CHAPTER 9

THE MULTI-BRAND STRUCTURE OF A MARKET

An Empirical Example

To put the repeat-buying results discussed so far into a wider context, we consider in this part of the book certain aspects of brand-switching or – to use a more neutral term – multi-brand buying. Our knowledge of multi-brand buying is far less developed than that of repeat-buying. The empirical results available are far more recent. There is as yet little underlying theory, and so far there are few *published* practical applications (but see also Chapter 13).

In this chapter, we can give one general practical application of the known results, namely in helping to understand the basic structure of any given market from the multi-brand point of view. The chapter complements the analyses of repeat-buying and penetration growth which were given in Chapter 3 for the same product-field and the analyses are based on the same standardised type of market report [Aske Research 1970]. This has been used for the analysis of some two dozen different product-fields covering items such as various food, drink and confectionery items, cigarettes, toiletries, household cleaners, and petrol and motor oil.

In this chapter various aspects of the interrelationships between the five leading brands and the total product-class in question are set out in 10 tables or groups of tables, together with commentary. The crucial feature of many of the tables here is not that there are explicit theoretical norms (as provided by the NBD theory for example in the repeat-buying analyses in Chapter 3), but that enough is known to be able to present patterns which are *simple* (*e.g.* tabulations where the figures in any one column tend all to be very much the same, i.e. approximately "constant"). This allows one readily to see basic regularities in the data, together with any exceptions.

A more general discussion of the type of results illustrated in this chapter is given in Chapter 10, and some ways in which these multi-brand results integrate with and explain the *repeat-buying* theory given in earlier parts are set out in Chapters 11 and 13.

Table 9.1 Brand-Shares Amongst Light and Heavy Buyers

In Table 9.1 we start to relate buying of a brand to buying of the product-group in total. The table examines the market-shares of Brands

A to E amongst light (or infrequent), medium, and heavy (or frequent) buyers of the product-field as a whole – using the definitions of buying less than once a month (i.e. up to 12 times in the year), up to about twice a month (13-25 times), and more than 25 times which were already used in Table 3.3 in Chapter 3.

The top section of the table firstly shows that "light" buyers are about 50% of all buyers, and that they account for about 20% of all purchases, and that about 20% or so "heavy" buyers account for 50% of sales, a fairly typical kind of breakdown in other product-fields also.

Secondly, the table shows that frequency of buying the product-group does not markedly segment the market for the different brands: the market-shares of Brands A to E among light, medium, or heavy users of the product show only small differences. It is *not* a case of the brand-leader, for example, appealing markedly more to heavy buyers, or vice-versa.

Table 9.1. Brand-Shares Among Light, Medium and Heavy Buyers

Brand-Shares in terms of PURCHASE OCCASIONS, Among Households buying the Product-Field 1–12, 13–25, or 26+ times in the Year

	Buyers of Product-Field			
	ALL	Light	Medium	Heavy
Total Product				
All Buyers	100%	55	25	21
All Purchases	100%	18	28	54
	%	%	%	%
Brand A	50	47	54	49
Brand B	13	12	13	13
Brand C	7	6	5	8
Brand D	5	6	7	4
Brand E		7	6	7
Non-itemised Brands	18	22	15	19

Table 9.2 Total Product Usage

In Table 9.2 we examine the average rates of total product-usage (i.e. the average number of purchases of *any* brand) for the buyers of each brand in each given length time-period from 1 to 48 weeks.

In the 48-week period for example, those households who bought Brand A (62% of the sample – see Table 3. la in Chapter 3) bought the

product-class 17 times on average, whilst buyers of Brand B bought the product 20 times, and so on*.

For each time-period these figures vary relatively little from brand to brand. Brand A is slightly different, in attracting fractionally more of the lighter buyers of the product-class (as is also just noticeable in Table 9.1), but the dominant feature of the results here is their stability. This also occurs in other product-fields (see Chapter 10).

Table 9.2. Total Product Usage

The Average Number of Purchases of the PRODUCT per Buyer of the Specified Brand, in Periods of Various Lengths

	Periods of length (in weeks):				
	1	4	12	24	48
Brand A	1.2	2.5	6	10	17
Brand B	1.3	3.0	7	12	21
Brand C	1.4	3.4	8	13	23
Brand D	1.3	3.8	6	12	20
Brand E	1.4	2.6	6	12	22
Average	1.3	3.1	7	12	21

Table 9.3 Buying Other Brands

Table 9.3 shows how often buyers of each particular brand also buy *other* brands in the same time-period. The figures are obtained by subtracting the buyers' average frequency of buying the *brand* (Table 3.2a in Chapter 3) from their average frequency of buying the *product* (the preceding Table 9.2). This illustrates how various kinds of results combine to provide a fuller picture of the market.

Taking Brand E as an example, the earlier tables showed how buyers of this brand in the 48-week period bought the product-group on average 22 times during the year, and the brand itself 7 times. This leaves on average 15 purchases of other brands per buyer of Brand E, as is now shown in Table 9.3. The pattern is much the same as for the other brands, except Brand A. Here the average yearly buyer makes only

* This average rate of purchasing the total product by all the buyers of any one particular brand is not the same as the rate at which *all* buyers of the product-class buy the product. (The latter is shown in the "Any Brand" line of Table 3.2a and tends to be marginally lower, because of brand duplication.)

about 7 purchases of other brands, a substantially lower degree of brand-switching. This is a brand-leader effect which tends to show up when the leading brand achieves a particularly high penetration (Brand A is exceptionally dominant, accounting for as much as 50% of total product-class sales — see Table 9.1).

Table 9.3. Buying Other Brands

The Average Number of Purchases of OTHER Brands per Buyer of the Specified Brand, in Periods of Various Lengths

	Periods of length (in weeks):				
	1	4	12	24	48
Brand A	.2	I	2	4	7
Brand B	.3	1.5	4	9	16
Brand C	.4	1.7	5	9	18
Brand D	.3	2.3	4	9	16
Brand E	.4	1.0	3	7	15
Average	.3	1.5	4	8	15

Table 9.3a provides an overall summary of the various rates of buying for the average or typical brand. Such a simple summary is possible just because each buying rate shows little variation from brand to brand, or at least, little variation compared with the other differences apparent in the table. In periods longer than a month or so, buyers of a particular brand tend to buy other brands more often than they buy the brand itself. This is particularly marked in the 48-week period — an average of 15 purchases of other brands and 7 of the given brand. Except perhaps in rather short periods, it is therefore generally wrong to think of buyers of one's brand as being people who buy only, or even just mainly, that brand.

This finding is common to many (but not all) other product-fields in periods of a half year or a year. Thus the result for 10 fields covered recently is 7 purchases of the brand per average buyer of the typical brand and 20 purchases of *other* brands, making a total of 27 purchases of the product.

A less common finding here is that in a l-week period, buyers of any given brand buy other brands .3 times on average. Although numerically small, this is in fact an unusually *high* value for a l-week

period. (In most other product-fields, buyers of one brand virtually never buy another brand in the same week.) This finding is further discussed in the comments on Table 9.9.

Table 9.3a. Brand versus Product Usage

Comparing the Average Rates of Buying the GIVEN Brand, OTHER Brands, and the PRODUCT, per Buyer of the Given Brand

(Average across Brands A to E)

The Average no. of purchases of	Period of length (in weeks): 1	4	12	24	48	Averages from:
the GIVEN brand	1.0	1.6	3	4	6	Table 3.2a
OTHER brands	.3	1.5	4	8	15	Table 9.3
the PRODUCT	1.3	3.1	7	12	21	Table 9.2

Table 9.4 The Incidence of Sole Buyers

Not *all* buyers of a given brand also buy other brands in any given analysis-period. There are certain highly "loyal" buyers who buy only the single brand in a given time-period. Table 9.4 shows the proportion of such "sole" buyers of each brand.

Thus, 85% of those who bought Brand A in a typical week bought *only* Brand A during that time. (Looked at the other way, 15% of buyers of Brand A in a period as short as a week also bought some other brand.) In 48 weeks, the longest period tabulated, the proportion of sole buyers of Brand A drops to 29%, so that few buyers of the brand remain buyers of *only* that brand.

The results for the other brands B to E are all lower but broadly similar to each other. Indeed, the incidence of sole buyers mostly varies only little for these brands. (The proportion depends on the market-share and on the time-period – see §§ 10.4 and 10.7, Chapter 10.') As a rough summary we can therefore note that about 70% of the buyers of a brand in a week are sole buyers of it, about 30% in a quarter, and about 10% in the year.

Table 9.4. The Incidence of Sole Buyers

The Percentage of Buyers of a Brand who ONLY Buy that Brand in a given Period, for Periods of Various Lengths

	Periods of length (in weeks):				
	1	4	12	24	48
Brand A	85	68	51	41	29
Brand B	71	36	16	10	5
Brand C	66	37	21	13	5
Brand D	71	49	26	15	8
Brand E	67	49	29	18	12
Average	72	48	29	19	12

Table 9.5 The Buying-Frequency of Sole Buyers

The sole buyers of a brand could come entirely from very light buyers of the product-field. The implication would be that their sole-buying habit is not a reflection of intense brand-loyalty but lack of opportunity – i.e. they do not buy the product often enough to switch brands. (In the extreme case, someone buying the product only once would necessarily be a sole buyer of the chosen brand.)

In practice, sole buyers are usually ***not*** especially light buyers of their chosen brand. Table 9.5 shows that the average frequency of buying by sole buyers of each brand in the present product-field is in fact fairly high, especially in the longer periods.

These buying rates can be compared with those in Table 3.2a for *all* buyers of each brand. This is done in summary form in Table 9.5a and shows that the buying frequency of sole buyers (averaging 7 purchases in a year) closely resembles that of all buyers of the brand (averaging 6 purchases). This near-equality is itself unusual – in most product-fields sole buyers tend to be somewhat heavier buyers of a brand than its average buyer (as mentioned in § 10.7 of Chapter 10).

The sole buyer of a brand tends however to be a relatively light buyer of the product-group as a whole, compared with the multi-brand buyer of the brand (i.e. those of its buyers who do also buy other brands). Thus Table 9.5a shows how in the year for example, the average buyer of a brand buys it 6 times and buys the ***product*** 2 1 times, whereas the average sole buyer of the brand buys it – and hence also the product – only about 7 times.

Table 9.5. The Buying-Frequency of Sole Buyers

The Average Frequency of Purchase for Households who buy only the Stated Brand, in Periods of Various Lengths

	Periods of length (in weeks):				
	1	4	12	24	48*
Brand A	1.0	1.8	3.7	6	10
Brand B	1.0	1.6	2.1	3	5
Brand C	1.0	1.7	3.5	5	11
Brand D	1.0	1.6	3.4	5	7
Brand E	1.0	1.5	2.9	3	4
Average	1.0	1.6	3.1	4	7

* Small sample-bases.

Table 9.5a. All Buyers versus Sole Buyers

Comparing the buying frequencies of sole buyers of a brand of all buyers

(Average across the itemised brands)

The average no. of purchases per buyer of the brand	Periods of length (in weeks): 1	4	12	24	48	Averages from:
— of the PRODUCT	1.3	3.1	7	12	21	Table 9.2
— of the BRAND	1.0	1.6	3	4	6	Table 3.2a
per SOLE buyer	1.0	1.6	3	4	7	Table 9.5

These results show that relatively few heavier buyers of this product remain loyal to one brand. Instead, heavy product-usage goes together with the purchasing of more than one brand. This is a point capable of further study, and suggests that heavy consumers in this market may have a need for variety. Whilst in other product-fields the general pattern is the same, the numerical values and the marketing conclusions are often rather different.

Table 9.6 The Number of Brands Bought

In Table 9.6 we move on to summarise how many brands people bought. The table shows how many buyers bought 1, 2, 3, or 4 or more of the itemised brands in the year. Thus 33% of all buyers bought only

one brand (the sum total of all the "sole" buyers of each separate brand), 27% bought 2 brands, and so on.

The table also gives a breakdown by frequency of purchasing of the product-group, with "heavy" buyers buying 3.6 brands on average in the year, and "light" buyers 1.9.

Table 9.6a gives the corresponding averages for the shorter time-periods. The average number of brands bought increases as we move from light buyers up the scale to heavy buyers. This is the typical finding in most product-fields so far, but not a great deal is yet known about the shape and nature of the distributions in these tables.

In the following tables we examine multi-brand buying in more detail, brand by brand.

Table 9.6. The Number of Brands Bought

The Percentages of Buyers of the Product-Field who buy1, 2, 3, etc. in the Year

Number of brands bought in 48 weeks	Buyers of Product-Field*			
	ALL	Light	Medium	Heavy
	%	%	%	%
1	33	46	21	14
2	27	29	24	22
3	16	13	19	21
4+	24	12	36	43
Average	2.5	1.9	3.0	3.6

Table 9.6a. The Average Number of Brands Bought in Periods of Various Lengths

The average number of brands bought	Buyers of Product-Field*			
	ALL	Light	Medium	Heavy
in 48 weeks	2.5	1.9	3.0	3.6
in 12 weeks	1.7	1.3	1.7	2.3
in 4 weeks	1.4	1.1	1.3	1.7
in 11 weeks	1.1	1.0	1.0	1.2

* Light Buyers : 1-12 purchases in the year (55%).
Medium Buyers: 13-25 purchases in the year (25%).
Heavy Buyers : 26+ purchases in the year (21%).

Table 9.7 Brand-Duplication of Purchase in a Year

Table 9.7 gives the basic results concerning the competitiveness of specific brands. It shows what percentage of the buyers of Brand A, say, also bought each of the other brands in the 48-week period. Thus 41% of the buyers of Brand A also bought Brand B, 20% bought Brand C and so on. (The diagonal element of the table should consist of 100% in each cell – buyers of Brand A also buying Brand A – but these figures are omitted here so as not to obscure the numerical pattern.)

This form of presentation effectively makes allowance for the different penetration levels in the market and makes it easy to see particularly high or low duplications between pairs of brands. The table is best understood by reading down each column. Thus, Brand A is bought by 79% of the buyers of Brand B, by 73% of buyers of Brand C, and so on – all the figures being close to the column average of 74%. On the other hand, Brand E is bought by roughly 15% of the buyers of each of the other brands. And so on. The *main* impression gained is one of stability of the figures within each column, a feature which has also been found to be true in other markets.

In general then, Brand A does not overlap any more or less with Brand B than with other brands like C, D or E. Where exceptions occur – some real segmentation or clustering – they stand out clearly. In the present instance, only one exceptionally high brand-duplication pattern emerges, namely between Brands B and C: the figures of 64% and 33% in the Brands B and C columns stand out from the general run of the other figures (round about 40% and 20% respectively). Thus Brand B is rather more likely to be bought by buyers of Brand C (64%) than by buyers of any of the other brands; and correspondingly, Brand C is relatively more likely to be bought by buyers of Brand B (33%). This clustering of Brands B and C could be due to some special product-feature which they have in common, or it could be a house-name effect due either to supply (i.e. similar patterns of retail distribution) or to demand (i.e. segmented consumer acceptance). The analysis so far has shown that an exceptional pattern exists, and further analysis can then show what factors are involved. Apart from this clustering of Brands B and C, there is little or no special segmentation in this market, but more complex groupings of items can occur in some other product-fields, as is illustrated in § 10.5 of Chapter 10.

A second basic result is given in Table 9.7a. This concerns the large and systematic differences between the columns of Table 9.7. These differences are largely attributable to the different penetration of each

brand in the population as a whole (i.e. the percentage buying). Thus, the first row of Table 9.7a reproduces the average duplication row from Table 9.7, and the last row gives the penetration figures from Table 3. la in Chapter 3. A simple calculation is given in the middle row, where each penetration figure is multiplied by a certain coefficient "*D*", here 1.3. This produces figures very close to the actual average duplication for each brand*.

The D-coefficient has a simple and distinct meaning. Consider two particular brands. With $D = 1.3$, we can then say that the buyer of one brand in this market is about 1.3 times as likely (or 30% *more* likely) to buy the other brand as is the average member of the population at large. And this applies generally to *any* pair of brands.

The fit in Table 9.7a between the predicted and observed duplication percentages is generally close. The largest discrepancy is for Brand A, where the theoretical value is 7 percentage points too high. This discrepancy is of a common type, in that for brands with high penetration levels the model generally over-estimates the duplication – a general failure in the mathematical model as such and not a matter of direct marketing significance.

Table 9.7. Brand-Duplication of Purchase in 48 Weeks

The Percentage of Buyers of a Brand in the Year who also Buy Another Brand in the same Period

48 WEEKS	Who also Bought				
	A	B	C	D	E
Buyers of					
Brand A = 100%		41	20	17	14
Brand B = 100%	79	–	33	18	12
Brand C = 10%	73	64	–	21	16
Brand D = 10%	74	40	24	–	17
Brand E = 10%	70	33	22	20	–
Average 100%	74	45	25	19	15

* Individual values of ***D*** can be calculated by dividing a brand's penetration into its duplication with any other brand (or with the ***average*** other brand, as in the first row). If the D-values do not differ greatly from brand to brand they can be averaged and the model gives a good fit, as in the present case. (A simpler and more robust way of calculating ***D*** is from the ratio of the ***average*** penetration to the ***average*** duplication, as given in the last column of Table 9.7a and discussed further in § 10.5. See also Appendix C).

Table **9.7a.** Predicting the **48-Week** Duplication from the Penetration

(D = 35.6/27.4 = 1.3)

48 WEEKS	Brand					Averages
	A	B	C	D	E	
Av. **Dupl.** (Table 9.7)	74	45	25	19	15	35.6
1.3 X Penetration	81	42	22	**18**	16	35.8
Penetration (Table **3.1a)**	62	32	17	14	12	27.4

Table 9.8 Brand-Duplication in a Quarter

Tables 9.8 and 9.8a present the corresponding duplication figures for a 12-week quarter. This allows us to compare the quarterly and yearly duplication levels, a form of comparison which is carried further in Table 9.9.

Table 9.8. Brand-Duplication in 12 Weeks

The Percentage of Buyers of a Brand in a Quarter who also Buy Another Brand in the Same Period

(A Typical Quarter)

12 WEEKS	Who also Bought					
	A	B	C	D	E	
Buyers of						
Brand A = 100%	–	25	9	7	7	
Brand B = 100%	64	–	17	6	7	
Brand C = 100%	50	36	–	10	6	
Brand D = 100%	51	16	12	–	11	
Brand E = 100%	45	16	7	10	–	
Average 100%	53	23	11	8	8	

Table **9.8a.** Predicting the **12-Week** Duplication from the Penetration

(D = 20.6/15.8 = 1.3)

12WEEKS	Brand					Average
	A	B	C	D	E	
Av. Dupl. (Table 9.8)	53	23	11	8	8	20.6
1.3 X Penetration	55	22	9	8	9	20.6
Penetration (Table 3. la)	42	17	7	6	7	15.8

Table 9.9 Brand-Duplication over Time

Table 9.9 summarises the duplication patterns for various time-periods from 48 weeks down to 1 week.

The table documents firstly the extent to which the observed duplications are predictable from the penetration in each period, the fit being generally very close (other than the theoretical over-statement for Brand A already noted in Table 9.7).

Table 9.9. Brand-Duplication over Time

Predicting the Duplication by "D X Penetration" in Typical Periods of Various Lengths

		% Buyers of another Brand who Also Bought					
	D	A	B	C	D	E	Av.
48 WEEKS							
Av. Duplication		74	45	25	19	15	36
1.3 X Penetration	1.3	81	42	22	**18**	16	35
24 WEEKS							
Av. Duplication		70	44	26	15	10	33
1.5 X Penetration	1.5	82	38	18	**17**	13	34
12 WEEKS							
Av. Duplication		53	23	11	8	8	21
1.3 X Penetration	1.3	55	22	9	8	9	21
4 WEEKS							
Av. Duplication		38	15	7	4	5	14
1.5 X Penetration	1.5	42	14	6	4	6	14
1 WEEK							
Av. Duplication		16	4	5	2	2	6
1.4 X Penetration	1.4	17	6	7	3	3	7

The table secondly sets out the values of the duplication-ratios for each time-period. These D-statistics vary little in the present case, all lying between about 1.3 and 1.5 – an average of 1.4 or so. This allows us to draw conclusions about the extent to which brands in this market are competitive or complementary.

The striking result is in fact that there is so little trend in the *D*-values with decreasing time-period. Even in a period as short as one week, the average buyer of one brand is about 40% more likely to buy another brand than is the average housewife. In most other product-fields, purchase of one brand generally *inhibits* another purchase for a certain time, there generally being a "dead-period" between one purchase and another (whether of the same brand or of another brand). This shows itself by D-values which in the shorter time-periods are lower than in longer ones, and which for periods as short as a week are generally less than 1, implying that one purchase of one brand definitely inhibits purchase of another brand.

This lack of such a trend in D-values may indicate how the different brands in the present product-field are complementary rather than substitutes. In a single week, buyers of a brand buy it only about once (see Tables 3.2a and 3.3 in Chapter 3 and Table 9.3a in this Chapter), but are 40% more likely than the population as a whole to buy each given other brand as well. Duplication occurs even in short periods because the buyer uses two brands for somewhat different purposes or on different types of usage occasion. This deliberate multi-brand buying here ties in with the relatively low buying frequency of sole buyers noted in Tables 9.5 earlier and the relatively high frequency of purchases of "other brands" in short periods like a week in Tables 9.3 and 9.3a.

Table 9.10 The Buying-Frequency of Duplicated Buyers

In Table 9.10 we examine how *often* the duplicated buyers of two brands buy each brand. For example, buyers of Brand A who also bought Brand B in the 48-week period on average bought Brand A about 11 times in the year and Brand B about 5 times.

The columns of the table show very little variation and are well summarised by their averages. Thus buyers of both Brand A and any particular other brand bought Brand A about 10 or 11 times (irrespective of which other brand they also bought), the duplicated buyers of Brand B bought it about 5 times, and so on.

These simple averages for the duplicated buyers are compared with the rates for *all* buyers of each brand in Table 9.10a. The two sets of figures agree closely. This is a somewhat unusual finding. In other product-fields the duplicated buyers of a brand generally show a *lower* purchase frequency for the brand than that exhibited by all buyers of the brand (although the difference is not large – see also § 10.6). The

present results tie in with the relatively low rate of product-usage by sole buyers in Table 9.5 and the complementary nature of brands implied by the lack of a trend in the D-values in Table 9.9. There is therefore no special tendency for duplicated buyers to be substituting one brand for another. Instead, duplicated buyers here are relatively heavy buyers who show a need for variety in buying different brands, each at its average rate.

Table 9.10. The Buying-Frequency of Duplicated Buyers in 48 Weeks

The Average Number of Purchases of a Brand by Households who Also Buy the Stated Other Brand in the same Period

48 WEEKS	The Average Number of Purchase& of				
	A	B	C	D	E
By households who also bought					
Brand A	(10)	5	4	4	7
Brand B	11	(5)	5	3	6
Brand C	11	5	(5)	4	5
Brand D	10	5	5	(4)	8
Brand E	11	5	6	5	(7)
Average	11	5	5	4	7

Table 9.10a. Comparing the Buying-Frequency of Duplicated Buyers and of All Buyers of a Brand

(Average across brands)

48 WEEKS	The Average Number of Purchases of					Average
	A	B	C	D	E	
– by Dupl. Buyers (Table 9.10)	11	5	5	4	7	6
– by ALL Buyers (Table 3.2a)	10	5	5	4	7	6

Summary and Conclusions

In the preceding tables of this chapter and in Chapter 3, some major dimensions of buyer behaviour in the market in question have been mapped out. Examples are

- the similarity of the buying rates for different brands in Chapter 3, and the overriding role of penetration in determining market-share,
- the simple dependence of brand duplication-of-purchase on the penetration of each brand in Tables 9.7 to 9.9,
- the perhaps complementary rather than the competitive nature of the different brands in this particular market,
- the slight clustering of brands B and C,
- the tendency of buyers of any given brand to buy *other* brands far more often than the given brand itself, summarised in Table 9.3a,
- the relatively regular incidence of 100%loyal or "sole" buyers in Table 9.4,
- the normality of repeat-buying and penetration growth (other than for seasonal reasons) shown in Chapter 3,
- the unusually intense but short-lived enthusiasm of "new" buyers there.

Over and above all such detailed findings, the analysis has brought out that the patterns of buyer behaviour are mostly regular and simple.

The main characteristic of the findings is that of being welldigested. Whilst they make extensive use of the rich information available in continuous buying records, they tend to be well-structured and predictable. These qualities emerge because the results follow from a range of analyses which have already been used and tested many times.

Further analysis may often be desirable – by no means everything is covered in the preceding tables. For example, there has been no analysis of brand-switching from one time-period to another. (This would however be difficult to interpret without the *within-period* duplication analyses already described in Table 9.7 to 9.10 – it would be difficult to judge whether a finding that 30% of buyers of Brand A in one quarter bought Brand B in the next quarter is high or low, good or bad, without knowing that 25% of them had already bought Brand B in the *initial* quarter.)

The aspects of multi-brand buying behaviour which have been illustrated in this chapter are discussed in more general terms in the next chapter, and related to repeat-buying theory and the problem of practical applications in Part VI.

CHAPTER 10

MULTI-BRAND BUYING THEORY

10.1. Three Questions about Multi-brand Buying

The NBD/LSD repeat-buying theory discussed in the earlier parts of this book deals with any one brand (or other item) in isolation. Essentially the theory tells us that all the various aspects of repeat-buying behaviour for the brand can be predicted from one or two basic parameters, such as its penetration b and the average purchase frequency per buyer w in some given analysis-period.

Three quite different theoretical questions now arise, concerning the purchasing of *more* than one brand in any given analysis-period:

Firstly, are there any general relationships between the repeat-buying parameters of Brand X, say, and the corresponding parameters of *another* Brand Y?

Secondly, to what extent and in what ways do buyers of Brand X also buy Brand Y (and the other brands in the product-class), i.e. what general relationships about brand-switching are there?

Thirdly, what insights do answers to the first two questions throw on buyer behaviour in general, and on the theory of repeat-buying in particular?

Following the numerical illustration of multi-brand buying patterns in the previous chapter, we briefly outline in the present chapter the current state of knowledge in respect of the first two questions. Some answers to the third question will be given in Part VI.

In analysing multi-brand buying, there are two main considerations. Firstly, we consider certain kinds of *penetration* figures, such as how many of the buyers of a given brand buy only that brand, and how many also buy each specific other brand. Secondly, we consider certain *rates of buying,* such as how often such "duplicated" buyers of two brands buy each brand, how often *all* buyers of a brand also buy *other* brands, and so on. The point is that these two kinds of variables can be considered separately and still yield simple results.

In §§ 10.2 – 10.4 we consider how often the average buyer of a brand or pack-size buys that item, and how often he buys the product-class as a whole, in terms of how these rates of buying vary from one brand to another. This provides certain *total* measures of brand-switching. In §§ 10.5 and 10.6 we examine the more detailed pattern

of duplication of purchase for individual pairs of brands. The incidence of 1 OO%-loyal or "sole" buyers of a brand is discussed in § 10.7. The way these various measures of multi-brand buying vary with the length of the analysis-period is considered in § 10.8.

10.2. Brand Rates of Buying

We have seen in the NBD/LSD theory that the repeat-buying patterns of a given brand depend largely on the average frequency w with which its buyers in a given analysis-period buy it. To interrelate the repeat-buying levels for different brands we therefore consider how the value of w varies from brand to brand.

The main finding is that in a relatively short time-period the values of w for the different brands are almost equal, whilst the differences in a longer period tend still to be small compared to the brands' differences in sales, penetration levels, or market-shares. This is illustrated in Table 10.1 which reproduces the observed findings in Table 3.2a of Chapter 3. In a period of say 12 weeks, the average rates of purchasing for the different brands are almost all equal, at about 3 purchases per buyer. And although in the 48-week period the result for Brand A, 10 , is more than twice the lowest figure, 4 for Brand D, this is much smaller that the almost *ten-fold* difference in market-shares.

Next, such between-brand differences in w as do occur, whether *fairly* large or small, tend to have a systematic form. Thus the average rate of buying is generally somewhat smaller for a brand with a smaller market-share than for one with a larger share. This trend is noticeable in the example of Table 10.1 *. It is very general across different product-fields* *.

Quantitatively, w_X varies with the penetration b_X of the brand or rather with $1/(1-b_X)$, in that it is generally found to a close approximation that in any given time-period

$$w_X(1-b_X) = w_Y(1-b_Y) = w. ,$$

where w. is a constant for the product-field. The fit of this relationship for the data in Table 10.1 has already been illustrated in the commentary on Table 3.2 in Chapter 3. Table 10.2 gives other published examples for five different product-fields. The contrast in the trend in the

* Brand E is an exception, as discussed in connection with Table 3.2 in Chapter 3.

** This also fits in with the more general law of "double jeopardy" [McPhee 1963, Shuchman 1968, Ehrenberg et al 1987].

Table 10.1. The Frequency of Buying per Buyer in Different Length **Time-Periods**

(Observed rates from Table **3.2a)**

	Market-share (Annual) %	Periods of Length (in weeks) 1	**4**	12	24	48
Brand A	46	1.0	1.8	3.7	6.0	10
Brand B	12	1.0	1.5	2.5	3.3	5
Brand C	6	1.0	1.7	2.8	3.9	5
Brand D	5	1.0	1.5	2.5	3.1	4
Brand E	6	1.0	1.6	3.0	4.9	7
Average	15	1.0	1.6	2.9	4.2	6

average values of w_x from 6 for the brand-leaders to 3 for the 5th ranking brands should be compared with the near-constancy of the expressions w($1-b$).

The multiplier $(1-b)$ has the property that in short time-periods it does not greatly differentiate between brands (since b is then generally small and $(1-b)$ close to unity), whereas in longer periods $(1-b)$ can vary markedly from brand to brand. This fits the facts. (The more theoretical background to this finding will be discussed in § 11.5.)

Table 10.2. The Near-Constancy of $w(1-b)$ in a Half-Year Period

(The five leading brands in each of five product-fields 1 to **V)**

24 Weeks	Product-field **I**	II	**III**	IV	V	Average $w(1-b)$	Average **w**
Brands*							
1st	4.8	4.4	3.2	3.3	2.3	3.6	6
2nd	3.4	3.1	3.7	2.6	2.5	3.1	5
3rd	4.0	4.0	3.3	3.4	2.5	3.4	5
4th	4.3	4.3	2.7	2.1	1.9	3.1	4
5th	4.6	3.8	3.7	3.4	2.0	3.5	3
Average	**4.2**	**3.9**	**3.3**	3.0	2.2	3.3	5

* In order of market-share in each product-field.

As a broad approximation, we therefore have that in relatively short time-periods the average frequency w at which a brand is purchased by its buyers is more or less constant from brand to brand. This result is very simple and hence very useful in leading to *other* findings. It provides a very straightforward link between the repeat-buying patterns of different brands (since these largely turn on the value of w), and it also has an immediate consequence in sales analysis. Thus it implies that of the two basic parameters b_X and w_X for Brand X, it is the penetration b_X and not the average purchasing rate which primarily determines the sales-level of the brand, which in terms of purchases is $b_X w_X$. If Brand X sells five times as much as Brand Y, this is because Brand X has almost 5 times as many buyers in a given period, rather than that buyers of X buy it all that much more often than buyers of Brand Y buy Y. This cross-sectional result appears to place a major constraint on the way in which the sales of a brand can be increased, and so is very pertinent to marketing and promotional strategies.

10.3. Pack-Size Rates of Buying

The approximate law that $w(1-b)$ is a constant applies not only to each different brand in a product-field but also to any constituent pack-size.

Thus suppose that w_x is the average frequency with which the 'small' pack-size x of Brand X is bought by buyers of that pack-size of X, and that w_y is the corresponding rate of buying the small pack-size y of Brand Y. Then the relationship

$$w_x(1-b_x) = w_y(1-b_y) = \text{constant}$$

holds empirically. The same form of relationship tends to hold for any larger pack-size of the different brands.

The penetration for a pack-size of a brand is generally a good deal lower than the penetration for the whole brand and the factors $(1-b)$ tend therefore to be closer to 1 for pack-sizes than for brands as a whole, and so is the ratio $(1-b_x)/(1-b_y)$. The average frequency of buying a particular *pack-size* tends therefore to be more nearly constant across different brands – i.e. $w_x \doteqdot w_y$ – than for rates of buying the *brands*.

A further and quite separate finding is that the average frequency with which buyers of the small pack-size of a brand buy it turns out to

be numerically very close to the average frequency with which buyers of a larger pack-size of the brand buy *that* – especially after allowing for different penetration levels *b* in terms of the factors (1-b). Table 10.3 briefly illustrates this extremely simple empirical result in terms of the straight rates w for the leading brands, across the same five product-fields as were shown in Table 10.2 for brands as a whole.

Table I0.3. Half-Yearly Frequency of Buying a Pack-Size of a Brand per Half-Yearly Buyer of the Pack-Size of the Brand

(Average across the five leading brands in the same five product-fields I to V as in Table 10.2)

	Product-field					
	I	II	III	IV	V	Average
Buyers of:						
Small pack of a brand	4.8	4.2	3.2	2.4	2.4	3.4
Large pack of a brand	3.8	4.1	4.4	3.1	2.0	3.5

10.4. Product Rates of Buying

The fact that the average rates of buying an item, that is a brand or pack-size, do not differ greatly from one brand or pack-size to another might be readily explained by two suppositions, namely

(i) that the buyers of any particular item satisfy most or all of their demand for the product-class by buying that particular item, and

(ii) that buyers of the different items do not differ from each other in their average needs for the product as a whole.

The second supposition is borne out in practice, but only when analysed in terms of purchase *frequency**. This is summarised in Table 10.4 for the same range of five product-fields as shown in Tables 10.2 and 10.3. Thus in Table 10.4, the average rate of buying the product is about 15 purchases per half-yearly buyer of a brand irrespective of whether we are dealing with buyers of the leading brand in the product-field, of the second largest brand, or whatever. Furthermore, buyers of the *large* pack-size of a brand buy the product-class as a whole as often as do buyers of the *small* pack-size.

* This is not so when analysing expenditure, or amounts bought in weight units or the like.

Table 10.4. Half-Yearly Frequency of Buying the PRODUCT per Half-Yearly Buyer of a Brand or Pack-Size of the Brand

(Average across five product-fields with brands in decreasing order of market-share, as in Table 10.2)

	Average frequency of buying the product by buyers of		
	the brand at all	the large pack	the small pack
Brands			
1st	15	16	16
2nd	15	15	15
3rd	15	16	17
4th	15	16	16
5th	16	16	17
Average	15	16	16

The first assumption – that buyers of a particular brand or pack-size satisfy their *product* needs with that item – is however not supported by the facts. Thus for the five product-classes illustrated in Tables 10.2 and 10.3, the average half-yearly buyer of any brand bought it something like 5 times (the overall average in the bottom right-hand corner of Table 10.2), and the average half-yearly buyer of a particular *pack-size* of a brand bought it about 3.5 times (Table 10.3). But the corresponding overall average rates of buying the *product* per buyer of each brand or pack-size are as high as about 15 or 16, as is summarised by the figures in Table 10.4. Except in relatively short time-periods (see for example Table 9.3 in Chapter 9 and also § 10.7 below), buyers of any particular brand therefore buy *other* brands far more often than they buy the brand itself.

In principle there is therefore no reason – in terms of their total product-need – why buyers of a brand should not buy more of it. But they do not do so, and different brands find it virtually impossible to break through this constraint (i.e. they tend to have similar brand rates w, all much lower than the rates of buying the *product).*

A possible explanation of this apparent paradox could be conceptual: what are usually regarded as "buyers of one's brand" – i.e. people who have bought it at all in a given time-period – are perhaps mostly heavy buyers of some other brand or brands, who *occasionally* also buy your brand.

10.5. Brand-Duplication of Purchase

The excess of the product rate of buying over the brand (or pack-size) rates of buying is a measure of the *total* extent to which buyers of one brand also buy other brands (or sizes), i.e. a total measure of brand-switching or disloyalty. (This is illustrated explicitly in Table 9.3 in Chapter 9.) We now turn to this overlap with other brands in more detail, brand by brand.

For any two Brands X and Y, we consider firstly how many people buy each at least once in the analysis-period (and on what factors this depends) and secondly (in § 10.6) how *often* on average they buy each brand. This analytic approach is taken because it produces simple and generalisable results.

If b_{XY} stands for the proportion of the population who buy both Brand X and Brand Y in a given time-period, then we have the empirical result that b_{XY} depends primarily on the penetrations b_X and b_Y of each brand in the period. Thus

$$b_{XY} = D b_X b_Y ,$$

where D is a number which is the same for all pairs of brands in the product-field in the given period (as long as the different brands are broadly similar in product-formulation and marketing background). The parameter D can be thought of as the average of the ratios $b_{XY}/b_X b_Y$ across all pairs of brands, but is usually best calculated by $D = \Sigma b_{XY} / \Sigma b_X b_Y$ (i.e. the simple ratio of the *averages* of b_{XY} and of $b_X b_Y$ across all pairs of brands).

This brand-duplication law has been found to hold for a wide range of different product-fields and for different lengths of time-period. Its degree of fit is illustrated by the residual deviations in Table 10.5 which are generally quite small (the average size, ignoring sign, is about 1 percentage point). The only sizeable exception is that the observed duplication between Brands B and C is rather high (11% of the population buying both, against a predicted 7%) *.

An alternative formulation of the duplication of purchase law is as

$$b_{XY}/b_Y = b_{X.Y} = D b_X .$$

* The observed duplications of Brand A with any of the other brands are generally below the predicted values but this is not of marketing significance – it reflects a *general* tendency for the mathematical model to give too high a prediction for brands with high penetrations, i.e. a failing in the model itself. (See also Chapter 13).

Table 10.5. **The Observed Duplications b_{XY} and the Theoretical Predictions Db_Xb_Y**

(The Five Leading Brands A to E of the Product Analysed in Table 9.7 in Chapter 9)

48 WEEKS	Brands: X / Y	A B	A C	B C	A D	A E	B D	B E	C D	C E	D E	Average
Observed	$(b_{XY})^*$	25	12	11	10	8	6	4	3	3	2	8.4
Theoretical	$(1.3b_Xb_Y)^*$	**26**	**14**	**7**	**11**	**10**	**6**	**5**	**3**	**3**	**2**	**8.7**
Deviations	$(b_{XY}-1.3b_Xb_Y)^*$	- 1	*- 2*	*4*	- 1	*- 2*	*0*	- 1	0	0	0	−.3

* All penetrations expressed as percentages (i.e. multiplied by 100).

This has the advantage of showing the structure of this aspect of buyer behaviour in a particularly clear form *. This form of presentation was adopted in Chapter 9, and Tables 10.6 and 10.7 reproduce the earlier Tables 9.7 and 9.7a, for comparison with the same data as shown in the b_{XY} form in Table 10.5. The data have two separate features.

Firstly, Table 10.6 shows how the popularity of any Brand X amongst buyers of any other Brand Y or Z does not depend on *which* other brand – Y or Z – one is considering. Thus the figures in each column tend to be more or less constant, i.e. $b_{X.Y} = b_{X.Z}$. Any exception (such as the special clustering of Brands B and C) stands out very clearly to the naked eye. Secondly, Table 10.7 shows how each brand's duplication levels tend to be directly proportional to, or predictable from, the brand's penetration in the population as a whole, i.e.

$$b_{X.Y} = Db_X$$

The fit is generally good (with the tendency for the theoretical model to overstate somewhat the duplication for brands such as A with high penetration being the main exception, as already noted above with Table 10.5).

10.6. Brand-Duplication of Purchase in 48 Weeks

The Percentage of Buyers of a Brand in the Year who also Bought Another Brand in the same Period

48 WEEKS	Who also Bought				
	A	B	C	D	E
Buyers of					
Brand A = 100%	–	41	20	17	14
Brand B = 100%	79	–	33	18	12
Brand C = 100%	73	64	–	21	16
Brand D = 10%	74	40	24	–	17
Brand E = 100%	70	33	22	20	–
Average 100%	74	45	25	19	15

* The $b_{XY} = Db_X b_Y$ formulation itself has two advantages, namely its symmetry and its homoscedasticity (i.e. that the numerical size of the discrepancies $(b_{XY} - Db_X b_Y)$ tends to vary relatively little with the numerical levels of b_X and b_Y).

This form of presenting the data is particularly simple for many practical purposes, and shows especially clearly how the tendency for buyers of one brand also to buy another brand depends not on the brands as such but only on their penetrations b_X and b_Y.

Table 10.7. Predicting the 48-Week Duplication from the Penetration

(D = 35.6/27.4 = 1.3)

48 WEEKS	Brand A	B	C	D	E	Average
Av. Duplkation	74	45	25	19	15	35.6
1.3 Penetration	81	42	22	18	16	35.8
Penetration (Table 3.1a)	62	32	17	14	12	27.4
(Dupl. – 1.3 Penetration)	- 7	3	3	1	- 1	– .1

Sometimes additional factors (such as the clustering of Brands B and C above) loom larger and the product-field is somewhat "segmented", although the penetrations of each brand invariably account for the largest part of the observed variation. A recent example is shown in Table 10.8 for 8 brands. The duplication-coefficient *D* calculated for all the data is about 2.3. It clearly leads to a good fit to the average duplication levels, as shown by the two penultimate rows of the table. However, there is considerable variation of the individual duplication figures $b_{X.Y}, b_{X.Z}$ etc. in each column, the average variation (ignoring sign) being almost 5 percentage points *.

Further analysis shows that there are effectively two major groupings of brands – IS, N, Q and R on the one hand and L, M, P and S on the other. The rearranged duplication figures and the corresponding $Db_{X.Y}$ type of estimate for each group of 4 brands are shown in Table 10.9.

* This still represents a halving of the observed variation in *all* the duplication values $b_{X.Y}$, i.e. a correlation of the order of 0.75 with the penetration levels.

Table 10.8. Brand-Duplication of Purchase in 4 Weeks in a Certain Product-Field

(The Average size of the residuals $|b_{X.Y} - Db_X|$ is about 5 percentage points)

4 WEEKS	Who also Bought K	L	M	N	P	Q	R	S
Buyers of								
Brand K = 100%	–	24	9	11	6	9	9	4
Brand L = 100%	23	–	14	5	9	5	5	4
Brand M = 100%	22	30	–	4	12	6	3	4
Brand N = 100%	38	19	7	–	4	13	16	3
Brand P = 100%	21	33	20	4	–	3	3	5
Brand Q = 100%	41	21	12	17	4	–	13	2
Brand R = 100%	44	23	7	22	4	14	–	2
Brand S = 100%	34	31	15	7	12	3	3	–
Average 100%	29	27	13	10	9	8	6	5
2.3 Penetration	30	30	14	9	9	7	7	2
Penetration	13	13	6	4	4	3	3	1

Table 10.9. Segmentation between Brands K, N, Q, R and Brands L, M, P, S

(The Average size of the residuals $|b_{X.Y} - Db_X|$ is about 2 percentage points)

4 WEEKS		Who also Bought K	N	Q	R		L	M	P	S
Buyers of										
Brand K = 100%		–	11	9	9		24	9	6	4
Brand N = 100%		38	–	13	16		19	7	4	3
Brand Q = 100%		41	17	–	13		21	12	4	2
Brand R = 100%		44	22	14	–		23	7	4	2
Average 100%		41	17	12	13		22	9	4	3
D X Penetration	3.5b:	45	14	11	11	1.5b:	20	9	6	2
Brand L = 100%		23	5	5	5		–	14	9	4
Brand M = 100%		22	4	6	3		30	–	12	5
Brand P = 100%		21	4	3	3		33	20	–	5
Brand S = 100%		34	7	3	3		31	15	12	–
Average 100%		25	5	4	4		31	16	11	4
D X Penetration	1.5b:	20	6	5	5	2.5b:	33	15	10	3
Penetration (*b*)		13	4	3	3		13	6	4	1

The duplication patterns can now be much more closely summarised by three different D-statistics, as follows:

	Brands K, N, Q, R	Brands L, M, P, S
Brands K, N, Q, R	$D = 3.5$	$D = 1.5$
Brands L, M, P, S	$D = 1.5$	$D = 2.5$

Thus higher duplication of purchase occurs *within* each group of brands (especially so within the K,N,Q,R group). For any two brands of the same type, buyers of one brand are either about 3.5 or about 2.5 times as likely to buy the other brand in the 4-week analysis period than is the average consumer in the population as a whole (i.e. compared with the second brand's "penetration"). On the other hand, there is relatively less duplication of purchase *between* the two groups. Buyers of a brand of the K,N,Q,R group for example are only about 1.5 times as likely to buy a particular brand in the L,M,P,S group as is the average consumer – and similarly the other way round.

Such sub-groupings or clusters of brands can occur for a variety of reasons, such as marked differences in product-formulation, in price, or in retail distribution. In the present instance, Brands K,N,Q and R, and Brands L,M,P and S are produced by two different manufacturers, with some minor differences in distribution, and marked differences in product-formulation.

However, the main finding is that such factors more often than not do *not* show up as market segmentation. And when they *do* occur, they are usually "local densities" superimposed on the underlying duplication pattern of the $b_{XY} = Db_X b_Y$ form [Collins 197 1]. Indeed, it seems to be true that the duplication of purchase law also tends to hold as the major factor in the situation even for different varieties or flavours (as opposed to simply for brands made by different manufacturers but having more or less identical product-formulations). However, the range of empirical evidence here has been increasing over the years (till *1987 so* far) and this appears to be the general pattern.

A further fmding is that the law also holds for the observed brand-duplication of purchase within a given pack-size, e.g. for the tendency for buyers of say the small pack-size of Brand X also to buy the small pack-size of Brand Y. In contrast, early findings indicate that duplication of purchase between the *different* pack-sizes of the same brand (or the different pack-sizes of *different* brands) does not follow the

$b_{XY} = Db_X b_Y$ sort of pattern at all. It appears that the duplication levels between pack-sizes do *not* particularly depend on the penetration of each pack-size in the population as a whole. *Positive* findings in this area are however not yet established, and a good deal more research is needed (also still in 1987).

One major factor in the incidence of duplication of purchase is also the length of the analysis period. This is discussed in § 10.8 below.

10.6. The Duplicated Buyers' Frequency of Purchase

One especially simple feature of the duplication law $b_{XY} = Db_X b_Y$ is that it seems to take no account of how *often* the duplicated buyers of X and Y buy each brand, nor yet of the general rates of buying w_X and w_Y of X and Y by *all* their buyers.

The reasons for this are that w_X and w_Y do not usually greatly differ from each other, as was noted in § 10.2 above. This lack of between-brands variation also applies to the average frequencies $w_{X.Y}$ and $w_{Y.X}$ with which Brands X or Y respectively are bought by their duplicated buyers. ($w_{X.Y}$ stands for the average frequency of buying Brand X by those buyers of X who also bought Y.) This lack of major variation explains why these rates do not have to feature in the duplication law.

There are in fact two main findings here. These have already been illustrated in Table 9.10 in the previous chapter, which is reproduced here as Table 10.10.

Firstly,

$$w_{X.Y} \doteqdot w_{X.Z}$$

In other words, the average rate of buying Brand X by its duplicated buyers does not depend in any systematic way on *which* other brand, Y or Z say, they are also buying. This may be seen from the lack of any large or systematic variability in each column of Table 10.10.

Secondly, $w_{X.Y}$ is usually fairly close to (but generally a little *lower* than) w_X, i.e. the average rate of buying Brand X by *all* its buyers. In Table 10.10 the two rates are virtually equal, but this is unusual. In most other product-fields, w_{XY} is usually something like 20% *below* w_X.

In the present instance, buying of another brand, Y say, however does not affect the buying rate of Brand X at all. This is a reflection of

Table 10.10. The average frequency $w_{X.Y}$ of buying of Brand X by duplicated buyers of any two brands X and Y

(The data of Table 9.10)

48 WEEKS	The average number of purchases of				
	A	B	C	D	E
By consumers who also bought					
Brand A	–	5.1	4.4	3.8	6.7
Brand B	11.0	–	4.4	3.6	6.4
Brand C	10.9	4.8	–	3.5	5.9
Brand D	9.7	4.8	5.4	–	8.2
Brand E	10.6	4.9	6.5	4.6	–
Average $w_{X.Y}$	10.5	4.9	5.3	3.8	6.7
w_X	10.1	5.0	5.1	4.3	6.8

what appears to be a search for variety. In contrast, when $w_{XY} < w_X$, Brands X and Y tend to act more competitively (buying Y somewhat *inhibits* the frequency with which X is bought).

In as far as w_{XY} tends to be close to w_X (or even is virtually equal to it), but does *not* *vary with w_Y, it follows that differences between the rates of buying any two brands by their duplicated buyers, i.e. the difference between w_{XY} and w_{YX}, will behave essentially like the differences between w_X and w_Y themselves. These follow the relationship $w_X(1-b_X) = w_Y(1-b_Y)$ discussed in § 10.2, and we therefore generally have the relationship

$$w_{X.Y}(1-b_X) = w_{Y.X}(1-b_Y) .$$

This tends to hold to a close degree of approximation in a wide range of product-fields.

10.7. Sole Buyers

The comparison of the buying rates $w_{X.Y}$ and w_X which has just been discussed is highlighted by separating out the "sole" or 1 OO%-loyal buyers of a brand in the analysis period.

The frequency with which sole buyers buy their brand does not vary significantly between one brand and another, as was shown in Table 9.5 and is illustrated more generally in Table 10.11. This applies not only for sole buyers of each brand but also for sole buyers of a particular *pack-size* of a brand. The latter buy that pack-size with an average frequency which also does not vary significantly by brand. Furthermore, this average frequency is virtually the same for sole buyers of the *large* pack-size as for sole buyers of the *small* pack-size. Some of the figures in Table 10.11 are relatively variable but this is because of small sample-sizes, and is not statistically significant. When the numbers of sole buyers are larger – as for example in shorter time-periods – the results are much more stable, as may be seen from Table. 9.5 in Chapter 9. Empirically it is not yet clear whether there is a trend with market-share.

The sales importance of sole buyers varies a little by product. There are two criteria – whether compared with *all* buyers of the brand, sole buyers are heavy buyers of their *brand,* and whether they are heavy buyers of the product-class as a whole. The comparison is made simple by the basic fact that for sole buyers, what they buy of the *brand* equals what they buy of the *product.*

Table 10.11. Half-Yearly Frequency of Buying by Half-Yearly SOLE Buyers of a Brand or Pack-Size of a Brand

(Averages across the five product-fields I to V as in Tables 10.2– 10.4, for five leading brands in decreasing order of market-share)

	SOLE buyers' average number of purchases of			
	the brand	the large pack*	the small pack*	
Brands				
1st	10		7	7
2nd	8		5	5
3rd	8		6	6
4th	8		3	3
5th	9		6	6
Average	9	5	5	

* Average purchases per sole buyer of that pack-size of that brand.

In one or two fields, sole buyers of any brand or pack of a brand tend to be relatively *Zight* buyers of the brand, buying the brand at virtually the same average rate as do *all* its buyers. The product-class

examined in Chapter 9 is an example of this. Thus in the 48-week period in Table 9.5a, sole buyers of the typical brand bought it on average about 7 times, which is almost the same as the average of 6 purchases of the brand by *all* buyers of the brand – but much less than the average of 21 purchases of the *product* made by the latter. This ties in with the equality of the buying rate $w_{X.Y}$ and w_X for this product-field, as was mentioned in the last section. In this case then, anyone who bought the product at all heavily bought more than one brand (an apparent search for variety).

In one or two other fields, sole buyers are however rather *heavy* buyers of the brand. But in the majority of fields studied so far, sole buyers merely buy the brand *somewhat* more often – although the product-class as a whole invariably much less often – than do *all* buyers of the brand.

Turning to the *numbers* of sole buyers of a brand, we also find simple patterns. To a first degree of approximation it turns out that in any given period, the proportion of buyers of a brand who buy only that brand in the period varies little from brand to brand. Thus in Table 9.4 in Chapter 9 we saw that in a week, about 70% of the buyers of any particular brand in that week only bought that brand, in 4 weeks about 50% were sole buyers, in 12 weeks about 30% and in the year about 10% or so, and this did not vary all that much from brand to brand.

Some degree of variation in the incidence of sole buyers does however occur for different brands. Apart from sampling errors and the like, some brands or groups of brands may have systematically different characteristics from others – Brand E in Table 9.4 was a typical example (this being also different from the other brands in the product-field in a number of other respects – see for example also Chapter 3). A more general tendency however is for brands with a higher market-share or penetration level to have a somewhat higher proportion of sole buyers. A factor of the $(1 - b)$ form, which can be derived on theoretical grounds (see § 11.5 in Chapter 1 1), again accounts for much of the observed variation here. This is another Double Jeopardy pattern. Thus

$$\frac{b_{SX}}{b_X}(1 - b_X) = \frac{b_{SY}}{b_Y}(1 - b_Y) = \text{constant},$$

where b_{SX} stands for the proportion of the population who are sole buyers of Brand X (and b_{SX}/b_X therefore is the proportion of buyers of X who are sole buyers of it).

Sole buyers are analytically and conceptually of particular interest because their buying of the brand in question necessarily equals their purchase of the total product-class, as already mentioned. Some initial pilot-analyses of sole buyers' repeat-buying from one period to another [Cannon et al. 1970] suggest that they may be more regular in their buying behaviour than is the general buyer of the brand (as reflected by the NBD/LSD theory), possibly rather like the general buyers of a product-class, at least for some types of product. But this is an area still requiring a good deal of further research.

10.8. **The Length of the Analysis-Period**

So far we have considered multi-brand buying patterns in any given time-period. We now consider the relationship between the results in time-periods of different lengths.

In general, the various kinds of multi-brand patterns described in this chapter all hold in different length time-periods, but the parameter values vary.

For sole buyers, variations in their average buying rates with changing length of analysis-period appear to resemble those of the rates of buying the *product* by *all* buyers of the brand in question, which differ from the NBD type of results for the brand-rates (see §§ 4.8 and 7.5). Thus for two time-periods of length T and some arbitrary "unit" length 1, the average frequencies w_{PT} and w_{P1} of buying the total product-group per buyer of a given Brand X (or pack-size of a brand) can be represented by

$$(w_{PT} - 1) \doteq T(w_{P1} - 1) .$$

This relationship is in terms of "displaced means" – i.e. the number of repeat-purchases, after the first purchase – and follows from direct empirical analysis. Table 10.12 illustrates how it tends to hold for the leading brands and pack-sizes in the five product-fields already referred to in earlier tables. The same *form* of relationship, i.e.

$$(w_{ST} - 1) \doteq T(w_{S1} - 1) ,$$

appears to apply to the rates of buying w_{ST} and w_{S1} of *sole* buyers in the two time-periods. It therefore seems that sole buyers behave as "product-buyers" in this respect, rather than as "brand-buyers".

Table 10.12. The Average Half-Yearly **Rate** of Buying the Product per Half-Yearly Buyer of a given Brand or Pack-Size of a Brand

(Averages across the five leading brands in the five product-fields I to V also examined in earlier tables)

Observed values "0" and Predictions "T" from the Quarterly Buying Rates by $w_2 = 2(w_1 - 1) + 1$

24 WEEKS		Product-field I	II	III	IV	v	Average*
Average Purchases per buyer of the typical							
Brand	0	21	20	19	9	6	15*
	T	20	19	19	9	6	15
Small Pack	0	25	21	19	10	7	16*
	T	25	21	19	10	7	16
Large Pack	0	20	20	23	9	6	16*
	T	19	19	23	9	6	15

* As recorded in Table 10.4.

In contrast, the rates of buying the brand (or pack-size) by *all* its buyers, viz. w_T and w_1, varies in a somewhat different way with the length of the time-period. The full NBD/LSD formulations have already been given in Chapters 4, 7 and 8, with illustrative examples in Table 3.2a of Chapter 3. The simplifying approximation to the LSD formula

$$(w_T - 1) \doteqdot T^{0.82}(w_1 - 1)$$

shows up the real contrast with the above formulae for product-rates of buying: thus, in a period twice the length of the unit period (i.e. $T = 2$), the "displaced" product or sole-buyers rates of buying are twice as big as in the unit period, whereas for the brand-rate of buying the ratio $T^{0.82}$ is only about 1.76.

The buying rates $w_{X.Y}$ by duplicated buyers, discussed in § 10.6, will tend to follow the same relationship with time as for w, since they tend to resemble the ordinary brand rate of buying anyway. More complicated patterns however occur when considering rates of buying "other" brands (or "other" pack-sizes), such as the difference between the w_p and w rates, as set out in Table 9.3 for example. Descriptively the complication arises because each of the two buying rates varies differently with time, with factors T and $T^{0.82}$ respectively. No simple result can be given. A particular difficulty is that in relatively short

time-periods, buyers of a given brand tend in most product-fields to be inhibited from buying another brand as well, because of the "dead-period" which tend to operate between one purchase and another in a short period, as already mentioned in § 4.9.

The Incidence of Sole and Duplicated Buyers. From the relationship $b_{SX}(1-b_X)/b_X \doteq b_{SY}(1-b_Y)/b_Y$ in § 10.7 for b_{SX}, the proportion of the population who were sole buyers of Brand X in a given time-period, we can write that

$$b_{SX} \doteq Sb_X/(1-b_Y) ,$$

where S is constant for the different brands in the particular analysis-period. Given that the NBD/LSD theory effectively describes the growth of the penetration b_X of each brand (as discussed in Parts II and IV), the value of S in each length of analysis-period will determine how the incidence of sole buyers varies with time.

We have noted in § 10.6 that b_{SX}/b_X generally decreases markedly with increasing length of time. Not unnaturally perhaps, fewer of the larger number of buyers in a longer time-period stay 100%-loyal to the brand. The value of S itself always decreases in longer time-periods. However, it is not yet fully known how to describe or model or predict the quantitative *rate* of its decrease (but see also § 11.5 in Chapter 11).

A somewhat clearer picture emerges for the corresponding parameter D which describes the incidence of *duplicated* buyers in the model of § 10.5, viz.

$$b_{XY} = Db_Xb_Y .$$

The reason is that certain *qualitative* differences occur in the behaviour of D with varying length of analysis-period.

Thus in the example of Tables 9.7 – 9.9 of Chapter 9, the value of D remained virtually the same (at about 1.4) in time-periods ranging from 1 week to 48 weeks. This however is rather unusual (as was noted in Chapter 9). It is a pattern which seems to occur in the relatively rare product-fields where the different brands tend to be not only of somewhat different product-formulation but also to be used for somewhat different end-uses or by different end-users (e.g. different family-members). The point is that even in short periods, more than one brand may then be bought. The different brands are therefore to some extent complementary rather than being only directly substitutable or competitive (examples might be different kinds of pickles, or different breakfast cereals).

In most product-fields however, where different brands tend to be of more or less the same product-formulation, buying of a brand tends to *inhibit* another purchase in the same relatively short time-period. This applies to repurchasing of the same brand (as noted in the departure from the NBD type of repeat-buying pattern – see § 4.9 of Chapter 4 and Chapter 11). It also applies to the buying of another brand, so that in short time-periods b_{XY} – the proportion of buyers of Brand Y who also buy Brand X – is *less* than b_X, the proportion of *all* consumers who buy Brand X. In other words, the value of D in $b_{XY} = Db_X$ is then less than 1.

In such product-fields the value of D increases above 1 (the point where the correlation between buying of X and buying of Y is zero) only in relatively long time-periods. A typical pattern for many food or toiletry products is illustrated in Table 10.13.

Table 10.13. The Time-Trend in the Duplication-Ratio D for Duplication between BRANDS

(A typical product-field with brands of similar product-formulation)

	Analysis-Period, in Weeks				
BRANDS	1	4	12	24	48
Duplication-Ratio D	.3	.5	1.0	1.2	1.4

In most product-fields tackled so far, the D-value for brand-duplication seems to level out at 1.5 or 2 in longish time-periods. Sometimes however – especially for sub-items like pack-sizes, varieties or flavours – markedly higher D-values occur, up to 5 or 10 or even values of up to 60 (i.e. buyers of one item being 60 times as likely also to buy the other item as was the population as a whole). Retail distribution and availability are two of the factors in such high values.

Though it is still very early days in this kind of research it may be the case that a radically different time-trend than for brands occurs when dealing with the duplication of purchase between different varieties (e.g. flavours) of a given brand. Here the tendency is for the duplication-ratio to *decrease* with lengthening time-periods, as illustrated in Table 10.14. The point is that different varieties of a brand tend more generally to be complementary to each other. More than one variety may be bought in a short time-period or even on the same purchase occasion (e.g. different flavours of soup or

Table 10.14. The Time-Trend in the Duplication-Ratio D for Duplication between VARIETIES

	Analysis-Period, in Weeks				
VARIETIES	1	4	12	24	48
Duplication-Ratio D	2.4	1.9	1.5	1.4	1.4

different types of chocolate confectionery). In longer time-periods, an increasing number of relatively *light* buyers appear*. These tend *not* to buy so many varieties, so that b_{XY} increases less fast than b_X and b_Y with time, and D in $b_{XY} = Db_Xb_Y$ decreases.

The time-properties of the D-statistic – the single descriptor of the basic brand-switching patterns that occur – may be very telling. But even with the Dirichlet Model in Chapter 13, more work is needed.

10.9. Summary

Many aspects of multi-brand buying follow simple and highly generalisable patterns. These results largely take the form of purely empirical regularities and, being new, have as yet relatively little by way of underlying theory (a point further discussed in Chapter 11).

There are two main kinds of results, concerning firstly the number of consumers who do or do not buy some combination of brands, and secondly their average frequency of buying.

For the buyers of any given Brand X, both the number of *sole* buyers of X (who buy nothing else in the period) and the number of *duplicated* buyers (who also buy some specific other Brand Y, or Z etc.) depend simply on the penetration of each brand in the population as a whole and on one general coefficient or parameter – such as the duplication-ratio D – which is the same for all the different brands in the product-field. In practice, the duplication-ratio D *increases* with the length of analysis period for brands which are substitutable for each other, but *decreases* for different varieties of a brand which are more complementary.

Various *rates* of buying, such as the average frequency with which the buyers of a brand or pack-size buy it, the rates at which they buy

* Thus the average rate of buying per buyer does not increase pro rata to the length of the time-period.

the product as a whole, and the rates at which *sole* buyers of an item buy it, all show – as their main pattern – little or no variation from brand to brand. It follows in particular that the major determinant why one brand sells more than another is that more people buy it in a given analysis-period, rather than that they either buy more of it per purchase occasion or buy it more often (since this does not vary much from brand to brand).