", *Teaching Statistics*. Iowa State University. DOI [10.1111/j.1467-9639.2009.00379.x](https://doi.org/10.1111/j.1467-9639.2009.00379.x)

- Uncles, M D & Ehrenberg, Andrew (1990a), "The Buying of Packaged Goods at US Retail Chains", *Journal of Retailing*, 66, 3, 278-296
<http://search.proquest.com/docview/228616978?pq-origsite=gscholar>
- Uncles, M.D. & Kwok, S (2009), "Patterns of store patronage in urban China", *Journal of Business Research*, 62, 1, 68-81 DOI [10.1016/j.jbusres.2008.01.002](https://doi.org/10.1016/j.jbusres.2008.01.002)
- Uncles, M.D., Wang, C & Kwok, S (2010), "A temporal analysis of behavioural brand loyalty among urban Chinese consumers", *Journal of Marketing Management*, 26, 9/10, 921-942 DOI [10.1080/02672570903441454](https://doi.org/10.1080/02672570903441454)
- Uncles, Mark (2011), "Understanding brand performance measures", Uncles, M. D. (ed.) *Perspectives on Brand Management*, 1st ed, Tilde University Press, Melbourne, Australia,
- Uncles, Mark D. & Ehrenberg, Andrew (1990b), "Industrial Buying Behavior: Aviation Fuel Contracts", *International Journal of Research in Marketing*, 7, 1, 56-68 DOI [10.1016/0167-8116\(90\)90033-J](https://doi.org/10.1016/0167-8116(90)90033-J)
- Walsh, John W. (1995), "Flexibility in consumer purchasing for uncertain future tastes", *Marketing Science*, 14, 2, 148-165 <http://www.jstor.org/stable/184197>