RELATIVE SALES AND MATCHING ANALYSIS OF CONSUMERS' BRAND CHOICES IN OPEN SETTINGS

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RELATIVE SALES AND MATCHING ANALYSIS OF CONSUMERS' BRAND CHOICES IN OPEN SETTINGS

by

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CARDIFF UNIVERSITY

CARDIFF BUSINESS SCHOOL

DECLARATION

This work has not previously been accepted in substance for any degree and is not concurrently submitted in candidature for any degree.

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The dissertation is dedicated to:

Halla, Alexander & Viktor

Values

Technical improvements that permit us to bring new behavior into the laboratory, or that permit refined experimental control over behaviour, are among the most important contributions that we can make.

-Sidman, 1960, p. 17

...the only persuasive argument for any measure of response strength is to show orderly relations between the parameters of reinforcement-its frequency, quantity, quality, and so on-and the designated parameter of behavior.

-Herrnstein, 1970, p. 246

Only by systematically varying the circumstances in which choices are made-by doing controlled experiments, in other words-can we find a rule for interpreting behavior that will explain behavior in terms of its consequences, whether or not the behavior violates our intuitions

-Herrnstein, 1990, p. 222

The possibility that empirical tests will demonstrate the differential capacity of brand and store features to reinforce relevant discriminated behaviour must not be pre-empted through speculation...The marketing level of analysis may jet reveal the limits of the EAB [Experimental Analysis of Behaviour] contribution to consumer psychology.

-Foxall, 1990, p. 167

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Abstract

The dissertation is a methodological exploration of the relevance of in-store behavioural experiments with relative sales and matching analysis to study consumers' brand choices in real open settings.

Three extensive in-store experiments, using alternating treatment design with baseline - testing the effects of Place, Price, and Promotion - were performed in different types of stores (convenience, supermarkets, and budget) in order to investigate the application of the consumer behaviour analysis research framework to real open consumer settings. Four choice-based behaviour analytical analyses - relative sales analysis, amount matching, cost matching and probability matching - were performed on the data when applicable.

The results show that the relative sales analyses for the in-store experiments often show orderliness and functionally interesting, and in some cases contradicting, buying behaviour patterns.

As for previous correlational consumer behaviour analysis research there is - as should be expected - strong relationship between relative spending and relative buying (amount matching). Although methodologically peculiar, the application of this compelled matching relationship lies in the ability of the free parameters of the generalised matching equation to indicate dimensions of the substitutability of brands to some degree.

Cost matching analyses, generally, did not show downward sloping curves, as is sometimes the case in previous studies. It, as well as amount matching, hides functional relations but can be appropriate if represented with a relative sales analysis, which gives clearer picture of behaviour-environment relationships than matching analysis. Results also show that the probability matching analysis, as applied in consumer behaviour analysis, gives misleading results.

The ingathering of the study is a new in-store behavioural experimental project which can appraise consumer behaviour analytical advantages, fallacies, and verification; seen with the lenses of in-store experimental techniques, and the inclusion of relative sales analysis to real and affluent consumer settings.

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CHAPTER ONE

INTRODUCTION

> We are concerned then, with the causes of human behavior. We want to know why men behave as they do. Any condition or event which can be shown to have an effect upon behavior must be taken into account. By discovering and analyzing these causes we can predict behavior, to the extent that we can manipulate them, we can control behavior. (Skinner, 1953, p. 23)

Marketing research must be able to show how its primary independent variables influence consumer behaviour. The marketing mix is made up of elements such as product, price, place and promotion, classes of stimuli that can and often are explicitly used to influence consumer choice. The function of these marketing factors is dependent on consumers' environment and experienced consequences, but this process is not very well understood. The various elements that make up the marketing mix are mainly used as criteria for what is important in marketing strategy. Their role can become more important if they are incorporated into a strong methodological and conceptual system.

The primary aim of this study is to assess how, and to what extent, it is possible to use behavioural experimentation and matching analysis to study the effects of marketing mix factors on consumers' brand choices in their actual environments. This is a key issue in consumer behaviour analysis; the use of the experimental analysis of behaviour in consumer behaviour research, as it has not yet exerted control of environmental variables in its interpretation of consumers' choices within the framework of matching theory.

This chapter introduces the key concepts of the study and the connections between them. It sets out the objectives, and describes the content and the structure of the dissertation.

1.1 Research Background and Context

To understand the relevance of behavioural in-store experiments and matching analysis for the investigation of marketing mix factors on consumer choice, the scientific disciplines behind these key concepts will be briefly explained. First, the subject matter of marketing is introduced. Relevant themes in behaviour analysis follow.

1.1.1 Relevant Topics in Marketing

> The railroads did not stop growing because the need for passenger and freight transportation declined. That grew. The railroads are in trouble today...because they assumed themselves to be in the railroad business rather than in the transportation business. The reason they defined their industry incorrectly was that they were railroad oriented instead of transportation oriented; they were product oriented instead of customer oriented. (Levitt, 1960, p. 45)

Marketing is based on behavioural function, which is interested in the effects of incentives and penalties in the form of fulfilment of needs and wants. As such, it can be defined as "the study of the behaviour of consumers and marketers, especially as they interact" (Foxall, 2001, p. 165) and the research of their bilateral workings on each other. This functional school of marketing, which explores what the work of marketing is, was discarded in the 1970s by a spurious "paradigm shift" analysis of the history of marketing thought by Shaw and Jones (2005, p. 243). However, it is still among us and is intellectually and critically important for marketing (e.g., Foxall, 1999a). The functional school entails enquiring about the consequences of behaviour that makes operant psychology (behaviour analysis) particularly relevant to marketing research. This enquiry is another conduct wrongfully depicted as desisted (Baars, 1986; Gardner, 1985; Mandler, 1985; Robinson-Reigler & Robinson-Reigler, 2004).

Marketing can be seen both as a sub-discipline of economics, the science of how organisms use scarce resources, and psychology, the science of overt and covert behaviour. Traditionally, marketing has been described as an area for application for its main disciplines (Foxall, 1999a). It has been seen as a business philosophy concentrating on how the organization can work as one entity to maximise revenue by fulfilling consumers' current and future wants (e.g., Kohli & Jaworksi, 1993; Jaworksi & Kohli, 1993; Narver & Slater, 1990). This entails the use of behavioural science in marketing management.

If theories of consumer behaviour are used, they are most often taken from one of the basic disciplines (for example psychology and economics) and applied to a particular marketing theme. It could, however, benefit marketing and its application if the laws and principles of the behaviour of marketers and consumers would be found, analysed and made clear. By focusing on description, prediction and control of behaviour different theories, methods and applications can be compared in the search for economical and comprehensible descriptions of the behavioural classes of marketing.

Marketing management has ideally gone from production orientation to selling orientation to market orientation, where "information on all important buying influences permeates every corporate function" (Shapiro, 1988 p. 120). For a classic discussion of market orientation see Levitt, (1960). As the understanding of what marketing is and what it stands for is developed, it will also be important to think of how it is best performed. Today, vague and ill-defined concepts slow further progress. The building's foundation, the marketing concept (market orientation), is even unclear (see for example: Gray, Matear, Boshoff, & Matheson, 1998; Harris, 2002; Lado, Maydeu-Olivares, & Rivera, 1998), and organisations have misunderstood it with negative consequences (Day, 1999). This hinders the application of marketing knowledge and techniques. Because of the difficulty of dealing with the connection between attitudes and behaviour, there has been a very common decline in the conduct of such marketing research (e.g., Simonson, Carmon, Dhar, Drolet, & Nowlis, 2001). Researchers have begun to measure how marketing variables, for example customer orientation, appear in the behaviour of employees in their service behaviour. For these marketing researchers the concept of customer orientation has diverged and morphed into a new concept of customer oriented *behaviour* that focuses on action and is clearer and easier to measure (Grönfeldt, 2004). For this reason, it is important to ensure the development of a more objective behavioural marketing that focuses on activities for their own sake as well as for understanding marketer and consumer behaviour. Subjective internal states, like attitudes, memory and expectations, will always be used to explain behaviour. On the contrary, the usefulness of such hypothetical constructs can be better appraised if behavioural marketing is developed further. The question is; how far it is possible to go in accounting for behaviour with objective variables and experimental manipulations of the consumer environment? For the purpose of advancing the scientific nature of modern marketing theory, making it more testable by scientific methods, it is appropriate to explore to what extent it is possible to use behaviour analysis, systematically studying the effects of environmental manipulations on consumer behaviour, and enforcing consistencies in the vocabulary.

1.1.2 Topics in Marketing Mix Research

In the 1960s McCarthy presented what was to become one of the most influential models in marketing, the marketing mix (McCarthy, J. 1960), also known as the four Ps model because it contains Product, Price, Place and Promotion. These four variables are designed to stimulate and influence consumer demand. The model describes what variables the marketer uses to affect the behaviour of the consumer and is important from a behavioural perspective as the "customer is not part of the marketing mix" (McCarthy & Perreault, 1990, p. 37). This makes the marketing mix a particularly suitable framework for the enhancement and exploration of behaviour analysis which is at the core of marketing science. From a behavioural perspective, the most important work of the marketer is to identify the brand's stimulus and reinforcement class, seen as different stimuli (e.g., packaging or price promotion) and consequences (e.g., amount or duration) that increase the likelihood the brand or service being bought.

Obviously, there have been notions that there exist more classes than those represented by the four Ps (e.g., Jobber, 2004; Kotler 1986; Zeithaml, 2003), but in essence the marketing mix contains "the controllable variables that the company puts together to satisfy a target group" (McCarthy & Perreault, 1990, p. 728). From a more consumer-centered perspective these variables have been converted to what Lauterborn (1990) calls the four Cs. In his terminology, Product translates into Customer Solution, Price converts to Cost to the Consumer, Place becomes Convenience, and Promotion is redefined as Communication. The next three chapters introduce briefly the literature for each of the three marketing mix factors studied with the in-store experiments.

1.1.2.1 Price: The Effects of Brand Price on Consumer Choice

> "A fractionally lower price gets the business. That is seldom true except in the imagined world of economics textbooks." (Levitt, 1980, p. 84)

Price is an important marketing mix factor as it is the only one that directly creates revenue, but the difficulty here is that the competition can more easily respond to price tactics than to most other promotions. Rao (1984) and Gijsbrechts (1993) have tried to capture the effects of price on consumer choice from the literature but have produced few generalizations. The research on pricing seems to be disjointed and not theoretically or empirically strong.

Many economists maintain that the law of demand, where the consumer demands more of a good the lower its price, is the most important empirical discovery in economics (e.g., Perloff, 2001). Although demand curves, the amount of a good that consumers are willing to and can buy at a given price, usually slopes downwards, exceptions are well known in the literature (e.g., Giffen goods, inferior goods, signalling). These findings are in no way a contradiction to the law of demand because all these effects change the values of the brands in some way, making them unequal. Things like Giffen goods are considered to be very rare (e.g., Silberg & Walker, 1984), but there is general agreement in economics (including marketing) that price can have both attractive and adverse effects on demand (Rao, 2005). Consumers are believed to use price as a signal of product quality. In economics-oriented literature "under some circumstances, judging the quality of a product by its price is a rational strategy for an uncertain consumer" (Pollak, 1977, p. 64). This is questionable in the light of findings which show that correlations between quality (according to consumer reports) and price are low (Gerstner, 1985; Riesz, 1979; Tellis & Wernerfelt 1987). Reference to 'snob value' is also common. Seen this way, consumers are "paying for the knowledge that certain of their possessions are expensive" (Bannock, Baxter, & Davis, 1998, p. 175). In more marketing-oriented literature upward sloping demand curves have traditionally been explained with references to cognitive processes. It is believed that consumers use price-quality heuristically as this is cognitively efficient. Price is thus generally believed to have two separate effects on consumer choice: utilitarian (e.g., budget constraint) and informational (e.g., as a quality signal) (Rao, 1984; Rao & Monroe 1988). Shiv, Carmon and Ariely (2005, p. 383) demonstrate that factors such as the price of brands can even change the effectiveness of products for consumers in a way that "...consumers who pay a discounted price for a product (e.g., an energy drink thought to increase mental acuity) may derive less actual benefit from consuming this product (e.g., they are able to solve fewer puzzles)". Price can apparently affect consumer behaviour in terms of negative effects for the consumer (budget constraint), but also positively in terms of having the ability to better signal quality and even enhance the experience and efficiency of the brand. This lack of consistency in the effects of price on consumer behaviour underlines the need for further empirical studies in the retail environment. In combination with research testing, the effects of price on attitudes and intentions (e.g., Dodds, Monroe, & Grewal, 1991; Zeithaml, 1988), or traditional econometric analysis (see Tellis, 1988), field experiments (e.g., Bennett & Wilkinson, 1974; Gaur & Fisher, 2005) on the objective relationship of price change and sales are rare but essential.

1.1.2.2 Place: The Effect of Shelf Placements on Consumer Choice

> Although the effects of some in-store stimuli have been studied extensively, much of this research is proprietary, and is not available in the marketing or consumer research literature because it has been conducted by firms seeking a differential advantage over competitors. (Peter, Olson, & Grunert, 1999, p. 418)

For most producers and importers, the store is an important consumer along with the end customer. This is because the brand needs to be available in the store. That generally does not happen unless the retailer benefits from selling it. This relationship has become more peculiar and difficult in recent years where the brands of producers and importers are increasingly competing with private labels operated by the stores (e.g., Juhl, Esbjerg, Grunert, Bech-Larsen, & Brunsø, 2006). The competition for supermarket shelves is fierce, and generally the first challenge for any new brand. A brand that is located just below eye level is, *ceteris paribus*, believed to have the greatest sales compared to brands which are located on the lowest or top shelves because such locations are believed to receive less attention (from adults in general). The shelf placement is considered to be so important that producers are sometimes ready to pay considerably for the best shelf placement in their product category. If they do not pay directly for the shelf space they "pay" for it by advertising the retailer.

Research usually supports the claim that more shelf space and better placements, in terms of being stacked in the middle, increase sales (e.g., Peter, Olson, & Grunert, 1999). However, these relations are not always apparent (e.g., Frank & Massy, 1970). Sterling Jackson and colleagues of the Wal-Mart CMK team used an eye tracking method to research consumer attention; what they see and miss when they are shopping in stores. The research consisted of 21 different product categories, and the results indicated that most shoppers completely ignore one third to half of the brands on the shelf. In the study, consumers mostly considered the products in the centre of the shelf. To account for these results the Wal-Mart research team has constructed a diamond (Figure 1) where consumers are most likely to consider brands in the centre, or slightly to the left, with the corners being the least noticed.

% Noting	1st 30 cm	2nd 30 cm	3rd 30 cm	4th 30 cm	5th 30 cm
5th Shelf	16%	20%	24%	19%	13%
4th Shelf	23%	35%	43%	32%	21%
3rd Shelf	28%	45%	52%	36%	23%
2nd Shelf	27%	38%	40%	31%	24%
Lowest Shelf	16%	22%	23%	16%	15%

Figure 1.1. Consumers' attention, the Wal-Mart diamond

It is considered likely that there should be a significant relationship between consumer attention to brands regarding the most important shelf placings and the total number of brands sold in the product category (Luigi Ciuti, Procter & Gamble, personal communication, August, 2005), with brands on the middle shelf enjoying considerably more attention than those on the lower or higher shelves. In terms of how long the attention endures, the brands positioned in the centre of the diamond received nine times higher consideration time than those placed in the corners. These "proprietary" studies indicate the importance of shelf placement in terms of how consumers choose brands.

1.1.2.3 Promotion: The Effect of In-store Advertising

As for the other marketing mix factors, promotion comes in many forms (e.g. advertisements on television, newspapers or in-store). Advertising is favourable to a brand as an attempt to increase sales. Promotions account for more than 65% of typical marketing budgets (Abraham & Lodish, 1990).

Promotions are intended to change consumer taste. One of the major ways to promote a product is by capitalising on the brand equity. Brand equity is defined by Keller (1993, p. 1). as "the marketing effects uniquely attributable to the brand-for example, when certain outcomes result from the marketing of a product or service because of its brand name that would not occur if the same product or service did not have that name." Abraham and Lodish (1990) show that only a small percentage of promotional programmes are profitable, and Mela, Gupta and Lehman (1997) demonstrate that their long term effects can be harmful.

In-store advertising (point-of-purchase displays) is frequently used in retailing where applied marketing researchers or consultants try to find what consumers notice and what the best medium is (e.g., television as an in-store medium) to get their attention. However these studies are proprietary and don't appear in the academic marketing world where in-store price promotions are the only topic presented (e.g., Anderson & Song, 2004; Pauwels, Hanssens, & Siddarth, 2002). It is therefore important to explore how it is possible to research the effects of stimuli such as in-store advertisements on consumers' buying behaviour.

1.1.3 The Relevance of Behaviour Analysis to Consumer Research

Behaviour analysis, also known as behavioural psychology, is "a natural-science approach to understanding behaviour regulation" (Pierce & Epling, 1999, p. 3). It is one of the most comprehensive and researched conceptual and methodological frameworks in the behavioural and social sciences. Behaviour analysis is particularly concerned with the interplay between behaviour and environmental variables. The field is built on extensive experiments with the aim of discovering lawful behavioural processes relevant for consumer research as consumers learn to adapt to their economic environment. The in-store experiments contained in the following matching analyses, which is the topic of this dissertation, represent unexplored territory for behaviour analysis. Behaviouristically their relevance to consumer behaviour will be judged by the ability to use precise logical terminology to define, measure and affect consumer choice. In what follows of Chapter 1.1.3, a few key concepts in behaviour analysis, relevant to the aim and execution of the study, will be briefly introduced. These ideas include behavioural experiments, the three term contingency, the matching law, applied behaviour analysis and consumer behaviour analysis. Some of these concepts will also be expounded in Chapters 2 and 3 in more depth.

1.1.3.1 Behavioural Experiments

Behaviour analysis is first and foremost an experimental discipline. The main objective is the discovery of laws and principles governing behaviour. This includes their generality and the development and application of behavioural techniques (Pierce & Epling, 1999). Behaviour analysis offers its researchers a conceptual and methodological system that makes it possible to analyse the interplay between environment and behaviour. According to Catania (1998, p. 380) the technique of behaviour analysis involves "breaking complex behavior down into its functional parts. A successful analysis should allow the behaviour to be synthesized by putting the parts back together." This entails verification of controlling variables and behaviour patterns by single subject experimental designs (see e.g., Barlow & Hersen, 1984) rather than statistical evaluation.

Behaviour has antecedents and consequences that often influence action. It is possible to analyse the effects of these variables with functional analysis by experimentally controlling and isolating them. Many decades of behavioural analytic research have shown that the behaviour under study can be built, modified, kept constant, increased, decreased or eliminated when the environment of the behaving organism is controlled. Within the context of behavioural economics (e.g., Hursh, 1984), where economic concepts are used within the original framework of behaviour analysis, contributions to consumer research have mostly had little impact on marketing scientists, except to some extent when humans have been experimental subjects, not lower animals. These few experiments have had limitations in terms of the full marketing mix, by exploring only the effects of price on consumer choice in spurious environments (Foxall, 2007).

1.1.3.2 The Three Term Contingency and the Matching Law

Behaviour analysts have researched both operant and classical conditioning extensively for many decades (see for example Catania 1998; Pierce & Epling, 1999). Both have relevance to consumer behaviour research but here the discussion will be exclusive to operant conditioning; especially the three term contingency, and the matching law, as this is the framework that consumer behaviour analysis has used.

Operant conditioning is the name for environmental control over behaviour. It involves an increase or decrease of behaviour, e.g., in terms of frequency or time, depending on the consequences that follow behavioural response. This is represented by the three term contingency (Skinner, 1953):

$$S^D -> R -> S^{r+/-}$$

Where S^D represents the discriminative stimulus for consequences that are contingent on behaviour that takes place in its presence, R is a response that is either reinforced (S^{r+}) or punished (S^{r-}). All stimuli, or events, that follow a particular defined behaviour and strengthen it (e.g., frequency or duration) are called reinforcers, but all such stimuli that weaken the behaviour are named aversive or punishing. Some consequences are classified as neutral, as they have no effect on the strength of the behaviour that they follow (e.g., Skinner, 1976).

The most common method to change the frequency or time of a particular behaviour is to use reinforcement or punishment. When behaviour is strengthened or weakened in this way, it is presumed that it affects neuronal relationships in the brain that make the activity possible (Carlson, 1998). In most circumstances there are changes in the environment or stimuli that increase the probability of a particular behaviour that goes before the change (positive reinforcement). Likewise, avoidance or escape from some stimuli can increase behaviour (negative reinforcement). When behaviour has been increased with reinforcement (positive or negative) and is then taken away, the behaviour should decrease in frequency. This decrease in behaviour strength as a function of responses without reinforcement is called extinction. Just as there are stimuli which increase behavioural frequency when present after a particular behaviour, there are also stimuli that lower behaviour strength when present after the behaviour has happened (positive punishment). Likewise, it is possible to lower behaviour frequency by removing reinforcement after the target behaviour is performed (negative punishment).

The three term contingency entails molecular-discrete analysis suitable to describe simple environment-behaviour relationships (e.g., effects of the price of brand A on it being bought) but does not handle competing environmental influences (the effects of the price of brand Y on the buying of brand X) very well (e.g., Herrnstein, 1997). This is an important limitation, as it is possible to have implicitly the same effect on behaviour, as direct reinforcement and punishment of the target behaviour have, by increasing the reinforcement or punishment for other (competing) behaviour than the target behaviour. This is hard to conceptualise from the standpoint of the three term contingency alone, but can easily be represented by the matching law which looks at all behaviour as choice (see Chapter 2.5). The matching law states that relative behaviour (e.g., response rate) matches its relative reinforcement in equilibrium. It is within the framework of relativity of response and matching that behavioural contrast (Reynolds, 1961) can be understood. It is called positive contrast when the frequency of the target behaviour, that is not directly influenced, increases as other behaviour decreases. A negative contrast is the opposite, when the frequency of the target behaviour declines when another response increases.

The concept of stimuli is important in behaviour analysis. We can think of a consumer who walks into a store. Although there is nearly an indefinite number of possible stimuli in that environment, there are only few that have a real impact on the consumer's choice. For example, the consumer may survey some brands while ignoring others to make his purchase. It is apparent that it is important to be able to analyse how the retail environment affects the behaviour of consumers. What effects do stimuli promote? What influence do brand price, shelf positioning, in-store stimuli and store types have on buying behaviour? In behaviour analytic terminology it would be stated that some stimuli become discriminative stimuli (Skinner, 1971), increasing or decreasing the probability of particular behaviour, or have motivational operations (Michael, 1982, 1993; Laraway, Snycerski, Michael, & Poling, 2003), affecting the effectiveness of the reinforcing or punishing stimulus. Seen in the consumer context, the presence of a particular brand can increase the likelihood of being bought (discriminative stimulus), but this function can be altered by the effect of other variables like the availability of other brands, their price and placement, and in-store advertisements (motivational operations). This sounds straightforward, but the generality of behavioural techniques and terminology, when moved from the behavioural laboratory to the real world of the market place adds complications. It can possibly refute the techniques of behavioural control and make the terminology seem strange and ambiguous.

1.1.3.3 Applied Behaviour Analysis

The law of effect and experiments has allowed the creation of behavioural techniques and terminology. Research in behaviour analysis has produced many useful applications in terms of methods to predict or control behaviour. Applied behaviour analysis is now used effectively in many important and diverse areas like developmental disabilities, problem behaviour, education and organizations. On the other hand, the field has "gotten stuck" in developmental disabilities. For example 60% of data-based articles published in the Journal of Applied Behaviour Analysis (JABA), the field's flagship periodical, from 2001 to 2005 were in this area of research (Woods, Miltenberger, & Carr, 2006). Applied behaviour analysis is therefore, unfortunately, not as relevant to society as analysts in the field would like. Behaviour analysts will not appreciate the idea that their behaviour principles and methods are mainly applicable to animals and developmentally disabled people. Applied behaviour analysis has its origins in the animal laboratory and closed settings that can be seen as resembling a laboratory environment (e.g., classrooms and institutions). There is nothing wrong with putting internal validity, acquired with extensive and precise laboratory experimentation, before external validity. However, further examinations and conceptualizations in more complex environments are helpful to broaden the scope and interpretation of human behaviour. At the JABA homepage (n.d.) there are search titles were you can find "alligator," "bats," "chicken", "cows", "dolphin", "goldfish", "pigeon" and "squirrel" but not "consumers"! It has been twenty years since Kunkel (1987, p. 329 and 330) stated,

> "one gets the impression that applied behavior analysis is in something of a rut...The rut has deepened over the years, and we will get out of it only by boldly venturing beyond today's methodological parameters. Applied behavior analysis can be considerably more than the endlessly repeated use of effective techniques to modify activities of individual children and patients. Such uses are laudable and necessary, and they may well remain central to applied behavior analysis."

Kunkel (p. 331[the arrows are mine]) puts forward ten questions, including two that are vital for consumer behaviour analysis as a field and its relevance to applied behaviour analysis in general:

- How complex can the activities subject to applied behaviour analysis be?
- To what extent can applied behaviour analysis occur outside the laboratory and institutional setting?

1.1.3.4 Consumer Behaviour Analysis

According to Foxall (1998), the impact of behaviour analysis has been minimal in consumer behaviour marketing research because it has mostly been done with animals as subjects and mostly constrained to rather closed and restricted experimental environments. Even though animal laboratory research is important, because it allows precise environmental control and linguistic variables to be taken out, it only gives a basic understanding of behavioural principles. It is not possible to generalise findings from these basic experiments to consumer behaviour without testing them in that realm. Recently there have been steps taken in that direction, with the Consumer Behaviour Analysis Research Group (n.d.), which has interpreted human economic consumption in open and real settings with behaviour principles.

Consumer behaviour analysis is an important discipline in relation to marketing, and behaviour analysis as a discipline that searches for proper methods to find regularities and principles of consumer choice in naturally occurring environments. The field is theoretically built on behaviour analysis, economic psychology and marketing. Of particular interest is the interplay between the behaviour of consumers and marketers (Foxall, 2001). Behaviour analysis has had problems moving to the real world (e.g., Logue, 2002; Kunkel, 1987). The problems of consumer behaviour analysis are therefore first and foremost conceptual and methodological. The field's key problem is to what extent the terms and techniques of behaviour analysis, especially behavioural economics, can be used profitably in the real consumer environment. This is important from the perspective of determining the impact of situational factors on consumer behaviour from the standpoint of behaviour analysis, which utilises well researched behavioural principles like the matching law.

Consumer behaviour analysis has the agenda of adding the realism of effects of a real consumer environment to basic behavioural laws and principles. It is genuinely assumed that this will make these laws and principles more able to describe, predict and affect consumer behaviour, but as a consequence the models will get more complicated. According to Foxall (1998); "[t]o explain consumer behavior is to *locate* it-in space and time, at the intersection of a learning history and a current behavior setting" (p. 322). This entails the use of behaviour analysis which offers researchers on consumer behaviour a conceptual and methodological system that makes extensive behaviour-environmental analysis possible (see e.g., Foxall, 1990, 2002, for introduction to consumer behaviour analysis). This has led to the development of the behavioural perspective model (BPM, Figure 1.2) of consumer choice that is built on the three term contingency of operant behaviour (Foxall, 1998, Foxall, 1999a, 1999b) presented in Chapter 1.1.3.2.

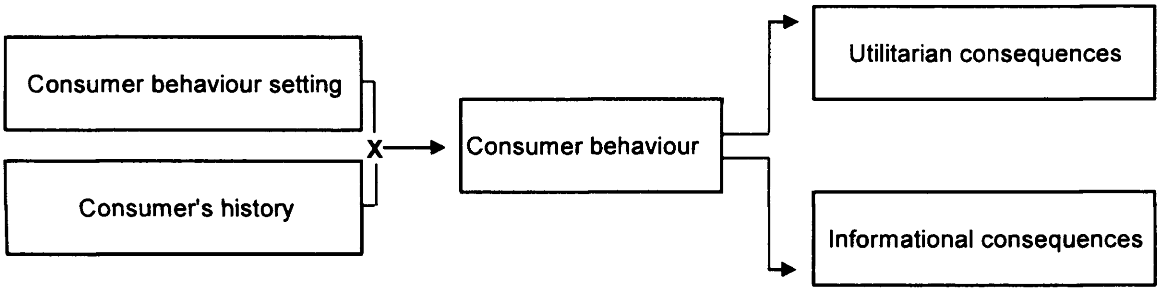

Figure 1.2. The behavioural perspective model (Foxall, Olivera-Castro, James, Yani-de-Soriano, & Sigurdsson, 2006).

Consumer behaviour contains patterns of behaviour that are simultaneously "reinforced" and "punished." Consumption can be reinforced by its use value for the consumer or by positive comments from other people, but it is simultaneously punished because the consumer has to surrender a generalised conditioned reinforcer, money, and go through effort (Alhadeff, 1982). Money is generally considered to be a generalised conditioned reinforcer by behaviour analysts, e.g., Martin & Pear (1999), but this idea has recently been challenged by Lea & Webley (2006). The behavioural perspective model is an operant account of consumer behaviour. Behaviour is a function of its consequences. The model explicates how the consumer behaviour setting, the social and physical environment signalling behavioural outcomes, consists of four kinds of discriminative stimuli. That is physical, social, temporal and rule-based. Each setting's discriminative and motivational strength depends on learning history, the consumer's history of similar behavioural consequences in the past. The model offers a continuum of closed-open behaviour settings based on criticism of premature, or fragmented, extrapolations of behavioural principles, analysed in the closed setting of the laboratory (Foxall, 1993a, 1999b). The behavioural perspective model differentiates operant consequences, consequences that operate on behaviour and increases or decreases its strength, as utilitarian and informational.

Utilitarian consequences (reinforcement/punishment and positive/negative) can be defined as an increase (or decrease) in operant behaviour (like money spent for a particular good or service) as a function of particular economic consequences. The consequences are tangible and include utilitarian reinforcers (or punishers) which stem from purchase, ownership and consumption, or the removal and avoidance of negative utilitarian consequences like a car failure. The concept of utility, in utilitarian reinforcement, is seen as it is usually used in economic analysis, where it generally means that products and service can give pleasure or satisfaction to consumers (Foxall, 1998).

Informational consequences (reinforcement/punishment and positive/negative) can be defined as an increase (or decrease) in operant behaviour (e.g., money spent) as a function of a presentation of particular symbolic consequences. The consequences are not tangible themselves but communicational and include informational reinforcers (or punishers) which stem from social status, vocal, written and gestural responses or the removal and escape of negative informational reinforcers. Communication occurs when behaviour of one organism generates a stimulus that affects the behaviour of another organism (for discussion of communication in behaviour analysis see Baum, 2005). It is an important term in the definition of informational consequences, because according to Foxall (1997b) informational reinforcement is symbolic and usually mediated by the responsive actions of others, closely similar to exchange value. It consists not in information *per se*, but in feedback on an individual's performance. It is usually publicly determined, judged by others according to rules, and therefore of primarily social significance. Much of the effort in marketing involves programming informational benefits by verbal brand differentiations. Marketers try to regulate the behaviour of consumers by using vocal, written and gestural stimuli.

1.2. Objective of the Research

> Even after we've studied behavior in the laboratory, we can't expect to be able to interpret every instance of behavior outside the laboratory. There are limits to what we can know... In our study of learning, it's important to recognize what remains out of our reach. (Catania, 1998, p. 6 and 7)

Marketing needs to have a theoretical and/or empirical foundation to account for the situational influence of the marketing mix on consumer choice. The matching law is a mainstream behaviour analysis of choice behaviour and has been studied for over forty-five years. The matching law's research history, indeed the history of the whole of behaviour analysis, has mainly been conducted in a systematic experimental framework where knowledge is built by constantly putting more factors under experimental control. Most of the research has been done on animal behaviour in the behavioural laboratory. The few experimental studies that have been conducted on human behaviour have all been done in a rather closed setting. This casts doubt on the generalisation of the matching law to the more complicated real behaviour of humans.

Consumer behaviour analysis explores the generalisation of the matching law on human behaviour in the most open, real setting. This important work has differed in three ways from most other research on the matching equations. The experimental method has not been applied, the behaviour under study is maintained on concurrent ratio schedules (instead of concurrent interval schedules), and relative response rates (relative sales) have not been explored.

The subject matter of consumer behaviour analysis is first and foremost the exploration of the possibility of using the concepts and methods of behaviour analysis applied in research, on a more simple level, for the study of consumer choice behaviour in real settings. As such, it studies the impact of more known important variables on consumer choice in real life situations. Some of these variables have already been identified from research on matching at a simpler level. To deal with the influences of the marketing mix on consumer choice, behaviour analysis needs to find the sole effects of the most important variables to determine its importance in accounting for complex consumer behaviour. The experimental method, where the effect of each independent variable is found to keep the others constant, is a necessary step in exploring the ability of behaviour analysis to describe, predict and control consumer choice in open settings. This brings the open experimental question of the dissertation, which is important for both consumer marketing and behaviour analysis:

> How can in-store behavioural experiments, with relative sales and matching (or matching-related[1]) analysis, help to get valid and reliable knowledge of the effects of marketing mix factors on consumers' choices in real and open settings?

This entails behaviour analytical evaluations (see e.g., Johnston & Pennypecker, 1993) and comparisons of the legitimacy of different outcomes from consumer choice

[1] The reinforcer-cost and probability matching analyses are properly related to the reinforcer-amount matching ("the classical matching law"), but deviate in that they deal with programmed reinforcement instead of obtained (see e.g., Herrnstein, 1970, Herrnstein & Loveland, 1975).

and matching analysis of sales data obtained with in-store experiments. The purpose of the thesis is twofold. The first aim is to conduct a relative sales analysis from the in-store experiments conducted. The Second purpose of the study is to investigate the extent to which behavioural economic techniques can be usefully applied in marketing.

1.3 Description of the Research

The study uses behavioural economics as a paradigm and explores the relevance of in-store behavioural experiments on relative sales and matching analysis to the study of consumers' brand choice in real open settings.

The open settings consist of three different store types in Reykjavík, Iceland. The store types are; convenience, supermarkets and budget (they include two of each). They are all operated by the Baugur Group, Iceland's largest retailer, with 74 stores in Iceland (see Baugur Group, n.d.). The study has been done in collaboration with the Icelandic American Corporation (see Icelandic American, n.d.), the importer of brands through Procter and Gamble to Iceland.

The thesis attempts to make it clear to what extent within-group in-store experiments, with relative responses and matching analysis, are relevant to consumer choice exploration. This is the first research which attempts to use the experimental method, from the framework of matching theory, to analyse consumer choice. It is thus expected that it will make the benefits and limitations of such a research program clearer. In all, there are four different methods of data analysis used on the sales data generated from the in-store experiments. This is (1) relative sales analysis, (2) reinforcer-amount matching analysis, (3) reinforcer-cost analysis, and (4) reinforcer-probability matching analysis (all the matching analyses refer to the concept of a reinforcer, which will not be mentioned in further discussion). The latter three methodologies are known from previous consumer behaviour analysis research as matching analysis, demand analysis and maximization analysis (see e.g., Foxall & James, 2001, 2003; Foxall, Oliveira-Castro, & Schrezenmaier, 2004; Oliveira-Castro, Foxall, & Schrezenmaier, 2005), but are here represented within the framework of matching. However, the first method of analysis, relative sales analysis, is new to consumer behaviour analysis. It has its predecessors in previous behaviour analytical work in the concept of relative response rate (Herrnstein's dependent variable, e.g., 1961) and visual inspections of moment-to-moment changes in response rate (Skinner's dependent variable, e.g., 1976). In fact, relative sales analysis is a combination of these, as it represents *momentary changes* in *relative* sales of a particular target brand (analogues to the experimental key in the behavioural laboratory) as a function of particular environmental contingencies. It is considered important for the evaluation of different matching analyses to have an assessment of consumer choice (relative sales analysis) to make a comparison with.

In detail, the study is designed to explore whether consumer choice and the substitutability of brands (matching) are affected by an experimental manipulation of (1) the placement of brands in store layouts, (2) price, and (3) in store advertisements of a brand's benefits.

1.4 Structure of the Dissertation

Chapter 1 has already introduced the relevance of behaviour analysis, especially consumer behaviour analysis, for consumer marketing. The objective of the study has been briefly explained and the research described.

Chapter 2 discusses how psychology and economics are used separately in research on the effect of marketing mixes on consumer behaviour and how the fields combine their forces in behavioural and experimental economics. The chapter focuses on the experimental analysis of choice behaviour in matching research. It explains thoroughly the matching law and the equations that derive from it, reviewing the literature from basic research, with animals as subjects in the behavioural laboratory, to studies in the modern market place, using panel data, in consumer behaviour analysis. Chapter Two justifies the importance and relevance of the study undertaken by emphasising the need for in-store experiments, with relative sales and matching analyses, to explore the generalisation of behavioural economics to open and real consumer environments. The chapter finishes with a review of previous consumer behaviour analysis research, setting the basis for the analysis of the data. The discussion emphasises the need to study experimental control in this area of research.

Chapter 3 discusses the methodology used in the in-store experiments, their aim, similarity and differences to characteristic experimental analysis of behaviour performed on lower levels (e.g., in the animal laboratory). Experimental questions are formulated, in terms of the effects of the marketing mix variables interventions. Expected results, from the view point of the literature review in Chapter Two, are presented. The experimental methodology and its procedure are detailed. This entails discussions on the sample, the research setting, dependent variables, measurement, the interventions and the research design. The chapter ends with discussing the analysis of the data.

Chapter 4 presents descriptive results from the in-store experiments. It shows raw consumer behaviour data, but includes measures of central tendencies and variability. The data is not placed in the context of any theoretical analysis or interpreted in any way. This is good preparation for later chapters as it clarifies the scope of the study, enabling the reader to be more qualified to asses the importance and quality of the research undertaken.

Chapters 5-7 show the results from the in-store experiments on the effects of the marketing mix variables Place, Price and Promotion on consumer choice of a target brand manipulated against the rest of its product category. It involves presenting the results, where appropriate, in terms of relative sales analysis, amount matching, cost matching and probability matching analyses.

Chapter 8 discusses the major findings and conclusions of the in-store experiments from the perspective of consumer behaviour analysis. The chapter examines the relevance of in-store experiments using relative sales and matching analyses in consumer behaviour research. This involves their possible contribution to behavioural science in general through matching and marketing mix research. The dissertation is rounded off by an interpretation of the quality of the research undertaken, evaluating its application and making recommendations for further research.

1.5 Summary

Consumer behaviour analysis is an important discipline in relation to marketing and behaviour analysis, as it is a discipline that searches for proper methods to find regularities and principles of consumer choice in naturally occurring environments (e.g., Foxall, 2001). Researchers in behaviour analysis have left the world outside the laboratory to untended (e.g., Logue, 2002). The function of consumer behaviour analysis is first and foremost as a conceptual and methodological exploration of the utility of behaviour analysis (behavioural economics) to real consumer behaviour. This is important from the perspective of the situational impact of marketing mixes on consumers' choices from the standpoint of behaviour analysis, with matching theory as its framework. The undersigned study uses behavioural economics as a paradigm and explores the relevance of in-store behavioural experiments with relative sales and matching analyses to the study of consumers' brand choices in real open settings. In detail, the study is designed to explore whether consumer choice and the substitutability of brands (matching) are affected by an experimental manipulation of (1) the placement of brands in store layouts, (2) the price of the target brand and (3) in store advertisements benefiting brands.

CHAPTER TWO

ECONOMIC PSYCHOLOGY

BACKGROUND

The aim of this chapter is to introduce the different topics in marketing, psychology, and economics that are important to the study. Marketing includes the subject matter of consumer behaviour. Consumer behaviour is not a discipline in its own right, but incorporates many important methods and closely approximates reality, in its research and application, than the main fields of psychology and economics, which it relies on. Chapter Two discusses how the disciplines of economics and psychology are used separately in consumer marketing, and how the fields have been combined in the form of behavioural and experimental economics. This discussion will lead to a focus on the utility of behaviour analysis, especially matching analysis - an explanatory framework here interpreted as being somewhere between economics and cognitive psychology[2] - often neglected in consumer behaviour research. The chapter finishes by looking at previous consumer behaviour analysis research in open settings using matching analysis. It concludes by emphasising the need for experimental control, to test the effects of important variables on brand choice and substitutability, for further enhancement of the behavioural interpretation of consumer behaviour in real settings.

2.1 Topics in Consumer Behaviour Research

Of the two key topics in marketing, the behaviour of consumers and marketers, the former has been emphasised. This is understandable when seen from the view of the application of marketing in management. Consumer research is the largest sub-

[2] In the respect that matching (or choice) analysis, in behaviour analysis, emphasises as do economists; objective, environment, constraints (scarcity) factors in explaining behaviour, distrusts verbal behaviour and try to avoid cognitive considerations. In line with psychology in general (and unlike traditional economics), behaviour analysis emphasises the experimental method and empirical searches for behavioural principle(s).

discipline of marketing and researchers in this field encompass nearly half of all marketing faculty members in business schools. Of the basic disciplines, psychology has had the most effect on consumer behaviour research (Simonson, Carmon, Dhar, Drolet, & Nowlis, 2001).

Consumer behaviour is a broad term. In psychology, in general, the concept of the consumer means "the recipient and user of services and goods" (Reber, 1995, p. 157). In economics, consumer behaviour is attached to the theory of demand, indifference-curve analysis and utility theory (Bannox, Baxter, & Davis, 1998). In this dissertation, Foxall's (1999b) definition of consumer behaviour as it "consists of economic purchasing and consumption activities" (p. 214), where the term "economic" involves literal exchange of property rights, will be used. This goes against some popular extensions in the definition of the fields of marketing, for example, when it is said to entail both literal and symbolic exchanges (e.g., Bagozzi, 1975).

Even though consumer behaviour research has advanced in the recent decades; regarding its scale, quality, and quantity of research, there are still considerable differences in opinion of what consumer behaviour research is. Consumer behaviour is, for instance, rather vague in terms of its speciality, and differences to other disciplines (e.g., Simonson, Carmon, Dhar, Drolet, & Nowlis, 2001). Overall, this is a multidisciplinary field of study with different assumptions, emphasis, methodology, and data analyses.

Consumer behaviour research is not only an academic discipline. There are countless applied studies done by research companies and other organisations, e.g., by retailers like Wal-Mart or multinational manufacturers of consumer products like Procter and Gamble, trying to get a competitive edge in the market place. These businesses have become increasingly advanced in this area. The retailing organizations are large and widely spread. They seem market oriented, do much research and also obtain market intelligence by applying their scanning systems. As small retailers are losing their numbers, these large organisations are competing more fiercely with each other and this creates more pressure on applied consumer behaviour research (see for example Reynolds & Cuthbertson, 2004). The retailers have, among other things, put more force on multinational manufacturers by increasing their sales of private labels (e.g., Juhl, Esbjerg, Grunert, Bech-Larsen, & Brunsø, 2006).

There is a lack of communication between the academic and applied fields of consumer behaviour. While future employers of marketing firms are prepared in university for participating in the real battle for consumers' choices, there is a lack of real world intelligence taken back into the theoretical disciplines behind marketing, psychology and economics. Psychological theory, in general, relies on laboratory experiments and abstract cognitive concepts (see for example Lea, 2000) and economic theorising is little concerned with what is going on in the real world (Coase, 1998; Smith, 1989; Thaler, 2000). Although the problems of marketing academics and practitioners are not the same, they share their interest in consumer and marketer behaviour. The two sides of marketing, managers and scientists, should collaborate more, because each has something to contribute that the other lacks. Mangers have various data that could be used to extend the domain of a theory to real environments and the ability to intervene in the market place. Marketing scientists have, by contrast, theories and methods that can enhance the value of the data for better marketing interventions and further theoretical and methodological testing. Academics are also often better able to disseminate the results. Collaboration between academics and practitioners is important to “keep marketing research both rigorous and relevant.” (McAlister, 2006, p. 517).

2.1.1 Consumer Research in Economic and Psychological Perspectives

> “It is only by understanding the intellectual concerns of other groups with a claim on our subject matter that we learn fully the nature and implications of our own.” (Foxall, 2007, p. 17)

It is important to appreciate that consumer behaviour research extents further than just analysing the choice of goods in supermarkets. Researchers in this field of study come from different fields of study, such as psychology, economics, and sociology. However, when all choices of products and services, broadly classified, are termed as consumer behaviour (e.g., Bettman, 1986) it leads to conceptual confusion in the sense that all activity can be seen as consumer behaviour. This simplification makes the concept worthless.

At the beginning of the 20th century, consumer behaviour research was exclusively accounted for by economics (e.g., Foxall, 1999b). The economic consumer theory, or rational choice theory, which states that the consumer maximises utility, prevailed and is still important today. Mainstream economists presume rationality, and it is also an assumption in most marketing research. In marketing the term utility is often interchangeable with satisfaction or benefits. The consumer is supposed to choose the product or service that gives him the most utility/satisfaction/benefits (see for example Narver & Slater, 1990). In marketing, however, utility maximisation is generally a beginning rather than an end. In the words of Hauser (1980, p. S32), discussing mutual understanding between economic and marketing scientists, "[u]tility maximization is a logical beginning, but utility is an elusive measure. Consumers are ill-informed, misinformed, and tend to simplify decisions."

Foxall (1999b) states, that during the 1950s, consumer researchers began to be discontented with rational choice theory. Approaches to methodology from psychology began to be transferred to marketing; first from behavioural psychology and later from cognitive science, as its influence began to increase in general psychology. Decision models were formulated and introductory books were written on them, as remains the case today. Marketing became more independent from economics, but all changes were heavily under the influences of psychology. Today cognitive models prevail. Researchers focus on cognitive structures and sequences. This entails examining consumers' thought processes, understanding, and interpretation of stimuli and events. In cognitive consumer research, knowledge, meanings, ideas and attitudes are analysed. This is reflected in the behaviour of marketers who try to increase consumers' attention and knowledge of their brands and services. The main concern, however, is that empirical research shows a gap between observed facts and theory. The relationship between internal hypothetical constructions and their presupposed processes and real consumer choice behaviour is low. For example, the relationship between attitudes and behaviour is in most instances low, if particular circumstances are not taken into account (see e.g., Lea, Tarpy & Webley, 1987; Perloff, 1993). This makes consumer cognitive theory speculative in origin. It is apparent that the consumers' environment will have to be taken more into account.

2.1.2 Consumer Behaviour in Economic Perspective

In the behavioural and social sciences there is a widespread agreement that behaviour is influenced by its benefits and costs. The only theory that comes close to being the paradigm for choice research is rational choice theory, or the theory of the economic man, as it is also known (see for example Baum & Nevin, 1981; Herrnstein, 1990).

The theory of rational choice basically says that the behaviour an individual chooses tends to maximize utility (well being). This means that such individuals behave logically, have goals and try to get what they want, subject to their beliefs and knowledge at a certain time (see for example Friedman, 1990; Rabin, 2002; Stigler & Becker, 1977 or examples of many types of rationality in Coleman, 2003).

The term, rationality, can be, and often has been, confusing. It means that people tend to find the correct, or the most useful way, to achieve their goals. It need not mean that consumers use rational analysis, go through evidence, use formal logic and so forth, each time they make a choice (Friedman, 1990). It is a statement about sensible action that leads to maximization, given the circumstances (Lea, Tarpy & Webley, 1987). More accurately, rational choice theory relies on the expected-utility maximization approach founded by von Neumann and Morgenstern and extended by Savage (Royal Swedish Academy of Sciences, 2002). The theory assumes that the choice maker has some real-valued function *u*, that is defined on the relevant set *X* of outcomes $x_1, x_2 ... x_I$, such that if one available action *a* results in probabilities p_i (for *i*=1,…,I) and another available action *b* results in probabilities q_i over the same outcomes, then the choice maker prefers action *a* over *b* if, and only if, the statistically expected value of this "utility function" *u* is greater under *a* than under *b*. In mathematical terms this can be expressed as

$$\sum_i p_i u(x_i) > \sum_i q_i u(x_i). \quad (2.1)$$

The consumer is thus presupposed to behave as if he correctly assigned the likelihood of relevant random events and behaved in accordance to what maximises the expected value of his utility (Royal Swedish Academy of Sciences, 2002). If utility is not specified objectively, researchers have to infer it from behaviour. This is problematic, as this is the behaviour that utility is supposed to explain. The standard practice is to invoke utility from whatever source needed to describe the observed behaviour (see Becker, 1993; Becker & Murphy, 1996, for an example). This is possible because there are no constraints on utility, other than that imposed by the behaviour.

It is possible to look at economics as more of a research methodology than a discipline with specific questions (see for example Becker, 1993; Friedman, 1990). In this view rational choice theory is seen as a research framework which can be applied to various questions. The questions which can be effectively tackled with the theory are then economical questions, while others are not. Economics, with its maximisation of choice behaviour, is a paradigm, not amenable to refutation. Rational choice theory has always been criticised and many have denied its validity. Boland (1981) asks; how do such critics know that it is false? His question is interesting because it is absolutely impossible to refute the theory. It is metaphysical and can thus not be tested.

2.1.3 Consumer Behaviour in Psychological Perspective

Psychology is a broad field of study with many sub-disciplines that have their own models and subject matter. It is mostly interested in overt and covert behaviour, and relies on experiments that combine or characterise significant factors in the field. For the discussion on consumer behaviour two fields of psychology will be presented, cognitive and behavioural psychology.

It is a widely accepted notion in modern thought in psychology to believe that cognitive psychology has superseded behaviourism, the underlying philosophical-psychological assumption behind behaviour analysis explored in this dissertation. It is crucial to realise that behaviourism as a whole was never a paradigm, in the sense that Kuhn (1970) meant, because its followers didn't agree as to what the fundamental explanatory terms were. It was thus no paradigm of behaviourism for cognitive psychology to overthrow. Cognitive psychology was not solving any anomalies in behaviourism and cannot be seen as even constituting a paradigm in its own right. There were no paradigms to supersede or to be superseded (Leahey, 1992). Psychology does not rely on a grand theory as economics does. As economics is theoretical, psychology is empirical, with many theories. However, it is possible to look at rational choice theory as one more form of psychological theorising. After all, it is a theory about behaviour.

2.1.3.1 Consumer Behaviour in Cognitive Perspective

If it is more possible to talk about mainstream psychology then it is cognitive psychology. It focuses on topics such as how the mind processes information. Therefore, it involves themes such as perception, learning, attention, memory, language, categorisation, problem solving and rationality. All of these concepts have been incorporated in to modern marketing thought.

The leading theory in cognitive psychology is information processing. It was originally borrowed from computer science by scholars such as Broadbent (1958) and Newell, Shaw, & Simon (1958), with its emphasis on computer metaphors. According to Leahey (1992) it is defined by vague dedications to the nature of psychological science. What is agreed on is "that organisms take in information from the environment; process it internally, creating representations; make decisions based on represented information; and in consequence, behave." (p. 315). Cognitive topics have increased their importance in consumer behaviour research. This includes behavioural decision making, memory and cognitive elaboration, language, variety seeking, and preconscious processing (Simonson, Carmon, Dhar, Drolet, & Nowlis, 2001).

From the viewpoint of cognitive psychology, the aim of marketers should be analysis of consumers' decision making. This differs considerably from the mainstream economic approach, which does not particularly consider consumers' decision making processes. It rather develops rational maximization models that are supposed to account for consumer choice behaviour. This characterises the difference between psychological and economic approaches to this area of study.

To examine how the cognitive system analyses information, researchers have made information processing models. These are computer programs used to model the decision making processes and the problem solving that it is supposed to entail. The most famous of these is a program called the General Problem Solver (Newell & Simon, 1972); it attempts to minimise distances from an initial state to a goal state, as defined by the user. To do this, it uses heuristics and means-ends analysis. This and other computer programs have since been modernised and can now solve more difficult problems. These models have inspired consumer researchers. One of the best known works is Bettman's (1979) influential book. Basically, in this line of research, consumers' decision making is supposed to contain three important cognitive processing systems. They each modify and change the representation and put them forward to the next system, where further processing takes place (e.g., Peter, Olson, & Grunert, 1999). First, consumers need to interpret appropriate information from the environment so they will acquire personal meaning and knowledge from it. Second, they need to put these representations together with former knowledge, to be able to evaluate the value of brands and other choices. Finally, consumers need to be able to retrieve knowledge from memory, to use in the interpretation of the new information. All these cognitive systems are supposed to be used in all consumer decision making.

Simon's (1955) concepts of satisficing and bounded rationality have been important in consumer research. They have also been a major point in connecting decision making research, from cognitive psychology, to economics. Satisficing means that the consumer settles for less than an optimal solution, taking into account a multitude of choices and limits in cognitive ability and time. To achieve satisficing, the consumer uses, among other things, heuristics. This goes against pure rationality as depicted in rational choice theory. Bounded rationality seems more realistic than pure rationality and does not surrender its rigorous analysis. According to Gigerenzer (e.g., Gigerenzer, 1999; Gigerenzer & Selten, 2001), bounded rationality is neither optimisation nor irrationality. The strategies that the consumer uses do not rely on optimisation, probabilities and utilities. Bounded rationality works like an adaptive toolbox of cognitive rules, emotions, imitation, social norms and other cultural tools. Contrary to conventional thinking, knowledge and computational capability is not always an advantage. Heuristics make the consumer able to exploit the structure of the environment. The tools, or heuristics, can be simple but very effective under the right circumstances (e.g., expert consultant, wait and see). Seen in this light, the consumer acts like a data processing system with bounded rationality, which has goals and uses comparison, built on a few heuristics, to evaluate what brands match with his objectives best. This is the framework generally seen in introductory books to consumer behaviour (e.g., Arnould, Price, & Zinkhan, 2004; Peter, Olson, & Grunert, 1999; Solomon, Bamossy, & Askegaard, 2002).

Although scrupulously built on cognitive programming and mathematics, leading to strict demands on researchers who have to show that their theories work in these systems, they are not without limitations. One of the difficulties is how 'placeless' consumer behaviour is in this research framework. It is taken out of its context, which without doubt has a major impact on behaviour. Another problem is how little connection, or correlation, there can be between the presupposed cognitive variables (e.g., belief, attitude, intention) and overt consumer behaviour (Davies, Foxall, & Pallister, 2002; Perloff, 1993). There also needs to be more evidence that can manifest the data processing and the decision making process that are presupposed to take place before the buying of brands and services occur (Foxall, 1980a, 1980b, 1984a, 1984b, 1984c, 1986a, 1986b, 1996b, 1997a, 1999b). To the extent that the theory is taken from other means (computer programs and mathematics) than from experiments on behaviour in its own right, it is no surprise there is a gap between theory and behaviour (Skinner, 1976).

2.1.3.2 Consumer Behaviour in Behavioural Perspective

The famous behaviourist John B. Watson, well known in psychology for heavily promoting behaviourism, was the first to bring behaviour analytical techniques to the area of consumer behaviour. Watson wanted to use behavioural methods, like classical conditioning, to control consumers' buying behaviour and did not hesitate to extrapolate, prematurely, from the animal laboratory (Buckley, 1982). Since the time of Watson, consumer psychology from a behavioural perspective (see Foxall, 1990, for a discussion) has advanced considerably. It has been studied from the perspective of applied behaviour analysis (Baer, Wolf, & Risley, 1968) with increasing emphasis on applied behavioural economics. Applied behaviour analysis emphasises behaviour-environment relationships of social importance, mostly studied with single subject research experimental designs. The focus has traditionally been on social marketing with an emphasis on environmental conservation (for a review of consumer choice research in behaviour analysis see DiClemente & Hantula, 2003).

The methods of behaviour analysis have received some mention in introductory books to consumer marketing. An introductory book by Peter, Olson and Grunert (1999) discusses few basic behaviour analytical principles adequately in the realms of consumer behaviour. The discussion is, however, generally based on poor empirical research on consumer behaviour (for examples see: Arnould, Price, & Zinkhan, 2004; Solomon, Bamossy, & Askegaard, 2002). The authors take behaviour principles and methods, which have been researched on lower animal and human behaviour in closed settings, and generalise the findings to relate to consumer behaviour. The discussion is not up to date. The few behaviour principles mentioned, were all discovered more than fifty years ago, but behaviour analysis has advanced tremendously since that time. What is most striking though, is the lack of applied behaviour analysis in consumer marketing. This may be no surprise if the shortage of research that deals with behaviour principles in real consumer settings and the increasing isolation of behaviourists - both in marketing, and psychology in general (in terms of psychology see; Leahey, 1997; for consumer marketing see; Peter, Olson, & Grunert, 1999) is taken into account. Behaviour analysts mostly publish research in their own journals, such as the Journal of the Experimental Analysis of Behaviour, and the Journal of Applied Behaviour Analysis.

As for cognitive psychology, the use of behaviour analysis in the field of consumer behaviour entails empirical methods in the search for the laws and principles of consumer behaviour. In the words of Vaughan and Herrnstein (1997) "[w]ithin economics, maximization of utility by consumers is usually part of the hard core, not subject to empirical test. For behavior analysis, on the other hand, assumptions which serve merely to protect the accepted view of consumer behaviour should be dropped." (p. 203). Although behaviour analysis pops up now and then in marketing (e.g., Markin & Narayana, 1976; Peter & Nord, 1982; Nord & Peter, 1980; Rothschild & Gaidis, 1981), there has been, and is, only one systematic long term research on consumer behaviour from an operant perspective. That is, the previously mentioned consumer behaviour analysis research program (see Foxall, 2007); a non-laboratory approach to consumer and marketer behaviour that combines behaviour analysis and economics.

2.2 Behavioural and Experimental Economics

> We descendants of Bentham can agree about the primacy of pains and pleasures; we can agree even that, as Hirshleifer recently said, there is only one social science. But now, to pursue that social science, and to use it to design social institutions, we need to reconcile the divergent answers provided by empirical approaches, such as that of behavioral psychology, with the formal structures of economic theory.
> (Herrnstein, 1997, p. 264)

Behavioural economics is a broad term; it can be classified, as was done for psychology in general, as cognitive and behavioural. This classification can be built on the explanatory value in behavioural terms that is given to internal, non-observable, variables (cognitive processes). The discussion will begin with the more mainstream behavioural economics, the interplay between cognitive psychology and economics. This is most famously known from the work of such scholars as Simon (e.g., 1955), Kahneman and Tversky (e.g., 1979) and increasingly Thaler (e.g., anomalies articles in *Journal of Economic Perspectives*) and Rabin (e.g., 2002). This line of research, cognitive psychological experiments on choice and decision making, have bridged the gap between economics and psychology by pointing to the overestimation of human rationality and the relevance of experiments in economics. It has had a major impact on consumer behaviour research (Simonson, Carmon, Dhar, Drolet, & Nowlis, 2001). The discussion will later be limited to research in the tradition of "behaviour analytical" behavioural economics, mostly known from former students of Skinner at Harvard University; such as Herrnstein (e.g., 1997), Rachlin (e.g., 1982), and Baum (e.g., 1979). From these and other behavioural scientists at the Harvard Pigeon lab, and afterwards, came matching analysis with rigorous animal experimental research, and mathematical treatment of behaviour. This has stimulated Foxall at Cardiff University, his students and collaborator, Oliveira-Castro, to explore to what extent these behaviour principles and this methodology is applicable and useful in the realm of consumer behaviour. Furthermore, this research has also been connected to, supported and challenged the basic disciplines; behaviour analysis and economics (e.g., Foxall, 2001; Oliveira-Castro, Foxall, & Schrezenmaier, 2006).

2.2.1 Rationality and Experiments

The old view that economics is a non experimental science (Samuelson & Nordhaus, 1985) that has to rely exclusively on field data has recently been under attack and is obviously untrue (e.g., Smith, 1989). However, experiments have been used relatively little, but their utilisation has recently increased dramatically. Economists rely increasingly on data from laboratory experiments. This research has its roots in two distinct but converging disciplines, in experimental studies of decision making and tests of predictions from economic theory (Güth, Warneryd, & Lea, 1992).

Psychologists, behavioural economists and others doing experiments, try to pry mainstream economists away from narrow and unrealistic assumptions but they are still persist (e.g., Kahneman, 2003). This has, though, strengthened the foundation for behavioural economics which is now flourishing like never before. According to the Royal Swedish Academy of Sciences (2002) this line of research has seen the greatest number of published articles in major journals in economics, new doctoral dissertations, seminars, workshops and conferences. Matthew Rabin (2002), in his Alfred Marshall lecture, mentions some assumptions of rational choice theory that behavioural economic research shows are either "wrong", or at least not very useful in predicting behaviour. These assumptions are that people:

> are Bayesian information processors;
> have well-defined and stable preferences;
> maximize their expected utility;
> exponentially discount future well-being;
> are self-interested, narrowly defined;
> have preferences over final outcomes, not changes;
> have only "instrumental"/functional taste for beliefs and information. (p. 660)

Mainstream (neo classical) economists have, perhaps until recently, resisted all new assumptions that depend on more psychological realism. Many have reacted to anomalies by trying to make them disappear. They have tried to add more opportunities for learning, raised the stakes or tried to rationalize the outcomes. According to Camerer and Thaler (2003) none of these reactions have generated much new insight. The reliance on unrealistic assumptions in economics can, at least in part, be explained with a historical lack of experimentation to validate theory. On the contrary, psychology has used experiments as a standard practice and has therefore had much better tools to deal with the problems of controlling variables than economics has traditional been able to do. Economists have dealt with these problems by designing logical models such as rational choice theory and put forward hypotheses from them that are checked against history. The crucibles of economic theories, at least in macro economics, have been the cataclysmic events which reshape economic activity. Hence, major economic theories which aspire to a policy role must explain the great deflationary waves of the late 19th century with their repeated panics, to mention one example. Econometrics or statistics have been the most important tools when it comes to testing economic theories empirically. Economists have mostly used statistical methods when it comes to try to exclude the interference of other variables on their research hypotheses.

The experimental method should be an important tool for every science. It is basically the wheel for scientific practice (although not all scientific disciplines are reliant on it entirely, e.g., astronomy). Unless controlled experiments can be carried out, tests of economic theory will remain limited. It is difficult to decide exclusively on the basis of field data whether a theory fails and to see the reasons for the failure. Experiments give the power of being able to replicate the research and get feedback from it, to suggest modification or new theories that then suggest the necessity of even more experiments. This is a good way to acquire reliable principles and laws. By increasing the use of experiments in economics, the strengths (e.g., Smith, 1991) and weaknesses (e.g., Herrnstein, 1997; Kahneman & Tversky, 1979), in terms of prediction of behaviour, of rational choice theory are now clearer than ever before. However, unfortunately the problem is not simple. The rational "theory" is indeed not theory, but metaphysics or a paradigm. It is both logical and irrefutable.

In the case of rational choice theory there are statements that are logically true. There is no doubt that if a consumer maximizes utility, then for the particular bundle of goods chosen, the marginal utility is zero and virtually everyone accepts that (Boland, 1981). Rational choice theory cannot be refuted as logically unsound. It has always been criticised and many have denied its validity. Boland (1981) rightly asks how do its critics know that it is false. His question is interesting because it is absolutely impossible to refute the theory. It is metaphysical and can thus not be tested. Metaphysical statements can be false, but it is impossible to find out because they contain assumptions that make it not possible. These are statements that allow for both "all" and "some" possibilities. These accounts are neither verifiable nor refutable. Rational choice theory states that the consumer maximizes something (utility). If one claims that he has found, for example, a consumer who is not maximizing anything, the rationalist can always respond by asking how he knows this. And because it is impossible to know this, the "theory" is always saved (See Boland (1981) for further discussion).

It is the usefulness of rational choice theory compared to others in different settings which should decide when it is appropriate to use it. Doing appropriate logical analysis and experimentation and comparing the description, prediction and control of consumer behaviour between rational choice theory and others is one way to further development. It is then that statements about real behaviour are being proposed. Then prediction and control of consumer behaviour become possible and that theory, although derived from the rational choice paradigm, becomes falsifiable. By conducting experiments it will be possible to see which theories have predictable and controlling functions, and which can only "explain" after the event has occurred. In this respect, it is the aim of the dissertation to test the explanatory ability of the matching law in the realm of consumer behaviour.

2.3 Matching Analysis

> Skinner discovered response rate, stimulus control, and schedules. He and his students saw the possibility of a real (natural) science of behaviour and set about establishing that science based on those concepts. Herrnstein discovered relative response rate, the matching law, and the psychophysics of choice. He and his students saw that the science could be quantitative and set about making it so. (Baum, 2002a, p. 355)

Principles and techniques developed in basic behaviour analysis have been transferred from the animal laboratories to the analysis of patterns of consumer choice in open real settings (cf. Foxall, 2007). This has mostly been done within the framework of the matching law, and has dominated research choice in behaviour analysis for over four decades. Theoretically, the matching law has been presented in many forms and played a major part in the mathematical enhancement of behaviour analysis; where different parameters have been experimented with and put together. It has been important in the cooperation, or friction, between economics and behaviour analysis. It is one of the most successful behavioural laws, discovered with experimentation, in terms of reliability and generalisation (Herrnstein, 1997), and has recently been successfully used in consumer choice research (e.g., in Foxall, Oliveira-Castro, & Schrezenmaier, 2004).

2.3.1 Schedules

To comprehend matching analysis it is necessary to introduce the topic of schedules. A reinforcement schedule (Ferster & Skinner, 1957) produces behavioural patterns because it is the rule that controls under what conditions reinforcement is delivered. Schedules have been investigated for more than five decades. They determine steady state behavioural patterns and resistance to extinction. In experimental analysis of non-human behaviour, schedules induce remarkably lawful behaviour but their effects on human behaviour are more controversial and complex (e.g., Lowe, 1979; Pierce & Epling, 1999)

Continuous reinforcement (CRF) is the simplest schedule; it requires that every response is reinforced. Intermittent reinforcement, when behaviour is reinforced occasionally, is most often the rule in a real environment. This intermittent type can be classified as either; ratio schedule, or interval schedule. Ratio schedule is response based, meaning that reinforcement follows a number of behaviours or responses. Interval schedule, in contrast, delivers reinforcement only after a particular behaviour is performed - when some time has passed since the last reinforcement. Both of these types of schedules are further classified as; fixed, or variable. Fixed schedule reinforces after a fixed number of responses or length of time. Variable schedule, however, has changeable reinforcement. It delivers reinforcers after various response requirements or time, and is generally dependent on some average delivery system in the long run.

2.3.2 Relative Response Rate

The single operant analysis, where behaviour is analysed based on one response class on a single schedule of reinforcement, is important for the discovery of basic laws, principles and applications. It is though, more natural to study behaviour as a choice among alternatives. De Villiers and Herrnstein's (1976, p. 1131) view "that choice is merely behavior in the context of other behavior" is appropriate for consumer marketing, when studying brand substitutability. This is because reinforcement on one schedule can affect the response on other schedule, and vice versa. The concept of relative reinforcement is important, in consumer behaviour analysis, as different brands compete for consumer choice. It is called concurrent schedules when two or more simple schedules are simultaneously available (e.g., concurrent VI VI). These schedules are used in experimental matching analysis, on animals, using a changeover delay (COD); a procedure that penalises rapid switching by delaying reinforcement for a brief period after each change of a key (Herrnstein, 1961). The COD is necessary to prevent accidental switching; arising from to little latency between changing a key and acquiring a reinforcer (leads to reinforcement of rapid switching behaviour that prevents any meaningful choice analysis). The duration of the COD can have an effect on the slope of the relative response function. Research has, however, shown that different delays generally don't have much systematic effects (Davison & McCarthy, 1988). In laboratory experiments on human behaviour, factors such as distance between keys have been used to avoid subjects pressing both keys at the same time (Herrnstein, 1997). Such procedure is not necessary in the consumer setting as rapid switching or choosing two brands (reinforcers) at approximately the same time is not a problem, but is seen as normal (matching data is found to be dividing behaviour with other behaviour, not time).

Choice behaviour has mainly been studied on concurrent interval schedules (mostly variable); where the schedule on one key is supposed to be independent of the other schedule (e.g., Herrnstein, 1961; Pierce & Epling, 1983). Concurrent variable schedules induce an allocation of behaviour between the alternative schedules. This does not, however, happen on concurrent fixed schedules, which make subjects show exclusive choice of the leaner (better) schedule - when in a steady state (Herrnstein, 1997, chapter 4; Pierce & Epling, 1999). According to Herrnstein (1997, chapter 4) concurrent VR VR schedules, or something akin to it, is frequently seen in real environments, including consumer situations (e.g., Foxall, Oliveira-Castro and Schrezenmaier, 2004).

2.3.3 The Strict Matching Law

The matching law was discovered by Herrnstein (1961, 1970) and was initially developed by him and his students at Harvard, but is now studied nearly worldwide (see Baum, 2002a; Logue, 2002). It is a molar law[3] which states that relative response rate (behaviour) matches its relative reinforcement (utility: See Herrnstein, 1997), on concurrent interval schedules of reinforcement[4], in equilibrium (see for example Davison & McCarthy, 1988; Herrnstein, 1997). For example, if 80% of all of the reinforcement in an experimental chamber comes concurrently from one of two

[3] Molar accounts of behaviour are concerned with large-scale factors that regulate responding over a long period of time (Pierce and Epling, 1999, p. 395)
[4] Overall response rate on different FI schedules typically does not fit the matching equation very well (de Villiers and Herrnstein, 1976)

possible response sources, then it will be chosen in that exact proportion. The simplest form of the strict matching law for two response possibilities is shown algebraically in Equation 2.2:

$$\frac{B_a}{B_a + B_b} = \frac{R_a}{R_a + R_b}, \tag{2.2}$$

where the B term stands for behaviour frequency, or specific choice, and R means corresponding reinforcers (e.g., per unit time). The reinforcement alternates between R_a which is contingent on behaviour *a* and R_b is reinforcement derived from behaviour *b*, which can also be defined as all other behaviour than *a*. As long as the behavioural possibilities under study are symmetrical (e.g., pecking discs or two identical lanes to drive on) and the reinforcement is indifferent between the behavioural choices, other than reinforcer frequency or any other measurable parameter (e.g., reinforcer amount) then Equation 2.2 above is appropriate. The matching law should therefore, theoretically, be appropriate for accounting for consumer choices between different brands.

The matching law is very well empirically established from laboratory experiments (de Villiers, 1977; Herrnstein, 1997). Although the matching law has this empirical foundation, it can be viewed either as an empirical generalization or as a theoretical (tautological) system of equations used to define how environmental consequences control behaviour (see for example Killeen, 1972; Rachlin, 1971).[5] It is

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[5] Operant behaviour (behaviour that is under the control of its consequences) will, ceteris paribus, match its relative consequences. This is not an empirical question. However, the matching law and its deratives can enhance empirical research that is aimed at discovering what enviornmental factors affect behaviour in particular circumstances. Is it reinforcer frequency, latency etc? It is also worth mentioning that although the matching law is essentially logically true it is not necessarily the best model to account for behaviour. That is an emprical problem.

a simple molar law, which is one of its strengths, but it has univocal explanatory ability and generality. It deals with overall relative frequencies of choice behaviour, which has been very useful and significant in behaviour analysis because it has forced researchers to take into account the competition of different reinforcers. Herrnstein and colleagues (Herrnstein & Prelec, 1991; Herrnstein & Vaughan, 1980) also developed a theory at the molecular level, that they called melioration, to account for how matching occurs in the long run.

2.3.4 Melioration

Melioration predicts that the consumer will always show behaviour which has a higher local reinforcement value each time, but will not take the long run consequences into account (as rational choice theory predicts). It is supposed to predict exactly when the consumer is going to shift from one activity to another.

Unlike melioration, that states which behaviour is the most likely on each occasion, the matching law predicts the behavioural allocation to different possibilities in the long run, when behaviour is steady. It is possible to define behaviour in many measurable ways, as for example time spent, frequency of response, magnitude chosen or as money spent on different brands.

In the analysis that follows the concept of melioration, as Vaughan and Herrnstein (1997) defined it, will be used, but the effects of punishment will be added because this is necessary when dealing with consumer behaviour. A defining character of consumer behaviour like any other economic activity is the reciprocal transfer of rights. It simultaneously presents intended reinforcers and possible punishers (see Alhadeff, 1982; Foxall, 1998). Purchase responses can be reinforced by the acquisition of the commodities, and other benefits, but factors like price and effort can, and will in most cases, make the demand lower than it would otherwise be. The operation of melioration leads to matching in the long run. The reinforcement magnitude will be equal between the brands because of diminishing returns in reinforcement value. If reinforcement (minus punishment) for buying and consuming tomatoes is higher than reinforcement (minus punishment) for buying and consuming chocolate, then melioration predicts that tomatoes will be bought next time and as a consequence the reinforcement value for buying and consuming them will decrease. In most instances this will result in average reinforcement for the different products to be equal in the long run (matching), when every thing else is unchanged. Melioration is the behavioural dynamic which is supposed to lie behind matching. The operation of melioration (with punishment) is shown in Equation 2.3;

$$d\frac{C_a}{C_a + C_b} / dt = f_x(V_a - V_b), \tag{2.3}$$

where V_a and V_b are functions of reinforcement and punishment per unit time that the consumer spends on a particular brand, which here are two. The terms C_a and C_b represent money spent on *a* and *b*, which here can mean tomatoes and chocolate, with a fixed income (C_a + C_b=1). It is assumed that the function f_x is differentiable, strictly monotonically increasing and $f_x(0) = 0$ (the analysis is built on Vaughan, 1985, with added punishment effects on choice behaviour). Equation 2.3 shows that if reinforcement minus punishment for brand *a* is more than for brand *b* then relatively more money will subsequently be spent on brand *a*. The process that the equation describes comes into equilibrium when:

$$V_a = V_b. \tag{2.4}$$

For consumer behaviour the assumption is that the value (V_i) for a particular circumstance is a strictly monotonically increasing function of reinforcement minus punishment in that situation: $V_i = g(R_i - P_i / T_i)$, where R_i represents reinforcement (for example the magnitude of reinforcers) in situation *I*, P_i represents punishment (for example price) and T_i stands for unit of time. By defining melioration with punishment in this way the molar law will be able to account both for the effects of reinforcement and punishment on behaviour in the form of the positive and negative law of effect.

2.3.5 The Positive and Negative Law of Effect

As there is general agreement in the behavioural and social sciences that behaviour is influenced by its benefits and costs,[6] it is important to add punishment to Equation 2.2. De Villiers (1980) presented Equation 2.5 to account for how reinforcement and punishment work simultaneously on behaviour. From the theoretical point of view of Herrnstein's (1970) matching law:

[6] For example utility/price in economics, and reinforcement/punishment in psychology. These concepts are also used in fields like criminology, political science, and many other social sciences. This comes generally in the form of customer satisfaction/utility, price, and effort in marketing.

$$\frac{B_1}{B_2} = \frac{(R_1 - P_1)}{(R_2 - P_2)}. \tag{2.5}$$

De Villiers' (1980) equation states that punishers (P) directly decrease the strength of reinforced behaviour and shows exactly how reinforcement and punishment jointly control behaviour.

The above equations of the strict matching law (2.2 & 2.5) describe choice behaviour only accurately in symmetrical choice situations. Although it is possible to add parameters to the equations to account for different quality of reinforcers (Miller, 1976) or other parameters such as reinforcer amount or delay (Herrnstein, 1997), most researcher today choose to use the generalized matching equation when studying matching.

2.3.6 The Generalized Matching Equation

The generalised matching equation (Baum, 1974a, 1979; Lander & Irwin, 1968) was developed so that data that did not conform to strict matching could be portrayed in the same terms as strict matching data. It "is a generalization of the strict matching law in the sense that the strict matching law is a special case of the generalized law" (Davison & McCarthy, 1988, p. 48). It is considered an improvement from the stricter version (McDowell, 2005) and measures how well the strict matching law can account for choice behaviour (see Equation 2.6):

$$\frac{B_a}{B_b} = c\left(\frac{R_a}{R_b}\right)^a. \tag{2.6}$$

Here the terms B_a, B_b, R_a and R_b represent behaviour and reinforcers as in the equations above. The parameters *c* and *a* are free and found by getting a straight line through data of relative response (choice behaviour) and relative reinforcers transformed logarithmically (Equation 2.7);

$$\log\frac{B_a}{B_b} = a\log\frac{R_a}{R_b} + \log c\,. \tag{2.7}$$

The parameter *a* accounts for the sensitivity of preference to changes in the independent variable and *c* is inherently biased. When both *a* and *c* are equal to one then the data shows strict matching. Then Equation 2.7 is equivalent to Equation 2.2, the strict matching law (for a discussion of the generalized matching equation and its parameters see Baum, 1979; Lowe & Horne, 1985).

2.3.7 Different Dimensions of Matching Analysis

Matching analysis can take different forms. Choice can show perfect matching, over-matching, under-matching, anti-matching and bias. The slope (*a*) gives a measurement of how much choice behaviour changes when the reinforcement ratio is altered. The parameter (*b*) represents the intercept or bias, a constant preference for one alternative over another for all points of the independent variable (Davison & McCarthy, 1988).

It is called overmatching (Baum, 1979) if the value of *a* (the slope) is higher than 1 because choices favour the richer reinforcement schedule. This means that the subject chooses this particular possibility (B_a) more often than the proportional reinforcement dimension for the option is [log(R_a / R_b)]. In the laboratory this is considered to be a problem of design if the reinforcers are supposed to be equivalent; indicating that one of the alternatives is qualitatively different, or that switching is being penalised too severely. However, if relative choice behaviour is allocated less to the target behaviour (B_a) than anticipated from the basis of relative reinforcement, it is called undermatching (Baum, 1974a). This can indicate that either switching between alternatives is accidentally reinforced or that subjects discriminate poorly between the alternatives (Herrnstein, 1997).

In the case of bias there is a systematic preference for an alternative not explainable from the view point of the strict matching law (from the perspective of one dimension of objective reinforce elements, e.g., relative rates of reinforcement alone). Bias indicates differences between response requirements (e.g., different shelf placements for different brands) or reinforcer parameters (e.g., different brand qualities or delivery time). This is represented by the intercept in Baum's generalized matching equation (see Equations 2.6 & 2.7). In terms of antimatching, when an increase of choices of one alternative increases the selection of a second option, the reinforcers (products or brands) are gross complements instead of substitutes (e.g., red wine and a steak). This makes the slope parameter a less than 0 (Foxall, 2007). In all, the generalized matching equation (sensitivity to reinforcer dimensions, reinforcer parameters and response requirements), accounting for consumer behaviour, should be under the influence of all traditional independent variables known in microeconomic analysis (see Lea, 1978, for a discussion of the analogy between reinforcement analysis and demand analysis).

2.3.8 The Concatenated Generalized Matching Equation

It is possible to use many independent variables for the generalized matching equation. These can, for example, be variables that research has shown affect behaviour such as; rate, amount, immediacy, and quality of the reinforcers or response effort (for a review see Fisher & Mazur, 1997). To account for this within the framework of the generalized matching equation it is possible to use the concatenated generalized matching equation (Equation 2.8):

$$\log \frac{B_a}{B_b} = a_r \log\left(\frac{R_a}{R_b}\right) + a_m \log\left(\frac{M_a}{M_b}\right) + a_q \log\left(\frac{Q_a}{Q_b}\right) + a_d \log\left(\frac{D_b}{D_a}\right) + \log c . \qquad (2.8)$$

Where R, M, Q, and D represent reinforcer frequency, amount, quality and delay. If it is possible to assume that the effects of the independent variables do not interact, then the concatenated generalized matching law can be relevant and useful when researching the effects of two or more independent variables (Landon, Davison, & Ellife, 2003).

Critchfield, Paletz, MacAleese, & Newland (2003) used the generalized matching equation to test the prediction of Equation 2.5 on human behaviour and compared it to other equation which is in the tradition of two-factor theories of punishment. Their results showed clearly that punishment directly reduces reinforced behaviour in the data for 6 of 7 subjects in their research:

$$\log \frac{B_1}{B_2} = a \log\left(\frac{R_1 - P_1}{R_2 - P_2}\right) + \log c . \qquad (2.9)$$

These results are consistent with other research (de Villiers, 1980; Farley, 1980), on nonhuman behaviour, which has pointed to the superiority of a direct-suppression punishment model. This increases faith in the generalization of experimental results that have tested the effects of punishment on nonhuman behaviour.

2.4 Experimental Research on the Matching Law

Research on the matching law has mostly been done with animals as subjects but some have been done on human behaviour. Research on human behaviour from the framework of the matching law has been increasing. This is how the science of behaviour analysis works. It starts on a simple level of analysis, such as experiments on animal behaviour, and then moves on to generalisation and studies on a more complicated stage. It is possible to classify matching research as that performed on animal/human behaviour, and in open/closed settings.

2.4.1 Open-Closed Settings

In accordance with the summative behavioural perspective model (see section1.1.3.4), and the matching law (Equation 2.2: More reinforcers in the denominator, *ceteris paribus*, mean less behavioural control from each, and vice versa); I propose a continuum of closed-open behaviour settings where the researcher has a different degree of control over the environment. A closed setting can be characterised as a situation were only few reinforcers are available and one has a great effect on behaviour. The researcher has control over deprivation and controls the delivery of the reinforcers to behaviours, which are clearly defined, and there are no effective alternative operant consequences (Schwartz & Lacey, 1988). Experimentation on animal behaviour in the laboratory can be example of the most closed setting related to the matching law. Thereafter, on the continuum, come experiments on human behaviour in the behavioural laboratory, studies on human activity in closed natural settings, and then studies on animal and human behaviour in open natural environments. One of the most open settings where the matching law has been used, on human behaviour, is the supermarket (for example see Foxall, Oliveira-Castro, & Schrezenmaier, 2004). If analysed according to the above classification of Schwartz and Lacey (1988); the supermarket has near uncountable numbers of reinforcers, where many can have a strong impact on behaviour, and the researcher has no control over deprivation or satiation. The consumer can choose whatever he likes and can afford, he can come hungry, or full, and freely wander around, and walk out when he wants (see Foxall, 1998, for a discussion).

In what follows I will go over important research on the matching law from research done in open-closed settings, and looking at animal–human behaviour. The discussion will go from closed to open settings; where as the setting becomes more open it is of more interest to the topic of this research. For this reason the research carried out in the most closed setting, in which animals were subjects, is not presented here in full detail. This will only be mentioned in terms of experiments conducted to compare the prediction of matching and maximization accounts of behaviour.

2.4.2 Matching Versus Maximization Accounts of Behaviour

One of the advantages of the matching law is that it does not rely on strict assumptions like rational choice theory, whose predictions do not hold up in results from empirical research, when the theory is fully understood (section 2.4.1 above). In fact, the matching law has been shown to be able to predict behaviour that researchers in behavioural economics have interpreted as going against the assumptions of rational choice theory. The matching law, for example, does not predict that utility (reinforcement) is always maximized but specifies when that happens and when it fails. It also predicts other departures from rational choice theory; like peoples' choices conforming to hyperbolic discounting of delayed outcomes, preference reversals, and predilection for rewards that are in the near future. Rational choice theory does not predict these outcomes, at least not unless consumers receive new information. Here the usual prediction of rational choice theory goes against common sense and empirical results (e.g., Herrnstein, 1997). The following two Equations (2.10 & 2.11) show the difference between matching and maximization. The matching law states, as mentioned above, that the average reinforcement per response is equalized across alternatives in equilibrium:

$$\frac{R_1}{B_1} = \frac{R_2}{B_2}. \qquad (2.10)$$

Where R means reinforcement (utility), and B is behaviour, or specific choice. Behaviour is thus orderly, according to the equation, but not necessarily rational. A utility maximization law, in contrast, states that behaviour should be equal to marginal utility per response when it is steady:

$$\frac{\delta R_1}{\delta B_1} = \frac{\delta R_2}{\delta B_2}. \tag{2.11}$$

Although both these equations sometimes predict the same behavioural outcome they do not replicate each other. In experiments that are programmed so that the equations should predict different behaviour, the outcomes support the matching law (see for example; Herrnstein & Prelec, 1991; Heyman & Herrnstein, 1986; Vaughan & Herrnstein, 1997). It remains, however, an open question how much impact these kinds of experiments have on economists. In a commentary section on an article by Heyman (1996), in the Behavioural and Brain Sciences Journal, where he among other things, discusses some of the research that has supported the matching law but not maximization, David Laibson (1996), professor in economics, writes:

> Of course they did not actually make the best choices possible. For example in the experiments conducted by Herrnstein, Prelec and Vaughan subjects would have earned more compensation from the experimenters by choosing the response associated with maximization. Like most economists, I interpret these experiments as cases in which actors made bad decisions but did not realize it at the time. If the subjects had known better, they would have changed their actions. (p. 584)

It is of course, a given that if the subjects had chosen the responses that were associated with maximization then they would have gotten more. Here the ability to save the "theory" from every empirical test is apparent. The outcomes from empirical research seemingly do not matter. Rationalists can always save their beloved old theory.

2.4.3 Research on the Matching Law with Animal Behaviour in Open Settings

Baum (1974b) published an important quasi-experiment where he studied a flock of free wild pigeons which lived in the attic of his house. Pigeons had access to grain through an experimental apparatus with different concurrent variable interval schedules. The results showed that the pigeons' choices conformed to the matching law. This experiment showed that matching for animals was not a creation of the laboratory procedure. This is because the pigeons were wild and the apparatus recorded the combined responses of many pigeons. Therefore, the animals could choose from a wide range of different reinforcers, and Baum had no control over deprivation (see also a similar experiment in Graft, Lea, & Whitworth, 1977). Related to this kind of open environment research are studies on the matching law, and the equivalent optimal foraging model of ideal free distribution, done on group choice (for a discussion see Kraft & Baum, 2001). This kind of research has, though, also been done on animal and human behaviour in closed settings.

2.4.4 Research on Human Behaviour in Closed Settings

The matching law has generally been used to predict human behaviour with good results. The amount of research on human behaviour is thought small compared with research done on animal behaviour. It is possible to roughly classify the research done on human behaviour from three types of closed settings; experimental setting (e.g., Bradshaw & Szabadi, 1988; Chritzfield, Paletz, MacAleese, & Newland, 2003; Goltz 1999; Hantula & Crowell, 1994; Horne & Lowe, 1993; Lowe & Horne, 1985; Shroeder & Holland, 1969); hospitals and mental institutions (e.g., Martens & Houk, 1989; Oliver, Hall, & Nixon, 1999); schools and universities (e.g., Beardsley & McDowell, 1992; Conger & Killeen, 1974; Martens, Lochner, & Kelly, 1992; Mace, Neef, Shade, & Mauro, 1994). In addition to this research it is worth mentioning a study by McDowell (1982/1988) that has similarities to the studies taking place at the hospitals and mental institutions. McDowell reappraised data originally published by himself and Carr (1980). He evaluated the relation between a boy's serious scratching, taking place at his home, and his parents' reprimands that occurred contiguously with the self-injury. Results showed that the matching equation closely predicted the proportion of time the boy spent engaging in self-injury. This correlation was useful for McDowell to experimentally test the hypotheses that the reprimands served as positive social reinforcement for scratching. The functional analysis supported the hypothesis, and behaviour modification was used to eliminate the problem behaviour.

Overall, the matching law accounted well for the data in the above research (except for a considerable undermatching and bias in the study by Mace, Neef, Shade and Mauro, and the two studies published by Horne and Lowe). Mace and colleagues pointed to the importance of adjunct procedures (e.g., COD and timers) in matching research. In the studies by Horne and Lowe, some subjects' behavioural data showed approximate matching - but other departed greatly from the prediction of the matching law. Regardless of this, the experiments by Horne and Lowe indicated the importance of matching research by pointing to the possibility that choice behaviour is both influenced by the current reinforcement contingencies and the subject's verbal rules. This is an idea that has stimulated other researchers in the field (e.g., Foxall, 1998, see the utilitarian – informational bifurcation in the BPM; section 1.1.3.4).

2.4.5 Research on Human Behaviour in Open Settings

There have been taken bold steps in the direction of studying the predictability of the matching law on human behaviour in open natural settings. As stated before (2.6.1), open setting is here defined as any environment which has numerous available reinforcers; where many can have an effect on behaviour (inversion of Schwartz & Lacey's, 1988, definition of a closed setting). The open systems can be contrasted with the closed controlled environments of the laboratory, clinical settings, and schools. The matching studies, in open settings, have been undertaken in two different areas of research; sports competitions and consumer marketing. Both types of research have a similar bearing for the external validity of the matching law, and seemingly uniform development, strengths and weaknesses. It is, however, interesting that the two research streams have not, to date, made any reference to each other.

2.4.5.1 Research on Behaviour in Sports

In the area of sports behaviour Vollmer and Bourett (2000) published an important study for the enhancement of the external validity of matching research. They showed that the relative frequency of two- and three-point shots in a college basketball division matched the relative frequency of the proportional reinforcement rate (scores) produced by each type of shot. The researchers had no control over the behaviour but used a version of the concatenated matching equation (2.12) to describe the allocation of two- and three point shots:

$$\frac{B_1}{B_1 + B_2} = \frac{R_1(1.5A)}{R_1(1.5A) + R_2(A)}. \tag{2.12}$$

As three point shots give more scores than two point shots (3:2 →1.5:1) the concatenated matching equation, applied in the study, used a reinforcement frequency parameter (R), in the form of point's acquired, and a reinforcement amount constant (A), representing the difference in reinforcement between the two alternatives.

Reed, Critchfield, and Martens (2006) followed-up on the sports study by using the generalised matching equation to describe play-calling data from the American National Football League. The results showed that the matching equation accounted for most of the variance in play calling, although some undermatching and bias was identified. Possibly one of the most interesting contributions of this study to the external validity of the matching law was that the researchers were able to show that estimated matching parameters varied in accordance to important sports conditions such as team success.

Although the sport matching studies are important explorations of the relevance of the matching law in real open environments they have some limitations that can be classified either as problems of reinforcement schedules, or lack of environmental control. The problem of reinforcement schedules is that these sport matching analyses differ from other matching studies in a way that both basketball shooting (see discussion in Vollmer & Bourret, 2000), and passing and rushing, are best described as being maintained on ratio schedules, but, as previously mentioned, nearly all matching research has been performed on behaviour maintained on interval schedules. The reason for the traditional restriction to the interval schedules, most often concurrent VI VI schedules, is that it provides a pure independent variable and behavioural allocation, whereas ratio schedules produce interdependent "independent" variables and monotinical choice patterns, not very suitable for the analysis of choice behaviour (see e.g., Pierce & Epling, 1999). As the matching law predicts exclusive choice allocation to the leaner, or better, schedule on concurrent ratio schedules (Foxall & Schrezenmaier, 2003; Herrnstein & Loveland, 1975) there is a serious misunderstanding in stating that the matching law predicts behavioural allocation in the sports research. This holds as long as there is an agreement that the behaviour is on ratio schedules, or more accurately, to what extent it is best characterised by ratio schedules. Scoring (reinforcement) is most likely affected not only by frequency of shooting, but also by time, as both two- and three-point shots should be more effective if they are performed unexpectedly, something that should be a function of time (see the tennis riddle in Herrnstein, 1990; and discussion of this point in Vollmer & Bourret, 2000). The sport matching results contradict anticipated choice data from concurrent ratio schedules in being well accounted for by the generalised matching equation (as it should be on interval schedules), as the behavioural allocation quite fairly corresponded to the relative reinforcement produced. However, the meaning and the importance of this relationship is questionable because ratio schedules compel matching, as more behaviour allocation must mean more reinforcement (at least in most instances). This means that the supposed dependent variable drives, at least in part, the independent variable.

The other problem mentioned in the sports studies, lack of environmental control, is attached to the schedules problem of interdependency. As these studies have no experimental control the correlational research is not equipped to deal with the problem of functionality; which variable is controlling which? The problem of reciprocal control is not restricted to studies on behaviour maintained on ratio schedules, but it certainly does not make things easier, especially where there is no experimental control. In previously mentioned research by Martens and Houk (1989), using VI VI schedules, they discuss the problem of interdependency in their correlational matching study on the compliance of an 18 year old developmental disabled girl, where it is hard to specify whether the teacher's attention ("reinforcement") is controlling the students behaviour or vice versa. This problem with experimental control is, however, more serious when there is little doubt that the "dependent" variable is a source of variation in reinforcement delivery, as is the case for concurrent ratio schedules.

The newest publication in the series of sport matching research is a further analysis of the two- and three-point shot allocation, published by Romanowich, Bourret, and Vollmer (2007). It attempts to deal with the lack of experimental control - but doesn't mention schedules of reinforcement. The research replicates and adds to the original study (Vollmer and Bourret, 2000), by analysing National Basketball Association (NBA) data from 1991 to 2000. During this time, the distance of the three-point line was decreased in 1994, but was increased again in 1997. This gives data in line with a quasi-experimental ABA reversal design where the reinforcement rate should increase during the time period from 1994, when the three-point line distance was decreased (it should increase the frequency of scores from such shots), until it was increased again. The logic is, if the data conforms to the prediction of the matching law, that is if the proportion of three-point shots increases during the 1994-7 period, and then lowers again, it should show that matching provides a valid description of the behaviour, and can be used to predict and control behaviour. In fact, the results do support this claim. The difficulty is, however, that this doesn't support the matching law (on concurrent FR schedules) and it is methodological flawed because if the rule change is successful in increasing the rate of three-point shots – that will automatically lead to an increase in the score. It isn't surprising that more shots (behaviour) will increase scoring (reinforcement) leading to a spurious approximation to matching. In fact, Vollmer, Bourret, and colleagues (Peter, Vollmer, Bourret, Borrero, Sloman, & Rapp, 2005), themselves, warn against the danger of spurious matching. This could result either from the rate of the behaviour under study (the problem behaviour in the article) affecting the rate of reinforcement (attention), or if matching occurs by chance, where there is only correlation between the variables but no functional relation. It seems to me that these methodological problems are unfortunately present in the sports matching research. There is no question if there is a functional relationship between scoring and type of shot; however this relationship is hidden, or overestimated, by the fact that shooting affects the rate of scoring. On top of this, the lack of control over variables, both internal and external, limits the valuation of the matching analyses, and their applications, in the sports settings. This is acknowledged in Vollmer and Bourret (2000) and dealt with cleverly, but in a rather methodologically limited way in Romanowich, Bourret, and Vollmer (2007). The next research steps must aim for further experimental control, which amounts to acquiring the autonomous variables controlled by the researcher as well as control of external variables.

2.4.5.2 Research on Consumer Behaviour

The insufficient amount of research on the matching law in real open settings is surprising for the reason that has been emphasised (e.g., Logue, 2002) and challenged (e.g., Fuqua, 1984) in the literature. The following text taken from Logue (2002) states the need for research testing the relevance of matching on human behaviour in real settings:

> Unfortunately, research that speaks directly to the world outside the laboratory has been limited, with the exception of some clinical settings. There are many areas still ripe for investigation. For example, why not examine, within the quantitative framework of the matching law, the tendency to save or spend money given changes in overall level of income and expenses? Another example might be shoppers' trips to one of two aisles of a grocery store as a function of the frequency of free samples of food in those two aisles.
> (p. 363)

As Logue points out, consumers' settings are an interesting new area for the matching law to be used and tested. In fact, at the time of Louge's publication, this kind of research had already begun under the name of consumer behaviour analysis, with similar promises and problems as the sports matching research.

2.5 Previous Matching Research on Consumer Behaviour

At a molar level of analysis the behavioural perspective model (1.1.3.4) comprehends consumer choices, as they are distributed over time, as a function of the rates of both utilitarian and informational reinforcement (Foxall, 1997b) and punishment (Foxall, 1999b). Here put into an algebraic form in Equation 2.13:

$$\frac{B_1}{B_2} = \frac{(({}_uQR_1 + {}_iQR_1) - ({}_uQP_1 + {}_iQP_1))}{(({}_uQR_2 + {}_iQR_2) - ({}_uQP_2 + {}_iQP_2))} \qquad (2.13)$$

This is the summative behavioural perspective model's matching equation where the only difference with previously shown matching equations (e.g., Equation 2.5) is that the consequences of behaviour are divided to utilitarian[7] (${}_uR$) and informational[8] (${}_iR$), for the two possibilities. Equation 2.13 is here shown to characterise the consumer behaviour analytical standpoint, this equation has not been empirically quantified. It captures the complexity of consumer behaviour as subject matter for matching research.

2.5.1 Correlational Consumer Behaviour Matching

If seen from the point of view of the generalised matching equation, (Equation 2.7) the consumer behaviour analysis research group (Foxall & James, 2001, 2003; Foxall,

[7] See Foxall (1998) and Wearden (1988). The shortest definition of utilitarian consequences, in consumer behaviour analysis, is those mediated by the product.
[8] See Foxall (1998) and Wearden (1988). The shortest definition of informational consequences, in consumer behaviour analysis, is those mediated by other persons.

Oliveira-Castro, & Schrezenmaier, 2004; Oliveira-Castro, Foxall, & Schrezenmaier, 2005; Romero, Foxall, Schrezenmaier, Oliveira-Castro, & James, 2006; see research review in Foxall, Oliveira-Castro, James, & Schrezenmaier, 2007) has studied three different forms of matching relationships in natural consumer settings, with ever increasing scope. In this panel research households, or participants, have gone from just a few (e.g., Foxall & James, 2001) to thousands, with research taking place for a period of time that extends from several weeks to up to a year. Three different kinds of matching, and matching-related, analyses have been performed; amount matching (classical matching), cost matching (relative demand analysis), and probability matching (maximization analysis). The data analyses have all been done within the framework of the generalised matching equation where matching between different variables in the consumer environment (brand amount, brand price, and reciprocal brand price) and some dimension of consumer behaviour have been tested. This research has been performed on the assumption that consumers' buying behaviour conforms to concurrent quasi or analogical FR^a or VR^a (a = the number of brand possibilities) schedules. This means that the market place analogy to the response requirements in the laboratory, brand price, is known (fixed) on each and every shopping occasion (FR) for fast moving consumer goods, but can change with time (VR). Consumer behaviour is considered to be best represented by being maintained on a quasi schedule because the "independent" (e.g., reinforcement in terms of brand amount) and "dependent variable" (behaviour in terms of spending) are reciprocal. For instance, the amount paid (the behaviour) seriously affects the amount bought (the reinforcement) and vice versa. As previously mentioned for the sports matching research (2.6.5.1), this deviates from standard laboratory matching analysis, using variable-interval schedules, which should give a true independent variable because responses do not control this when reinforcers become available. The interval (time period programmed) controls this.

2.5.1.1 Amount Matching

The consumer behaviour analysis research group has studied the connection between relative money spent on a commodity and the proportion of reinforcers earned in the form of quantity of brands. Expressed here in Equation 2.14:

$$\log\frac{S_1}{S_2} = a\log\frac{M_1}{M_2} + \log c \qquad (2.14)$$

where S and M represent money spent and magnitude of brands acquired. It should not come as a surprise, as predicted, that the selection of brands within the same product category showed a rather precise matching relationship, and between product categories (e.g., non independent products) showed some evidence of anti-matching. These results, however, go against the prediction of the matching law as they should, in a steady state, exclusively choose the cheapest brand in the product category (Foxall, 1999c; Herrnstein and Loveland, 1974). However, this only holds if there is an agreement that the brands within the same product categories can be seen as equivalent, something that many marketers would by no doubt reject. On the other hand, if the brands are not gross complements but rather fulfilling many different needs and wants, the results also go against the matching law, as it does not predict approximation to ideal matching in such situations. In fact, that consumers' brand choices, studied on behaviour-behaviour (relative spending - relative buying) analogical ratio schedules, show a matching relationship, is more a question of its tautological nature than its empirical meaning (see Foxall, 1999c, for an initial discussion of problems with translating the matching law to consumer behaviour and an argument for the adoption of the variables; spending - buying, as analogical to behaviour - reinforcement).

2.5.1.2 Cost Matching

In consumer behaviour analysis, price is analysed using behavioural economics methods of relative demand analysis similar to animal experimental studies done by Kagel, Battalio, Rachlin, & Green (1981). This method is unlike traditional economic demand analysis, as it takes into consideration competition among competing brands in the product category, and uses the x-axis to represent price instead of the y-axis (see a discussion of how psychological and economic demand curves are drawn in different ways in Lea, Tarpy, & Weblay, 1987). As for amount matching, cost matching is also studied using ratio analysis. In terms of matching this denotes the connection between relative reinforcers earned, in the form of the quantity of brands (dependent variable) earned, and proportion of punishment in the form of the cost (independent variable) of them:

$$\log\frac{M_1}{M_2} = a\log\frac{P_1}{P_2} + \log c. \qquad (2.15)$$

Here P stands for average monetary price over the duration of the study. The dependent variable, the relative amount bought, is best represented as being maintained on concurrent ratio schedules, inverse to amount matching; as price goes down, the amount bought should increase (see punishment parameters in Matching Equations 2.5 & 2.9). This relationship is methodologically interesting, as it does not have the problem of interdependency between the independent-dependent variables denoted for sports matching and consumer amount matching analyses. The researcher can control prices (price=aversive stimuli=punishment) which are not a form of behaviour (like the amount bought in amount matching), but true environmental stimuli. The results from previous cost matching analyses (e.g., Foxall, Oliveira-Castro, & Schrezenmaier, 2004) reflect this empirical foundation by showing mixed relative demand curves for purchasing data aggregated across purchasers and stores, where the regression lines show either neutral, downward, or upward sloping demand curves.

2.5.1.3 Probability Matching

As a sub-discipline of behavioural economics, the field of consumer behaviour analysis has been concerned with testing maximisation theory in the form of the amount of brand returns on price. This has followed procedures originally used to compare the predictions of probability matching and maximisation (cf. Herrnstein & Loveland, 1975). As previously stated in section 1.2, the matching law differs from probability matching, although the two are formally related (Herrnstein, 1970; Herrnstein, 1997; Herrnstein & Loveland, 1975). In the animal laboratory probability matching analysis determines that on concurrent ratio schedules there is a fixed probability of gaining a reinforcer for each response. For example, in this case a

VR30 VR 60 reinforcement schedule means there is a probability of 1/30 and 1/60 of getting a reinforcer on the schedules. On concurrent ratio schedules, both maximisation and matching theories predict exclusive responding on the leaner schedule (cf. Herrnstein, 1997; Foxall, Oliveira-Castro, & Schrezenmaier, 2004). Maximisation, in consumer behaviour analysis is studied (Equation 2.16) as the connection between relative reinforcers earned in the form of quantity of brands (dependent variable) and probability of reinforcement; "as the reciprocal of the price of brand A (brand 1) over the reciprocal of the mean of the prices of the other brands" (Foxall, Oliveira-Castro, & Schrezenmaier, 2004, p. 241):

$$\frac{M_1}{M_2} = \frac{\frac{1}{P_1}}{\frac{1}{P_1} + \frac{1}{P_2}} \qquad (2.16)$$

Foxall, Oliveira-Castro, and Schrezenmaier (2004, p. 258) assert that their "results are equivocal on the question whether consumer brand choice is sensitive to price." This is because the cost matching and probability matching, both dealing with demand and price, present equivocal evasive and contradictory results regarding the relationship between prices and the amount bought of a brand.

2.5.1.4 Strength and Weaknesses

Consumer behaviour analysis has to date indicated the importance of using the matching law in consumer research and takes the important step of making a research program where the matching law is researched in open settings. Johnston and Pennypacker (1993) point out that "[d]oing science is not a matter of following specific rules like recipes in a cookbook. Cookbooks may work quite well when the recipe is well tested, but scientific discovery is more like creating the recipe in the first place (p. 13)."In accordance with this, the consumer behaviour analysis research group has created methodological recipes (see e.g., Foxall and Schrezenmaier, 2003) which get increasingly more challenging and extensive. They show behavioural and consumer scientists how it is possible to interpret and perform consumer matching research, something that was previously only speculated about (e.g., Logue, 2002; Vaughan & Herrnstein, 1997). This makes the methodological strengths and weaknesses of correlation research, of the particular matching equations used, clearer. But further methodological exploration is needed to assess the capability of the matching law, and the behavioural perspective model in consumer research. The power of behaviour analysis has not yet been explored. It is not known how the different matching analyses, with their respective strengths and weaknesses, will fare in experimental fieldwork on consumer behaviour.

2.5.2 Experimental Consumer Behaviour Matching

> Marketing action consists mainly in altering the scope of consumer behavior settings and manipulating the system of rewards which maintain various patterns of consumer choice. (Foxall, 1996a, p. xii)

A behaviour analysis begins with complex behaviour and breaks it down into its components, and functional analysis holds the stimuli and responses of interest constant, while changing their relations (Catania, 1998). This is the ideal methodology that has mainly been used in research on the matching law. The aim of behavioural psychologists and analysts is to describe, predict, and control behaviour. Foxall (1998) recognises this: "given the radical behaviourist provenance of the BPM, the capacity of its analysis to lead to prediction must be demonstrated...and to comprehend the control of consumer behaviour in its various environments" (p. 56 and 57). Acknowledging this, we have a criterion to appraise different ways of doing behavioural science. When comparing different descriptions of behaviour it is important to focus on the invented concepts and try to use those which make for economical and comprehensible descriptions of behaviour (Baum, 2005). By focusing on control, the effectiveness of different methodologies is assessed by looking at the degree of control over the target behaviour that can be produced by each approach (Johnston and Pennypacker, 1993). Foxall (1998, p. 338) asks the important question; "How far can the control of behaviour be attributed to the environment when the setting is relatively open." The sufficient condition for identifying functional relationships is the experimental manipulation of an independent variable (Johnston & Pennypacker, 1993). To answer Foxall's question it is thus necessary to manipulate the retail environment and see how it affects consumer behaviour. By not being able to control, or hold constant, important variables of the concatenated generalised matching equation (e.g., reinforcement schedule, effort, and quality), it is hard to find the sole effects of marketing mix variables; like price, shelf placements, and in-store advertisements, on consumer choice. This is because all these variables intervene to produce the results in a purely statistical research.

Consumer behaviour analysis, as a sub discipline of behavioural economics and applied behaviour analysis, has the agenda of fully exploring the usefulness of these parent disciplines in real marketing systems. In this respect the matching law has been researched with panel data, in different forms and with ever increasing scope, in real environments (e.g., supermarkets). However, examination of the experimental techniques, with their possible ability to control and surrender the situational influences of real marketing mix variables on consumer choice and matching relations, will now commence.

2.6 Summary

Chapter 2 has critically examined topics in consumer marketing from several psychological and economic perspectives; and how these parent fields combine their forces in economic psychology, or behavioural and experimental economics. The discussion has focused on the importance of consumer behaviour analysis which has transferred concepts and data analyses, originally generated in the behavioural laboratory, to consumer choice research in the marketplace. Within the reviewed framework of matching research, Chapter Two has enforced this conduct by arguing also for the transfer of behavioural analytical research methods and relevant data analysis. How experimental control and relative choice analysis have the possibility to shed further light on methodological problems in this area of research, such as those of reinforcement schedules and lack of environmental control has been discussed. This was necessary to make possible a judgement of the validity and importance of consumer choice and matching research in terms of generating data which are possible to evaluate in terms of behaviour analytical and marketing criteria. As both these fields are applied in orientation, by focusing on the effects of important marketing variables on the matching relationship, important new data will hopefully emerge to enhance the ability of this kind of research to accurately and logically describe, predict, and control consumer behaviour. This possibility has created the foundation for Chapter Three, which reveals the newly generated behavioural in-store experiments, built on alternating treatment design. Their results and interpretations, e.g., in terms of visual inspections of functional relationships and minimisation of behavioural variability, will be revealed in later chapters.

CHAPTER THREE

METHODOLOGY

The aim of the research has been rationally explained and stated in Chapters One and Two. The study is a methodological exploration of the relevance of in-store behavioural experiments. It is part of the consumer behaviour analysis agenda of investigating the relevance of behavioural economics in the context of marketing. This chapter shows how the experimental method of behaviour analysis, choice, and matching analysis, are laid down in the realm of economic behaviour. It studies how important marketing factors affect consumer choice in complex, real, affluent, and competitive retail environments. More precisely, three of the traditional marketing mix factors are manipulated to explore their effects on consumers' buying behaviour. The main question is to what extent the behaviour analytical methodology can answer what effects certain periodical changes in the factors of Place, Price, and Promotion have on consumers' buying behaviour in the retail environment

The chapter begins with deriving open ended experimental questions for the three major interventions, building on Chapter One. After that, similarities to and deviations from characteristic behaviour analysis (including behavioural economics), performed on lower and simpler levels, of this study are discussed. The main emphasis of this section is to describe the research methods employed. Involving topics like; samples, interventions, research design, and procedure. The chapter finishes with detailing how the data from the in-store experiments are analysed. This is done within the extended matching framework characterised for previous consumer behaviour analysis research on consumer brand choice, described in section 2.5.1, and relative sales analysis.

3.1 Derivation of the Experimental Questions

> In order to eliminate or overcome bias [from perfect matching], Pierce and Epling (1983) suggest several possibilities, which are here looked at from a marketing perspective. These authors suggest manipulating efforts, punishment, inequity and reinforcement in order to change consumers' behaviour as a solution. This could for instance imply a changed positioning of a product on a supermarket shelf, making it easier or harder for consumers to see and reach for a particular brand. It could also entail that a manufacturer or marketer would use certain advertising techniques in an attempt to increase a brand's (informational) reinforcement. (Schrezenmaier, 2005, p. 216)

In Chapter One the objective of the study was described as one open ended experimental question. Here stated again:

> How can in-store behavioural experiments, with relative sales and matching (or matching-related) analyses, help to get valid and reliable knowledge of the effects of marketing mix factors on consumer choice in real and open settings?

To answer the question three behavioural in-store experiments, using alternating treatment design, were performed. The data were analysed from the perspective of the matching research program, where all behaviour is choice (e.g., Herrnstein, 1997). At this stage it is important to clarify the nature of the in-store experiments which also have more direct marketing questions to answer.

3.1.1 Price, In-store Experiment

The first in-store experiment manipulated the price of a target brand in two related product categories, shampoo and conditioner. The price was periodically reduced, according to an experimental design (see Appendix Two). This tested the effects of a price reduction of an international shampoo and conditioner brand (Procter & Gamble's Pantene® brand line), as a "target brand", against their relevant product categories (shampoo and conditioner). This is a well known brand, but its market share is less than one would expect, with about 5% market share in Iceland over the last two to three years (Markaðsgreining IMG/AC Nielsen, 2006). Therefore, there is a distinct possibility of increasing the dependent variable (relative sales of the target brand).

The in-store experiment was performed in two convenience stores and two supermarkets. It should be possible to see if the intervention has had different effects, depending on store type (convenience stores and supermarkets) or product category (shampoos and conditioners).

When analysing results from a price experiment it is reasonable to emphasise the cost matching analysis (demand analysis). It is hard to predict the results of the price intervention. The academic fields of economics, marketing, and consumer behaviour analysis, reviewed in Chapter One and Two, provide no straight answer. Economists and marketing scientists could refer to the "law" of demand but both disciplines allow for upward sloping demand curves, be it because of "signalling" or "price-based quality" heuristics. From the perspective of behaviour analysis, or behavioural economics; price on its own should generally be seen as aversive, or punishing, and therefore lower demand. However, it is possible in some cases, to look at price as having a motivational operation (section 1.1.3.2): Some consumers' behaviour has been reinforced for buying high priced brands (e.g., with quality) and this price, although not being a discriminative stimuli for buying (because it is not enough of a factor to set the occasion for that behaviour), can possibly alter the effectiveness of the brand, and make its consumption more likely.

Prior consumer behaviour analysis research, with panel data, has shown mixed results where relative demand curves have been neutral, downward, and upward sloping in aggregated studies (see Foxall, Oliveira-Castro, James, & Schrezenmaier, 2007). Seen from the perspective of the summative behavioural perspective model of consumer choice, all these disciplines have in common building their interpretations of the effects of brand price on consumer choice as utilitarian and informational in some way. One would first expect price to act as a budget constraint, limiting demand, but if results show otherwise, the researcher will justify it with some kind of informational consequences (signal for product quality or the "snob" effect).

The amount matching curve, supposed to measure the substitutability of brands (e.g., Foxall, 2007), should shift to the right as consumers pay less for the target brand, and the probability of reinforcement should increase. These results are most likely since the price decrease interventions directly reduce the price parameters used in the amount matching and reinforcer probability matching formulations (the "dependent" variable!). The experimental question, at the marketing level, of relevance is:

> What are the effects of different price, of the target brand, on consumer choice, and different dimensions of matching (substitutability of brands)?

From the point of view of behaviour analysis the question is related to the functional effects of price on consumers' choice behaviour, where money is generally interpreted as a generalised conditioned reinforcer (e.g., Martin & Pear, 1999; see also Lea & Webley, 2006, for a critical discussion). As such it should be expected, in accordance with behaviour theory (as well as economic theory), that a significant reduction in the price of a commodity should increase its relative sales, everything else being equal. Price acts as a response cost because the consumer has to give up a generalised conditioned reinforcer (money) following the buying behaviour, where he receives another reinforcer (the brand). Logically, the consumer should not do this unless the reinforcer received has more value than the money given up.

3.1.2 Place, In-store experiment

The second class of in-store experiments investigated the effects of different shelf placements on consumer brand choice. The product category used, crisps, is considered to be an example of an "instant buy" and sales are thus supposed to be sensitive to shelf positioning. As this intervention changes behavioural effort, it should alter the substitutability of brands (matching). The target brand (Procter and Gamble's Pringles®) should be preferred less in upper and lower shelves compared with the middle shelf, considered to be the best shelf for sales (section 1.1.2.2). The target brand is a well known international brand, with about 10% share of the crisps market in Iceland for the last two to three years (Markaðsgreining IMG/AC Nielsen, 2006). The in-store experiment was run in three different types of store; convenience stores, supermarkets, and budget stores (two of each). The "Place" experiment adds the budget store as a setting. This is something that was difficult to perform in the "Price" in-store experiment, because the budget stores have fierce price competition, and are therefore reluctant to change prices as it will show in price information published in newspapers. This can create price competition with a "slide" effect in the form of the competition lowering prices in many product categories. The "Place" experiments focus on the effects of reinforcer-effort (e.g., search cost) on consumers' choice behaviour, and matching in terms of the reinforcer-amount and probability of reinforcement. The open ended question is:

> What are the effects of different shelf placements of the target brand, on consumers' choices, and the different dimensions of matching (substitutability of brands)?

It is expected that relative sales of the target brand, compared with the rest in the product class, will be higher on the middle shelf compared to the lowest or highest shelf.

3.1.3 Promotion, In-store Experiment

The third field experiment introduced an in-store advertisement (see Appendix One) highlighting a particular brand's benefit. This point of purchase stimuli was present, and absent, according to a repeated measure experimental design (see Appendix Two). The in-store advertisement was intended to motivate consumers to buy a premium international washing-up liquid brand (the target brand: Procter & Gamble's Fairy®). It is supposed to entail better quality and last longer than competing washing-up liquid brands. Overall, the target brand is a market leader in Iceland with about 50% market share for the last two to three years (Markaðsgreining IMG/AC Nielsen, 2006). As for "Place," the "Promotion" in-store experiment was run in three different types of stores; convenience stores, supermarkets and budget stores, and again two of each were used.

As branding is the preoccupation of marketing practice (Abraham & Lodish, 1990), the in-store experimental method is an interesting new approach to objectively investigating the effects of branding. Although weak, the marketing literature supports the notion that in-store advertisements generally increase sales. From a behavioural point of view this is a question of whether such an advertisement can function as a motivational operation (see section 1.1.3.2). The detailed marketing question is:

> What are the effects of an in-store advertising of a utilitarian benefit on consumers' brand choice and matching (substitutability of brands)?

3.1.3.1 Technical Interpretation of the Promotion Experiment

In behaviour analytic terminology, the presence of the primary brand, for example, the target brand of washing-up liquid, is a discriminative stimulus for a particular segment of the store's customers, as they are more likely to buy the brand if it is present on the shelves. For the other segments of the store's customers (e.g., who like to buy the cheapest, private label) it is possible to assume that the presence, or absence, of Fairy® has no effect; making the target brand stimulus neutral. This is the three term contingency that is in effect during the baseline and comparison periods (presence of the target brand [S^D] $->$ buying of the target brand [R] $->$ amount of the target brand [S^{r+}]) in the "Promotion" in-store experiment. In addition to this stimulus control (for the target brand's consumers) the experiment introduces a fourth factor, the in-store advertisement of a utilitarian brand's benefit (in essence: the target brand is better and lasts longer than the competition). This stimulus is intended to be an unconditioned motivational operation (Laraway, Snycerski, Michael, & Poling, 2003), meaning that no learning periods were presented to change the effectiveness of consequences. Trying to capitalise on possible existing stimulus control, the advertisement presents a rule in the form of a four-term contingency of reinforcement (rule: "buy the target brand (Fairy®) as it lasts longer" $->$ presence of Fairy® $->$ buying Fairy® $->$ utility in the form of the brand fulfilling the want of giving a good washing-up for a longer time, making it practical in terms of money spent, and less trouble of having to buy a new washing-up liquid soon). These are consequences in the future. When consequences of behaviour are delayed and rapid behaviour change is desired, rules are especially helpful (Martin & Pear, 1999). The message is aimed at reducing the most aversive factor associated with buying the brand (utilitarian punishment; it is the most expensive). Therefore, the intervention phases are planned to have a four term contingency – the in-store advertisement [intended *Motivational operation*] $->$ the presence of Fairy® in the shelves [S^D] $->$ Buying of Fairy® [*R*] $->$ amount of Fairy® that lasts longer than competition [S^{r+}].

3.2 Similarities and Deviations from Characteristic Behaviour Analysis

As described in Chapter One, behaviour analysis is built on the method of single-subject experimental designs, where the term "single" refers to the experimental comparison but not the few subjects generally used (Karlsson, 2005; Perone, 1991). According to Johnston and Pennypecker (1993, p.8) "[an] experiment is a series of actions that result in a set of special observations that would not otherwise have been possible." The main purpose of an experimental design is to avoid threats to internal validity by trying to exclude the effects of other variables under study on the dependent variable. This is ideally done by controlling both the variables under study (the independent variables) and other important variables (extraneous variables), thought to affect the dependent variable, and make the effects of the independent variables unclear. This allows the researcher to examine what effects different conditions have on behaviour. Without the ability to intervene, behavioural control is bound to be based on speculations.

When evaluating the behavioural perspective of consumer behaviour research, and marketing in general, it is of importance how much affect, or control, of consumer behaviour can be attributed to the environment. Experiments are the best way to explore this. But unlike the laboratory experimentalist, who can control most or all important variables in the laboratory - like deprivation, reinforcement schedules etc. - the consumer behaviour analyst unfortunately does not have that option; studying, as he/she does consumer behaviour in real settings. There are both strengths and weaknesses in experimental work in consumer behaviour analysis. This is because external validity and the analogous interpretations, built on the findings, are much more related to the actual reality than interpretations built on experimental findings with lower animals as subjects; without wanting to diminish their value. I here propose, in line with the BPM, a continuum of open to closed settings, where the aim for consumer behaviour analysis is to get the most control possible in open real settings (Figure 3.1). This shows how the research, listed here, tries to transfer experimental control to study consumer behaviour in open settings, within the framework of matching theory.

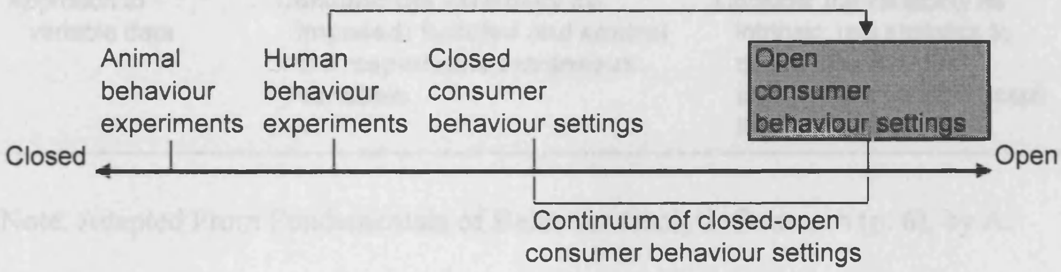

Figure 3.1. Continuum of consumer behaviour settings and the transfer of experimental control from closed to open environments. Note. Adapted from “A Behaviourist Perspective on Purchase and Consumption,” by G. R. Foxall, 1993b, European Journal of Marketing, 27, p. 7-16.

This research tries to keep the rigorous methods and concepts used and developed in the behavioural laboratory, but obviously this can be hard to attain. It is important to be patient in the search for greater control over consumer behaviour, there are many stepping stones. Table 3.1 shows, in a simplified manner, how this study differs in an important way from general laboratory research in behaviour analysis, in that it shares some familiarity to experimental work in general psychology, and related disciplines.

Table 3.1

A comparison of Behaviour Analytical and Traditional Experimental Psychology Research. Applications in this Study (see text)

Dimension	Experimental analysis of behaviour	Traditional experimental psychology
Number of subjects	Few	**Many**
Research desing	**Within-subject**	Between-subjects
Data collection	**Direct, repeated measures of behaviour**	Various methods, often indirect and nonrepeated measures of behaviour
Data analysis	**Graphic**	Statistical
Approach to variable data	**Consider the variability as imposed; isolated and control the responsible extraneous variables**	Consider the variability as intrinsic; use statistics to detect effects of the independent variable despit the variability

Note. Adapted From Fundamentals of Behavior Analytic Research (p. 6), by A. Poling, L. L. Methot and M. G. LeSage, 1995, New York: Plenum Press.

Table 3.1 compares the experimental analysis of behaviour with more traditional experimental psychology. The bold items best correspond to this research. The in-store experiments have many participants, consisting of the consumers in the stores during the experiments. The research uses within-subject experimental design, to the extent that the consumers (in each store) can be looked at as a group. The main point is that the experimental comparison is made within each store's consumer group, but not with some other independent group (between-group comparison). The study uses direct, repeated measures of consumer choice behaviour (e.g., relative sales). This is different from dividing a large number of subjects into two groups, experimental and control groups, where the behaviour of the two groups is generally compared using the rules of inferential statistics (Johnston & Pennypecker, 1993).

Regarding analysis of data, the results are presented in graphic form showing consumers' choices during the baseline and interventions for each store. The data is not put into a data base for the ease of an inferential statistical analysis; not for data from each experiment (e.g., the Price experiment) nor for same types of stores (e.g., budget stores), as would be expected from a social science perspective. This is an exploration of the relevance of behaviour analysis, as represented in the work of Skinner (e.g., 1938) and Herrnstein (e.g., 1961, 1970, 1997), and their followers (e.g., Sidman, 1960, Foxall, 1998). As characteristic for behavioural analytical research, the results chapter presents descriptive statistics such as measures of central tendency, variation, and association (e.g., mean, range, and regressions with slope and intercept) but no inferential statistics (for the pros and cons of the use of inferential statistics in behaviour analysis see an introduction to six articles in Baron, 1999, see also Hopkins, Cole, & Mason, 1998). Instead, visual inspections are used to interpret if there is a difference between conditions (see a critical discussion of this approach in Fisch, 1998). It is important to remember that although the dissertation puts behaviour analysis forward in the realm of consumer behaviour research, it is first and foremost a critical exploration of the behavioural perspective (matching), and those methods advocated by the behavioural research community (e.g., visual inspections, repeated measures, behavioural control). As such, in this case, these factors are tested (like visual inspections) but others, although being worthy of exploration (especially inferential statistics), are omitted.

Concerning attitudes against behavioural variability, I rely on experimental techniques by controlling important extraneous variables, such as the prices of the competing brands, extra-line ups, and other stimuli in the stores; variables not controlled in a correlational study (previous consumer matching studies, section 2.5.1). However, this is obviously a field experiment, meaning that it is impossible to control the environment in the way done in the closed setting of the behavioural laboratory. This study deals with the behaviour to be interpreted, real consumer behaviour in the modern marketing system.

3.2.1 Group Analysis

> [I]nterest may center on an arbitrarily defined collection of individuals who do not interact among themselves in the usual definition of a group but may all respond in the same way in the same setting at least once. This is illustrated by the purchasing behavior of customers in a store. We might arrange to identify by means of sales receipts purchasing responses emitted by a collection of different people who each make at least one such response while in the store. (Johnston & Pennypecker, 1993, p. 81)

Traditionally, behaviour analysis has emphasised the study of individual organisms; analysing the interrelationship between a behaving organism and its environment. The field owes much of its successes to the individual behaviour approach since it, among other things, reduces behavioural variability compared to studying groups (Karlsson, 2005). Strictly speaking, "Behavior is a biological function of organisms, and a group is not an organism" (Johnston & Pennypecker, 1993, p. 81). Lot of valuable information is lost (e.g., individual patterns of behaviour) when researchers study only the behaviour of a number of people. When data are put together it can hide functional relationships. That can also be asserted whenever data are grouped or aggregated, as is done in matching analysis and all molar accounts - a conduct of primary interest to behaviour analysts at least since the 1970's. It is important to allow different kinds of behaviour analysis; studying their strength and weaknesses. Be it molar, molecular, mathematical orientation, or experiments. Each has something to offer, keeping the constraints in mind. For instance, it is necessary to study group behaviour to be able to interpret convincingly the third level (group behaviour/culture) of selection by consequences (genes - individual behaviour - culture) (e.g., Glenn, 1988; Skinner, 1984). In fact, most of the articles included in the previously mentioned (section 2.3.2) literature review of applied behavioural research in consumer choice (DiClemente & Hantula, 2003), present group data.

Studying individuals is not always achievable or of primary interest. In marketing, individual behaviour is important, but for an applied discipline the subject matter is often groups (e.g., segments of consumers), because individuals will not make fast-moving consumer brands successful. Only large numbers of people buying the brand will make it thrive in terms of revenue. In the realms of consumer behaviour, researchers, or marketers want to know what functions stimuli have for consumer choices. In consumer behaviour analysis this has been done on the basis of observational data:

> When dealing with consumer behavior, however, research and managerial interests frequently lie in identifying what functions as reinforcement to large groups of people and, in the large majority of cases, this has to be done on the basis of observational, rather than experimental data. This may increase some already existing ambiguities in defining different types of reinforcement. (Foxall, Oliveira-Castro, James, Yani-de-Soriano, & Sigurdsson, 2006, p.105 and 106)

The Consumer Behaviour Analysis Research Group has built an essential research methodology to study real affluent consumers' choices, both at the individual and group level of analysis (for a review see Foxall, Oliveira-Castro, James, & Schrezenmaier, 2007). This researrch has established the molar law of effect (the matching law) in the realm of consumer behaviour with "correlation between output and feedback" (Baum, 1973, 141), for instance in the form of the relative amount paid for and the relative amount of a brand received. The correlational methodology is important as in many cases there will be no experimental control available to the consumer behaviour analyst. However in some cases, as here, control will be available in the form of interventions. The consumer researchers will be able to perform macro contingencies, defined as; "individual contingencies applied directly to a large number of people" (Branch, 2006, p.6). This can give the researcher better ground for functional relationships, which is important when there is an interest to extend the success of behaviour analysis to the social sciences (like marketing).

Group choice behaviour (where individual behaviour is also examined) has been studied with matching analysis. Its results show that group behaviour by no means mirrors individual choices. Baum and Kraft (1998, p.227) state that "results at the level of the flock in no way paralleled behavior at the level of the individual." They present a generalised matching equation for group behaviour (Equation 3.1):

$$\log\frac{N_1}{N_2} = a\log\frac{r_1}{r_2} + \log c \qquad (3.1)$$

Predicting that group choice, number of predators (*N*), matches obtained resources (r) (Baum & Kraft, 1998). It is possible to transfer this to consumer matching where the number of predators can be seen as analogues to the amount paid, and obtained resources is similar to the amount of brands. In a later publication, these authors (Kraft & Baum, 2001) also state that "experiments demonstrate that an IFD analysis [equivalent to matching analysis] of group choice is possible and useful". This strengthens the foundation for matching analysis conducted on choice data from large groups of consumers.

3.2.2 The Tautology of Amount Matching in Consumer Behaviour Analysis[9]

Although matching analysis has been successfully employed in behaviour analytical research for decades it is inevitably tautological in some versions of consumer research. This holds for amount matching in which relative spending is plotted against relative quantities bought. The relationship between these two parameters will inevitably be a case of biased simple matching where any deviation will be a result of

[9] I want to express my gratitude to Professor Stephen Lea, head of School of Psychology at Exeter University, for the mathematical formulation presented in section 3.2.2.

variations in the price mix of the non-targeted brand. This can be algebraically demonstrated with Equations 3.2 to 3.6. The generalised matching law states that

$$\log\frac{B_a}{B_b} = a\log\frac{R_a}{R_b} + \log c \tag{3.2}$$

where B_a and B_b are response rates and R_a and R_b are the corresponding reinforcement rates. In consumer behaviour analysis, amount matching B_i identifies with S_i, the amount spent on the *i*th commodity, and R_i with M_i, the quantity of the *i*th commodity purchased. Then, generalised matching states that:

$$\log\frac{S_a}{S_b} = a\log\frac{M_a}{M_b} + \log c\,. \tag{3.3}$$

But S_i and M_i are linked by the unit price of the *i*th commodity, P_i:

$$S_i = M_i\ P_i\,. \tag{3.4}$$

It follows that

$$\frac{S_a}{S_b} = \frac{M_a P_a}{M_b P_b}, \tag{3.5}$$

so

$$\log\frac{S_a}{S_b} = \log\frac{M_a}{M_b} + \log\frac{P_a}{P_b}\,. \tag{3.6}$$

Equation (3.6) is biased strict matching, and it results directly from the price relationship (3.4); the amount of bias will depend on the price ratio $\frac{P_a}{P_b}$. So if prices remain constant, nothing but exact matching with a bias can possibly be observed; any deviations from this relationship can only reflect variations in effective unit prices, presumably resulting from slight variations in the mixture of brands and package sizes being bought in the composite non-target brand. Such fluctuations will usually induce apparent undermatching because they will cause some regression to the mean. This means that there is essentially no interest in plotting the relationship between $\frac{S_a}{S_b}$ and $\frac{M_a}{M_b}$ to detect if the amount matching law accounts for consumers' brand choices. The other matching analyses, as identified here, previously used in consumer behaviour analysis and discussed in chapter 2.5 (the cost matching and probability matching analysis) do not have this problem.

Despite the tautological problems of the consumer matching law (amount matching), the consumer behaviour analysis research group has used amount matching analysis in consumer research on panel data to distinguish brands and products. Foxall and James (2001, 2003) used amount matching analysis to study brand choice in a small sample of consumers. Foxall and Schrezenmaier (2003) and Foxall, Oliveira-Castro and Schrezenmaier (2004) continued this type of research by analysing panel data from 80 consumers purchasing nine different product categories. In these studies the parameter *a* in the generalised matching equation, that is believed to account for sensitivity of preference, was generally very close to 1.0, indicating perfect matching. Foxall et al. interpreted these results as a demonstration that brands within the same product class function as substitutes. Romero, Foxall, Schrezenmaier, Oliveira-Castro, and James (2006) extended the amount matching analysis to product categories that were not necessarily substitutable, those that are relatively independent or complementary products. Results suggested that the occurrence of matching may depend upon the level of analysis adopted. Nevertheless, when the data was studied at an aggregated level, consumers allocated their brand choices in concordance to the prediction of the generalised matching equation for different levels of substitutability. Consequently, despite the tautological nature of amount matching, it has been used as a useful technique in marketing. Furthermore, Romero et al. (2006) conclude that further research is needed to clarify the value of amount matching analysis as a method to analyse the substitutability of brands.

3.3 Method

3.3.1 The Sample

The effects of the in-store experiments were inferred by so called scanner data from the stores. Each of the stores scanned the barcode of every brand sold, and it was organised into different data sets for each product category. In all, each data set consisted of sales volume of each and every brand in the relevant product categories (shampoos, conditioners, snacks, and washing-up liquid) sold each day in two convenience stores, and two supermarkets, but only snacks and washing-up liquids in the two budget stores. All stores are owned by the Baugur Group, Iceland's leading retailer, and are situated in the Reykjavik area. Chapter Four presents descriptive statistics for the scanner data showing the sales volume for each store used in the in-store experiments. The stores also gave information about brand amount, in grams or litres, and price. The in-store experiments took place during the period from 1 February to 30 April 2006 (nearly 13 weeks), except for the "Place" intervention which lasted to 21 May. Consumers that bought brands in the above product categories, in the stores, automatically became subjects in the experiments. The following information was gathered from the stores, it characterises the consumers' buying behaviour:

- Store name and type
- The product categories
- All brands sold. Brand lines (e.g., Fairy) are classified into sub brands (e.g., Fairy Ultra® and Fairy Lemon®)
- Package size/amount in relevant units (portions of a litre or a kilogram)
- Date of purchase
- Price of the brand

The study enjoyed the advantage of having real sales data captured automatically by scanner.

3.3.2 Research Setting

The stores selected for the in-store experiments were Bónus (budget stores), Hagkaup (Supermarkets), and 10-11 (convenience stores) (two of each). These stores are very different from each other, operated by Baugur to cover different consumer segments. Bónus, being a budget store, offers the lowest price and shortest opening time. It has the most turnover. Hagkaup, is a supermarket and has a good variety of different brands, and is more expensive than Bónus. The convenience stores, 10-11, have the highest prices and are open longest. One of the 10-11 stores used in the in-store experiments is twenty-four hours.

These stores were chosen on the basis of having an even share of low priced, variety, and service stores in the study. Because of this, it is possible to see if the results of the interventions are affected by store type. The individual outlets were chosen on the basis of being the largest of their respective kind in Iceland. This is important as larger stores give more data.

3.3.3 Dependent Variable

Consumers' brand choice was the most significant, general dependent variable in the in-store experiments. For the relative sales analysis the dependent variable was units sold of the target brand, that is all sub-brands attached to the brand line (e.g., all Pringles® brands), against units sold of other brands in the relevant product category (Layes®, Doritos® etc.) in the store.

In the matching analyses, building on existing consumer behaviour analysis research, the dependent variable was ratio of behaviour, for example the amount paid (in Kronur [ISK], the Icelandic currency) for the target brand (the brand line being manipulated) divided by all other brands in the relevant product category in the store. For instance, in the in-store Place experiment, Pringles® crisps were the target brand. They were sold in different forms (sub-brands) in the convenience stores as:

- Pringles, Original®
- Pringles, Paprika®
- Pringles, Sour cream and onion®

The amount bought of these sub-brands was combined to form the relative sales of the target brand for each day.

3.3.4 Measurement

> From a researcher's standpoint, studying sales has one advantage over studying, say, leadership or organizational behavior: Selling is inherently and directly measurable. (Stewart, 2006, p. 10)

As stated before, consumers' brand choices consisted of the sales data generated by bar code scanners used at the cashiers of the stores. Below is further information on what was measured in each of the three in-store experiments.

3.3.4.1 Price, In-store Experiment

The in-store Price experiment, testing the effects of price on consumers' choices, used two related product categories, shampoo and conditioner, each analysed separately. The target brand was Procter and Gamble's Pantene® along with all brand extensions. This was the case for both shampoo and conditioner. The sales of all the Pantene® sub-brands, and the other brands in the shampoo and conditioner categories, classified by the store, were measured. The scanner data, involved individual sub-brands sales each day, and came in number of units sold.

3.3.4.2 Place, In-store Experiment

In the in-store Place experiment the sales of the target brand, Procter and Gamble's Pringles® with all its brand extensions, and all other brands in the product category (crisps), sold and classified by the store, were measured. The scanner data from the store consisted of the daily sales of each brand.

3.3.4.3 Promotion, In-store Experiment

In the in-store Promotion experiment, the sales of the target brand, Procter and Gamble's Fairy® with all its brand extensions, and all other brands in the product category (washing-up liquid), sold and classified by the store, were measured. The scanner data from the store consisted of daily sales of each brand.

3.3.5 Analysis of Data

The data from the in-store experiments were analysed in four ways, each giving separate measurement of the effects of the marketing mix variables on consumer choices, and the substitutability of brands. Each analytical method should help in interpreting the results from the in-store experiments and, in combination with the descriptive data presented in Chapter Four, clarify its strength. The relative sales analysis is here presented for the first time in the realms of consumer behaviour analysis. The matching analyses have, without any interventions, been used in previous consumer behaviour analysis research.

The relative sales analysis is supposed to examine the effects of the interventions on consumers' choices, and the behavioural processes revealed for each store. Based on it, reliability of effects from the same interventions can be examined both within the same store, among the same types of store, or between store types. This gives also the cumulative effects, which are important to assess the validity of the repeated measures in experimental design for this kind of research. It helps to sort out if there is a carry over effect between experimental interventions, which leads to underestimation of the differences between experimental interventions.

The amount matching analysis is supposed to give a measurement of substitutability of the target brand against its product category, for each store used in the in-store experiments. It is concerned with the effects of relative reinforcement (amount of brands) on behaviour (amount paid). The questions should be, how strong the brands are in terms of willingness to pay. It is of importance if the particular store's consumers treat the brands in the same product category as functionally equivalent, paying in accordance to the amount received of the brand, or if the target brand is preferred or inferred.

The cost matching analysis should study the effects of monetary cost on relative demand. It should reveal the store's consumers overall responses to considerable price reductions, in terms of how sensitive their relative choices are as a consequence of a change in relative prices. The amount and cost matching analyses are related to the positive and negative law of effect (Equation 2.5), showing the combined effects of reinforcement and punishment on choice behaviour. The amount matching analysis is supposed to account for the effects of the reinforcer while the cost matching analysis explores the sole effects of punishment on consumers' relative choices of the target brand.

The probability matching analysis will indicate if consumers are maximising benefit in the sense that they are choosing the brand in terms of it being cheaper than the others. If not, maximisation of magnitude via price indicates further studies of what consumers are getting from the brands, in terms of informational consequences, are required.

3.3.5.1 Descriptive Statistics

To help the reader assess the quality of the study, raw sales data is presented in Chapter Four, where both measures of a central tendency and variability of the data set are shown.

In preparation for the relative sales and matching analyses in Chapters Five to Seven, numerous statistics are presented. These include total number of purchases of the target brand, total number of purchases made, and total number of brands available. This is shown for each store in the three experiments (price, place, and promotion), as well as the averages for the measurements. This facilitates comparisons among stores, and store types; expanding the scope of the study.

In the case of variability, raw sales are displayed for each of the periods, consisting of Monday to Thursday or Friday to Sunday, used in the figures for the relative sales analysis. This includes number and range of purchases for the target brand, and total number of purchases made in the product category; each shows figures for every period and store in the study. It is important to see on how much data inferences of the effects of interventions are built; which is vital for assessing the validity of the experiments.

3.3.5.2 Relative Sales Analysis

> There is no point in publishing a block of sloping straight lines if the only important fact is the slope...What has happened to experiments where rate changed from moment to moment in interesting ways...These "molecular" changes in probability of responding are most immediately relevant to our own daily lives. They seem to me much more useful in the interpretation and design of contingencies which bring about the kinds of changes likely to be of technological interests. (Skinner, 1976, p. 218)

In the relative sales analysis the dependent variable is units sold of the target brand, divided by units sold of all other brands in the relevant product category in each store. This proportion was grouped into periods that consisted of unit sales during either Friday to Sunday, or Monday to Thursday. The transformation of the data from raw observations into proportional configurations meant that fluctuations in sales (e.g., an increase in sales of potato chips on Friday) were removed. The effects of the interventions are therefore more clearly apparent. The relative sales analysis examines the effects of the interventions on consumers' choices, and behavioural processes. Measures of reliability permit the effects from the same interventions to be examined either within a single store, or between the two budget stores; revealing whether there is a carry over effect between experimental interventions which result in an underestimation of the difference between experimental interventions.

The relative sales analysis was performed to infer the effects of the experimental interventions on consumers' buying behaviour. In line with molar behaviourism (Baum, 2002b), where aggregated choice behaviour is studied, sales are presented as a choice between the target brand (brand A) and the other brands (brand "B"). This gives the sales data its relativity and makes it usable for comparison in terms of market share and in terms of the competition of brands. For the relative sales analysis, the units sold of the target brand are divided by the total units sold in the relevant product category in each store (Equation 3.2):

$$\frac{U_t}{\sum U} \tag{3.2}$$

Where U represents units sold of brands and t the target brand.

By presenting relative sales instead of the raw data from the stores, various external factors, hiding the functional relations between the independent variable and sales, are taken out. These include temporal fluctuations (e.g., more sales on weekends) making it more difficult to explore the sales figures. The data is shown separately for each value of the independent variable (e.g., original price, reduced price) as is custom when using alternating treatment design. This makes a visual interpretation of the effects of the independent variable, on relative sales, easier (Barlow & Hayes, 1979).

3.3.5.3 Matching Analysis

Unlike the relative sales analysis that shows data for experimental periods, each data point in the matching analyses represents ratios for every day of the in-store experiment. This is presented for each store and product category in Chapters Five to Seven.

The data from the in-store experiments were analysed in three different ways according to the matching standpoint. This is supposed to reveal separate effects of each marketing mix factor (Price, Place, and Promotion) on matching relations in each experiment (Figure 3.2). In all, the in-store experiments and the matching analysis allow the identification of the influences of the interventions on choice behaviour and the appropriate generalised matching relations (amount, cost, and probability). This is important from the perspective of consumer brand choice as these matching relations are supposed to give a measurement of the substitutability of brands. Each experiment can be seen as manipulating one of the components of the three term (or four term) contingency.

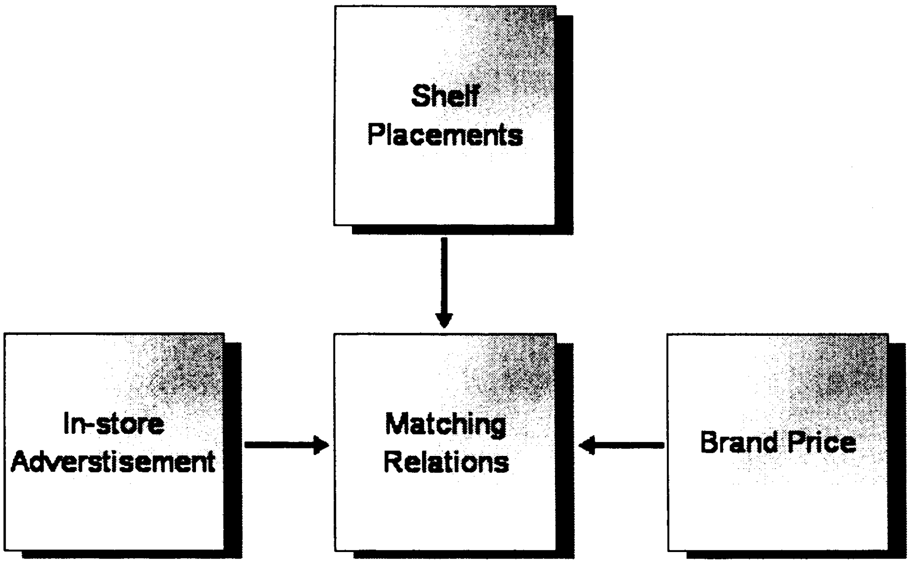

Figure 3.2. Effects of in-store experimental interventions on general matching relations

The in-store advertisement (Promotion) was intended to act like a motivational operation, increasing the brands value as a reinforcer. The shelf placements of the target brand (Place) manipulated reinforcer-effort, making it easier or more difficult to choose the target brand (e.g., search effort). Finally, target brand's price manipulations (Price) affect the consequences of behaviour. As discussed in relations to the BPM, consumer behaviour is both simultaneously "reinforced" and "punished". When brand price is reduced the consumer has to give up less money (generalised conditioned reinforcers) to acquire the brand. From a strict utilitarian perspective it should be expected that this would increase the buying of the brand, based on the assumption that it is fairly equivalent to the competing brands, and that the price reduction is considerable. If, however, the price reduction has no effect, or is even detrimental, on the buying behaviour of the brand, then the three term contingency has difficulty explaining this without referring to informational consequences in line with the BPM (e.g., the snob effect or price-quality rule governance).

In fact, the BPM's bifurcation of behavioural consequences to utilitarian and informational acts similarly to more traditional functional concepts in behaviour analysis. Take for example the classification of operant consequences into reinforcement and punishment. If a particular event or stimulus following certain behaviour patterns increases its strength (e.g., more money spent for a particular good or service) it is classified as reinforcement. If, however, it decreases its strength (less money spent) then it is classified as punishment. The utilitarian/informational bifurcation acts similarly. If behavioural consequences, considered as being an increase in utilitarian value, surprisingly decreases behavioural strength, then it guides the consumer behaviour analyst to infer and explore further, if this can be explained by referring to informational reinforcement. This leads to further research in terms of definitions, measurement, predictions, and even control.

3.3.5.4 Amount Matching Analysis

In marketing, including consumer behaviour analysis, amount-matching states that:

> "The proportion of dollars/pounds spent for a commodity will match the proportion of reinforcers earned (i.e. purchases made as a result of that spending" (Foxall, 1999c, p. 245)

The amount matching (Equation 3.3) analysis (simply termed matching analysis in previous consumer behaviour analysis research) states the connection between the relative amount paid for the target brand as a function of the relative amount of the brand earned (bought). To calculate this, two parameters are necessary, amount paid ratio (the behaviour), and amount bought ratio (the reinforcement). This relationship is expressed in Equation 3.3, using the generalised matching equation (Baum, 1974a, 1979):

$$\log \frac{S_1}{\sum S_2} = a \log \frac{M_1}{\sum M_2} + \log c . \tag{3.3}$$

Consumer choices' are characterised as amount spent for the target brand (S_1) against amount spent for all other brands (the competition) in the relevant product category (S_2) (e.g., Foxall, 1999b). As the field experiments were performed in Reykjavik, Iceland, the currency involved is Icelandic Kronur (20.02.07.ISK/£ ˜ 135). The reinforcer-amount's effects on relative choice behaviour is calculated as the amount bought of the target brand (M_1) against all amounts bought of the other brands in the product category (M_2). The matching analysis is performed for each day of the study. The amount bought is handled in a standardised measurement, kilograms or litres, as pack sizes are different. When behaviour and reinforcer-amount ratios have been calculated the data is transformed into logarithmic form.

The amount matching analysis, presented here, deviates in one respect from previous consumer behaviour analysis on matching. Previous research has used the most frequently purchased brand in the numerator (as brand A) in the matching equation, because it has not dealt with or manipulated any factors attached to any particular brand. As this is field experimental work, the sales of the target brand, which is manipulated, is used in the numerator (brand A), in a similar way to traditional experimental work on matching.

As previously mentioned, in this research, matching is analysed with group behaviour. Group matching resembles an individual matching equation. The difference is that instead of showing the behavioural allocation of the behaviour of the individual consumer, group matching involves the behavioural allocation of many people (for an example of group matching see Baum & Kraft, 1998; Kraft & Baum, 2001; Foxall, Oliveira-Castro, & Schrezenmaier, 2004). These studies have demonstrated that matching analysis of group choice is possible and useful. It is, however, silent about the behaviour of individuals, although it is possible to build on assumptions like momentary maximisation, or melioration.

3.3.5.5 Cost Matching Analysis

What is here treated as cost matching analysis has been called relative demand analysis, as it reveals the relative quantity obtained of a brand as a function of relative price. It was introduced to consumer behaviour analysis by Foxall and James (2001) who adapted it to the realms of human consumer behaviour analysis building on experimental economic studies on animal behaviour by Kagel, Battalio, Green, & Rachlin (1980). The analysis is performed exactly as previous consumer studies have been done (e.g., Foxall, Oliveira-Castro, & Schrezenmaier, 2004), but is incorporated within the matching standpoint. It is considered to be beneficial to think of these calculations from the same point of view; matching. In accordance to previous relative demand analysis, the cost matching analysis is defined as:

> the ratio of amount bought of the dominant brand (A) to the amount bought of the remaining brand in that category (B) as a function of the ratio of the relative average prices of the dominant brand to the average price of other brands purchased from the appropriate product category. (Foxall, Oliveira-Castro, & Schrezenmaier, 2004, p. 241)

This is ratio analysis, and as such departs from more standard demand calculations in economics; showing the quantity that consumers are ready and able to buy at a given price. In line with the matching standpoint, were all behaviour is choice, the relativity of the amount bought of the target brand as a function of relative prices gives an economic account of the competition between brands in the same product category. This reveals the target's brand market share as a function of its relative price against the prices of the other brands, making it possible to analyse the effects of the target brand price positioning against its product category. As all prices are either constant, or nearly so, during the in-store experiments (excluding the price interventions) it is only possible to perform the cost matching analysis for the Price experiment. There the target price is reduced so that it becomes cheaper than its rivals. To perform the cost matching analysis, two parameters are used, amount bought ratio (reinforcers earned) and relative price ratio (reinforcer-cost). The former, amount bought ratio, was discussed in the previous chapter (3.3.5.4) in the section on amount matching, and treated as an "independent variable" but here it is used as a dependent variable. The relative price ratio is the independent variable in this analysis, and is measured as the "amount paid for brand A/Amount paid for the remaining brands in the product category (B)." (Foxall, Oliveira-Castro, & Schrezenmaier, 2004, p. 241). This relationship is shown in Equation 3.4:

$$\log \frac{M_1}{\sum M_2} = a \log \frac{P_1}{AP_2} + \log c . \tag{3.4}$$

Where P_1 stands for the price of the target brand (or average price if there is a brand line); AP_2 for average price of the other brands in the product category; M represents the magnitude bought of the brand(s), and the subscript *1* and *2* stands for the target brand, and the other brands. The cost matching analysis states the connections between relative average prices and the relative amount bought as a consequence.

3.3.5.6 Probability Matching Analysis

The fourth and last calculation performed on the data is probability matching analysis. It was known as maximisation analysis in previous consumer behaviour analysis research as it is proposed to reveal if buying behaviour maximises returns on money spent on brands (e.g., Foxall & James, 2001, 2003). This work has followed procedures developed by Herrnstein and Loveland (1975), and Herrnstein and Vaughan (1980); who called it probability matching in line with former literature (see Herrnstein & Loveland, 1975). As previously discussed, the matching law has been extensively researched on concurrent interval schedules, as it gives a true independent variable. On such schedules the reinforcement probability is independent of rate of response (Foxall & James, 2001). However, real behaviour often occurs at a ratio schedule (e.g., work) and probability matching analysis is appropriate for that conduct, as well as examining the appropriateness of the maximisation hypothesis, or rational choice theory. Probability matching (maximisation analysis) assumes, on concurrent ratio schedules, that there is a fixed probability of reinforcement for each response the organism performs which has been expressed as reciprocal of the schedule parameter. The general theory is that the organism chooses between options that have different probability of reinforcement. If one option pays off one reinforcer (e.g., food pellets) in 1/20 and the other alternative 1/40, then probability matching entails that the ratio of choices between the alternatives should be 2:1 (1/20 : 1/40 :: 2 : 1) (Herrnstein & Loveland, 1975). In the consumer analogue, the brand price stands for the ratio schedule where every unit (e.g., pence, Icelandic Kronur in this research) accounts for one possibility. If the price of Pantene® shampoo is 300 Kronur, then the possibility of obtaining it is 1/300; which seems bizarre, but has been considered useful in previous consumer behaviour analysis research (e.g., Foxall, Oliveira-Castro, & Schrezenmaier, 2004). This is supposed to provide a foundation for exploring the usefulness of rational choice theory, e.g., in terms of what and how consumers maximise (Foxall & James, 2003).

In order to calculate the probability matching analysis, two parameters are necessary. These are the previously discussed amount bought ratio and probability of reinforcement proportion. This gives a generalised matching equation (Equation 3.5):

$$\frac{M_1}{M_2} = \frac{\frac{1}{P_1}}{\frac{1}{P_1} + \frac{1}{P_2}}. \qquad (3.5)$$

Where probability of reinforcement is characterised as the reciprocal of the average prices of the target brand (brand "A" including all the brand extensions) over the reciprocal of the average price of the target brand, in addition to the reciprocal of the average price of the other brands in the product category. This calculation is here based on a fixed ratio schedule as prices are generally stable. The concurrent quasi-FR FR schedule is put into operation as the measurement of the amount bought as a function of prices for each day during the research (FR1 FR1).

The results from the probability matching analysis are, like the other analyses performed, pictured to help the reader judge to what extent the behaviour of the consumers' conforms to maximisation - by consumers matching their income in accordance with the prices of brands. For interval schedules this would make a 45° straight line on the graphs, starting from the point of origin all the way to the other end, likewise those known from the traditional amount matching figures. Previous consumer behaviour analysis research has interpreted buying behaviour as being based on concurrent ratio schedules where probability of reinforcement is maximised by choosing exclusively the cheapest brand (leanest schedule). This has been shown graphically by a step function (in line with Herrnstein & Loveland, 1975). In this case there are two choice possibilities; if this step function, based on how the data points line-up on the abscissa, is less than .5, then the consumers are buying the target brand, as it is more expensive than the average price of the other brands in the product category. In terms of previous CBA research; the target brand (brand A) is more expensive than the average price of the other brands ("brand B"). This is supposed to indicate that the consumers are maximising something other than return on price expended (e.g., informational value such as "snob" value). If, however, the step function is to the right of .5 on the x-axis then the consumers are maximising (in terms of the A brand vs. B brand, two choice paradigm) by choosing the target brand (A) as it is less expensive than the average price of the other brands.

3.3.6 Interventions

The interventions consisted of three elements from the marketing mix (Price, Place, and Promotion). Other important marketing mix variables (McCarty, 1990), or analogous concatenated matching factors (Baum & Rachlin, 1969; Killeen, 1972), such as brand amount, quality, packaging, and promotions in the product category were kept constant, or did not significantly change (any deviations from this are specifically noted in Chapter Three and Four).

3.3.6.1 Place, In-store Experiment

In the case of the in-store experiment testing, regarding the effects of different shelf placement of a target brand on its relative sales and substitutability (matching), there was one main independent variable for all store types; the shelf placement. There were three different values associated with it, 1) lowest shelf, 2) middle shelf, and 3) highest shelf. According to the experimental design (Appendix Two), the brand was systematically put on those shelves, always holding the number of brand items in terms of their width, the same on each shelf for each store. In addition to the shelf placements, store types consisted of another independent variable (convenience stores, supermarkets, and budget stores). In terms of the budget stores there was another intervention performed after the baseline, and shelf placements. It consisted of an extra line-up of the target brand situated at the entrance of the stores. This gives an assessment of the maximum effects of the presentation of the target brand on its relative sales. This is because the target brand was put in an extra line-up at the store entrance where it is almost impossible for consumers to avoid seeing the target brand. The basis for performing this intervention only in the budget stores is that the firm needed to sell the target brand quickly to make space for a brand extension. I used the opportunity and included the data acquired. A baseline comparison was used in all stores because it allows further comparison, and provides an assessment of the validity of the in-store experiment in the absence of controlled experimentation for either the independent variable or external influences. Hence, comparison between the baseline (which involved no experimental control) and the interventions (where experimental control was implemented) became possible. The sequence of interventions (lowest, middle, and highest shelves) was semi-random, meaning that the same intervention could not come more than three times in a row. This was done to minimise threats to internal validity attributable to the order of interventions. The sequence of the in-store Place experiment was as follows:

Baseline. Relative sales of the target brand against the rest of the crisps product category was calculated before any intervention took place. The target brand was placed (not by us) on different shelves. This is characteristic of real life retailing, representing methodological difficulties for non-intervention studies.

Shelf placements. During interventions, the target brand was placed on three different shelves, the lowest, middle, and highest. The number of the brand facing the consumer (e.g., 8 in a horizontal row in the budget stores) was the same in each intervention. The price of the target brand was kept constant throughout the in-store experiment, and the cost of most of the other brands remained constant. The only variable which did change was the placement of other brands (reinforcer-effort) during the transition of the target brand's placement. This was performed in a random fashion. Other important marketing variables did not change.

Extra line-up. In this condition an extra line-up of the target brand was put at the entrance of the stores (7 x 16 = 112 facings). This was only performed in the budget stores.

Table 3.2 shows the height of each shelf used in the in-store experiment. It demonstrates that the height of the shelf classification (lowest, middle, and highest) was similar within each store type, and indeed the same for the two budget stores used. This made the budget stores especially relevant for assessing the generalisation of effects. Table 3.2 reveals how the general height of the shelves was different between store types in that the convenience stores had the lowest shelves, as customers are supposed to see "over" the shelf; next came the supermarkets, and then the budget stores, which had the highest shelves (in terms of the top shelf).

Table 3.2

The Height of the Shelves used in the In-store Place Experiment

		Store Type		
Outlet		Convenience	Supermarkets	Budget
A	Highest	150 cm	168 cm	173 cm
	Middle	120 cm	112 cm	123 cm
	Lowest	20 cm	24 cm	24 cm
B	Highest	132 cm	165 cm	173 cm
	Middle	102 cm	130 cm	123 cm
	Lowest	14 cm	24 cm	24 cm

These shelves measurements are important when it comes to interpreting the effects of the placements on buying behaviour, and possible differences between stores, or store types. Both the convenience stores and the supermarkets had five levels on each shelf so it is easy deciding where to put them, the lowest and highest shelves defined themselves and the "middle shelf" was the shelf in the middle (shelf number 3 out of five, counted from the floor). However, the budget stores had only four large layers on each shelf. The lowest and highest shelves defined themselves, leaving two shelves over. It was decided to let the next highest shelf represent the "middle shelf" as it is closer to eye level, generally considered to be around 140 cm from the floor for adults. Appendix Two shows the baseline and order of interventions for the Place in-store experiment.

3.3.6.2 Price, In-store Experiment

For the Price in-store experiment there was one main independent variable; the price of the target brand, which took two values; 1) normal price, that is price before the intervention; 2) reduced price, which entailed a 15-26% price reduction from the normal price of the target brand in each of the store types. The store type consisted of another independent variable. The Price experiment was separately conducted on two product categories; shampoo and conditioner. Table 3.3 shows the prices used in the shampoo product category. The prices are the same for all sub-brands of Pantene® in the convenience stores, but there was a small variation within the brand line in the supermarkets. There was also some variance in the intervention, the price reduction, meaning that it did not result in the same price in each and every price reduction for the target brand. The higher price (289-299 ISK) was used for the first two interventions but the lower price (279 ISK) was used on the last three occasions. It is interesting to see if there will be any difference in the consumers' choice of the target brand between the first two interventions and the last three. The price difference between the interventions and the original price (18-26% reduction) was considerable, and the five repetitions should be able to reveal clearly if there is a difference. The small difference between the first two and the last three interventions was minor (still 3-7%), but if there is also a difference between these interventions (although less repetitions to build the comparison on) it should indicate that the consumers were very price sensitive. The bottom line here is, however, is that the price was reduced below that of the competition, and under the possible 300 Icelandic Kronur[10] price criterion (psychological pricing).

Table 3.3

Prices Used in the In-store Experiment (Shampoo)

	Prices (ISK)	
	Original	Reduced
Convenience	399 (GBP=3.31)	319 (GBP=2.65)
Supermarkets	369 (GBP=3.06)	279-289 (GBP= 2.32-2.40)
	379 (GBP=3.15)	279-299 (GBP=2.32-2.48)
	369 (GBP=3.06)	279-299 (GBP=2.32-2.48)
	369 (GBP=3.06)	279-299 (GBP=2.32-2.48)
	349 (GBP=2.90)	279-289 (GBP= 2.32-2.40)
	379 (GBP=3.15)	279-299 (GBP=2.32-2.48)
	349 (GBP=2.90)	279-289 (GBP= 2.32-2.40)

[10] The median of ISK/GBP was 121,1 (GBP/ISK=0,0083) during the duration of the study (01.02.06 – 30.04.06). See:
http://www.glitnir.is/Markadir/Gjaldmidlar/GreiningKrossa.aspx?g1=GBP&g2=ISK
http://www.glitnir.is/English/AboutGlitnir/Global/Uk/

The in-store Price experiment conducted on the conditioner product category was similar to the one where shampoo was used (Table 3.4).

Table 3.4

Prices Used in the In-store Experiment (Conditioner)

	Prices (ISK)	
	Original	Reduced
Convenience	399 (GBP=3.31)	319 (GBP=2.65)
Supermarkets	369 (GBP=3.06)	279-289 (GBP= 2.32-2.40)
	379 (GBP=3.15)	279-299 (GBP=2.32-2.48)
	349 (GBP=2.90)	279-289 (GBP= 2.32-2.40)
	358 (GBP=2.97)	279-289 (GBP= 2.32-2.40)
	339 (GBP=2.81)	279-289 (GBP= 2.32-2.40)
	349 (GBP=2.90)	279-289 (GBP= 2.32-2.40)

The original price (399 ISK) and the price reduction (319) was the same for all sub-brands of Pantene® in the convenience stores, but the situation was more complicated in the supermarkets. There, the individual sub-brands had different prices, and the price reduction had little variation. As for the shampoo product category, the lower price (279 ISK) was used for the last three interventions.

3.3.6.3 Promotion, In-store Experiment

In the Promotion intervention, an in-store advertisement was periodically introduced in accordance with the experimental design (Appendix Two). During the baseline and the comparison no advertisement was present. The in-store advertisement was put up on the store shelf where the washing-up liquid product category was located. The advertisement is shown in Appendix One, and the message is that Fairy® washing-up liquid cuts through grease better than any other washing-up liquid for dishes and lasts longer. This is in accordance with the general concept behind Fairy® (see Procter and Gamble, Western Europe). The text in the advertisement, translated form Icelandic, says:

> According to Guinness World Records Fairy was used in the most extensive bout of washing-up that has ever been documented. The book states the following concerning the record "The Brobyærk sports club washed 23.892 dishes on the Langalandfestival in Rudkøbing, Denmark, 28th July 2004. Only one litre of washing-up liquid was used for the assignment.

The brand-concept for Fairy® is that you go more "miles" with Fairy® than other washing-up liquids, and the in-store advertisement enhances this image by pointing to the record. The message is that consumers should consider the quality, and how long the brand lasts, instead of putting an emphasis on the price and the amount. In behaviour analytical terminology this means that the reinforcement value (Reinforcement quality and duration – Punishment in the form of a price) is more than for the competing brands.

3.3.7 Research Design

The research was built up like a two-way mixed design, with with-in group comparison and between-group comparison (Table 3.5). The effects of the marketing interventions are built on repeated measures, and as these experiments are conducted in different store types, they form the between-group comparison. The Price in-store experiment was conducted in both convenience stores and supermarkets, the other two kinds, Place and Promotion, were also conducted in budget stores.

Table 3.5

The Research Design: Store Types and Conditions

Store Type		Conditions			
Price	Baseline	Original Price	Reduced Price		
Convenience Stores	X	X	X		
Supermarkets	X	X	X		
Place	Baseline	Lowest Shelf	Middle Shelf	Highest Shelf	Extra Line-up
Convenience Stores	X	X	X	X	
Supermarkets	X	X	X	X	
Budget Stores	X	X	X	X	X
Promotion	Baseline	No Stimuli	Advertisement	Baseline	
Convenience Stores	X	X	X		
Supermarkets	X	X	X		
Budget Stores	X	X	X	X	

The behavioural field experiments all use in-store repeated measures experimental design, and are seen to give a with-in-group behavioural comparison in the sense that the group is composed of customers in each store. This suggests that no group was chosen that experienced the interventions, but simply that the store consumers which bought in the product categories were used. This has both advantages and disadvantages. The benefit is that the customers had no knowledge that their behaviour was being recorded and analysed. If they knew they would very likely have shown different behaviour, making the in-store experiments show action that would not be expected under normal conditions. Here is the assumption that similar people shopped in each store, on average, making it possible to see the effects of the marketing interventions on relative sales, and substitutability of brands. The results should reveal to what extent this assumption is correct. The disadvantage is that the experimental comparison was not made between exactly the same customers, as they shop at different times. This could make the comparison of the effects of different values of the independent variable more difficult to interpret, as variation in behaviour is generally greater between people than with-in the activities of the same person.

The experimental design and terminology was derived from operant/behavioural laboratories, and applied behaviour analysis, and implemented in the stores. Alternating treatment design (Barlow & Hersen, 1984) was implemented in all the in-store experiments, with one independent and dependent variable (for each store). There was always a baseline at the beginning of the experiment, and in some cases also at the end. This gives further ground for experimental comparison.

3.3.7.1 Experiments

A fundamental component of experiments is the control of both internal and external conditions. The internal conditions are the causal relationship between the independent and the dependent variables. To get internal validity it is important to have control of the independent variable, in order to be able to experience the effects of different values of it. This relationship is under the threat of other factors that can affect the visibility of these effects. The external control lies in being able to control these other factors so they do not hinder the interpretation of the relationship between the independent and dependent variables. As the researcher achieves more control over the external factors he becomes more confident in his interpretations of the strength of the variable under study, thought to control behaviour in some way.

3.3.7.2 Field Experiments

The in-store experiments are part of what is called field experiments, meaning that it is not possible to control the environment to the same degree, or avoid the impact of external factors, as is possible in the closed settings of the laboratory. It is challenging to speculate on the most important variables that can have an effect on sales. In the in-store experiments the independent variable was manipulated and some important external factors were either kept constant or did not significantly change. For example in the Price experiment, the cost of the target brand was manipulated, and important external factors like the price of other brands in the product category did not change. A field experiment can never get the same control over factors as is done in the laboratory. However, its advantage is that it is performed in a real environment, and measures the behaviour of interest.

There are two issues of primary interest when comparing the difference between a true experimental design and a field experiment; internal and external validity. The marketing scientist wants to know the effect of changing a particular marketing factor (M) in environment (E) on consumer behaviour. To answer the question experimentally there are two ways. The first possibility is to do a pure experiment by imitating the marketing factor (m) in the laboratory environment (e), controlling (c) the variables in a closed artificial environment. The second possibility is to perform a field experiment by controlling (C) the real marketing factor (M) in the actual environment (E), but with less power over the situation. It is the importance of the difference between the values of M, E, C and m, e, c that should be weighted. The laboratory experiment should have stronger internal validity as more control gives clearer causal relationships, but external validity should be greater in the field experiment as it deals with real customers in their actual situations, making the results closer to that expected for the larger population of customers.

3.3.7.3 Repeated-measures Experimental Design

One of the benefits of using repeated-measures experimental design is that it is possible to change and improve the experiment after it has started, and get a better grip on the situations and other variables that are threats to the internal validity of the experiment. This possibility makes it easier to show what variables control behaviour (Karlsson, 2005). It is possible, and in fact important, to graph the measures of the dependent variable from the beginning of the experiment. By graphing at the start of the experiment, the researcher, using a repeated measures design (single subject design) can fine tune the independent variable and/or change its control over external factors. This is because the researcher does not have to wait until the end of the research to see if there is something that might be put right (Barlow & Hayes, 1979).

If, for example, a researcher wants to change behaviour, and he notices that the intervention has no effect, he can strengthen the independent variable or change it. In this way it is possible to use early measurements as an indication, and if acted upon they can be used as a comparison to the new or changed intervention. This makes it easier to assess and find variables that control behaviour, compared to using between-group research. In addition to this, the repeated measures design gives data showing the behavioural processes and how they interact with the intervention.

When experimenting in the real world it is important to have a very efficient design, one that rapidly gives information about stimulus function. The researcher has to be able to change the independent variables if he suspects that they have no effects on the behaviour under study. The researcher has to be prepared for an early termination of the research project. This is because the consumer behaviour analyst manipulates the consumer environment in cooperation with others, such as store managers. This is a critical difference to the laboratory experimenter who has absolute control, and is generally not as dependent on other people for his interventions. Because of this, the in-store experiments were implemented by using an alternating treatment design which allows different conditions to be compared rapidly; giving valuable comparisons much earlier than withdrawal, or multiple baseline designs (Poling, Methot, & LeSage, 1995).

3.3.7.4 Alternating Treatment Design

As stated earlier, the in-store experiments used an alternating treatment design, comparing the choice behaviour of consumers between each condition (e.g., different shelf placements) as with a baseline. The sequence of interventions was semi-random, meaning that the same condition had the same possibility of being implemented for each period, but could not appear more than three times in a row. This was done to minimise threats to internal validity attributable to the order of interventions. A baseline comparison was used because it allows further comparison, and provides an assessment of the validity of the in-store experiments in the absence of controlled experimentation for either the independent variable, or external influences. Hence, a comparison between the baseline (which involved no experimental control) and the interventions (where experimental control was implemented) became possible. In some instances an extra baseline, or intervention, was implemented at the end of an experiment. This enables a further comparison for interpretation and in some cases an assessment of the maximum effects of the intervention under study.

Alternating treatment design is considered to be appropriate in research settings where controlling for extraneous variables is important (Barlow & Hayes, 1979), or where there is much behavioural variability (Poling, Methot, & LeSage, 1995). Extraneous variables are factors that can affect sales (and matching relations) data such as time, store, shelf positioning, price, availability of brands,[11] and in-store promotions. This control of extraneous variables is of the highest concern when implementing an experimental control in real life consumer environments that are obviously complex, and influenced by several variables. The fairly frequent alternation used in the in-store experiments is supposed to control extraneous variables, based on the assumption that such variables affect all of the experimental conditions. Therefore, in addition to basically controlling many important external factors, the experimental design counterbalances external factors not accounted for.

[11] The availability of the target brand was monitored, and for the other brands as much as possible. If there was a noticeable shortage we asked if the brand was available in stock.

These are variables that can hide the control function of the experimental conditions, but are counterbalanced with the semi-random presentation of the conditions (Barlow & Hayes, 1979). The number of alternations is intended to neutralise the confounding factors to a reasonable degree. For example, the price of the target brand could be reduced first during the Monday to Thursday period, and then next during a weekend period. This makes it possible to attribute reliable differences in the dependent variable (e.g., in relative sales during the lowest shelf) to the conditions used in the in-store experiments. By comparing the differences between the dependent variable under each condition it is possible to interpret the effects and evaluate its reliability by looking at all the implementations. On top of this, there is information that gives the researcher even further means to test his interpretation of the controlling function of the variables under study. He can look at differences between two similar stores or even between different store types, giving him an assessment of the generalisation of the effects.

Like all experimental designs, alternating treatments has its potential problems. These have been grouped into three classes by Barlow and Hayes (1979), sequential confounding, carryover effects, and alternation effects.

The first, sequential confounding, involves an interaction between the conditions of the independent variable which generates a question if the effects of condition A will be the same when it is experimented with condition B, compared with being tried separately. The second potential methodological problem with applying an alternating treatment design is carryover effects, denoting influence of one condition on the next, withstanding the general sequence. The third methodological threat regards the fast alternation of conditions (Poling, Methot, & LeSage, 1995). The short duration of the condition can be inadequate to show the "true" effects of the independent variable on the dependent variable. This is especially relevant for conditions that have cumulating or long lasting effects. It can lead to confounding effects between different conditions. Marketing interventions do not necessarily affect sales immediately when they are implemented, or stop when they end. It sometimes needs a couple of exposures before an advertisement starts to have an effect on consumer behaviour, and promotion should be expected to affect sales, - although in a diminishing fashion - after it has ended. When new loyal customers are created by a marketing condition their buying behaviour spills over into other conditions of the in-store experiment. This can hinder the reversal of future conditions.

Alternation treatment design is ideal as a functional analysis, assessing if stimuli has discrimination ability, leading to sales being different based on presentation of the stimuli. It gives the marketing researcher a good indication of how consumer behaviour is dependent on the conditions. Fortunately, applied behaviour analysis has developed experimental techniques to minimise, or even eliminate, the methodological threats mentioned above (Barlow & Hayes, 1979). One method, applied in the in-store experiments, is to counterbalance the order of conditions by randomising the order of its presentation, so that they will follow each other in an unpredictable fashion. This controls sequential confounding, and minimises the danger of carryover effects, especially when there are different orders of conditions running together in the stores (4 to 6 stores depending on the experiment). Regarding problems with fast alternations, the experimental periods are either three (Friday to Sunday) or four (Monday to Thursday) days. Barlow and Hayes (1979) suggest that very high alternation (e.g., by minutes) compared to once or twice a day, increases carryover effects, indicating less danger for the reasonably long time that the in-store experiments give for each condition.

3.3.7.5 In-store Experiments in Marketing

Experiments are not an uncommon methodology in marketing science, where the field has drawn heavily from traditional experimental psychology. Of the sub-disciplines of marketing, experimental methods are mostly seen in the field of consumer behaviour where both true experimental and quasi designs are used.

In-store field experiments (e.g., Curhan, 1975) are surprisingly uncommon in marketing science and consumer behavior research, where researchers rely on interviews and laboratory experiments (e.g., Gaur & Fisher, 2005), mostly based on an information-processing approach (e.g., Lea, Tarpy, & Webley, 1987). However, in-store experiments are well known in marketing practice, where simple between-group and AB (before and after) research designs are considered frequent (e.g., Doyle & Gidengil, 1977). Gaur and Fisher (2005), for example, declare that in a study of 32 large U.S. retailers, they found that 90% conduct price experiments. The findings are however proprietary, and therefore the rigorousness and relevance of the research methods are not known, but the study declared that the retailers rated their usefulness with a median score of 6 out of 10. There is obviously a gap between academia and practice that underlines the need for testing and advancing in-store experiments in academic marketing. This entails observing the controlling function of marketing interventions on sales and the challenge of directly controlling external factors in this open environment.

3.3.8 Procedure

At the beginning of the project, when the in-store experiments were still just an idea, Mr. Saevarsson, a colleague and the marketing manager of Icelandic-America, met with the executives of Hagar to discuss their possibility. Icelandic-American imports brands from Procter and Gamble to Iceland, and has therefore valuable business with Hagar, a sub- company of Baugur, which owns and operates a large amount of grocery stores for different Icelandic consumer groups. The plan for the in-store experiments, their possibility, and finally what stores were the most appropriate was all discussed and decided in collaboration with executives at Hagar. After getting the permission to perform the necessary interventions in six of their stores (convenience stores, supermarkets and budget stores) it was decided to use those with the highest sales turnover. This was done to get as much sales data as possible out of the stores. After this, the stores were checked for possible problems, pictures were taken and some suggestions made. There was no intervention performed during the baseline condition of the experiments. Things were kept normal and there were no visits to stores, or control of any kind exerted. Some of the data from the stores was looked at and checked if there were some important variables, needed for calculations, missing. Before the interventions started the stores were examined again, and there were discussions with executives at Hagar and all relevant store managers. When the interventions began the stores obtained information regarding the price reductions, as this was more dependent on the stores. The shelf placements and in-store advertisements were easier to execute. The in-store experiments (baseline and interventions) took place during the period from 1 February to 30 April 2006, except for the budget stores which lasted to 21st of May. Researchers checked each store at least once a day to ascertain if the experimental design was being correctly implemented and that the changes were being applied as planned. The target brand in the crisps product category was moved between the lowest, middle, and highest shelves. The price of the target brand, in both the shampoo and conditioner product categories, were each reduced (and put up again according to the experimental design). The price reduction was not advertised in any way. We checked that each price change was put into practice and made sure that prices matched on the shelf and the counter. The in-store advertisement was put up (and taken down) on the shelf where the washing-up liquid product category was presented. One show bill was used in the convenience stores, but two in the supermarkets and budget stores; where the shelves are larger. This was done to try to make sure that the customers noted the advertisement and gave the message their attention. The show bill was put where it could be seen and read clearly; generally very close to the target brand itself. The conditions, preformed for each experimental period, were different between stores and store types. This means, for example, that when the target brand was on the top shelf in convenience store A, it was placed on the middle shelf in convenience store B, and on the bottom shelf in budget store A. This is intended to negate effects dependent on which day the intervention was done, and makes comparison possible, if there were any suspicions about such effects. Photographs were taken of each period during the interventions, and all external factors were kept to a minimum. A sufficient supply of the target brand, and the other brands, was kept in the stores while the experiment was being run. We recorded all the brands in each product category, for each store, a couple of times during the in-store experiments. The brand names, their quantity, and price were listed. This was later used in the data analysis when the stores had delivered their information (brand names, quantity, prices, and sales for each day).

Our listings were very helpful in checking the data from the stores, and filling in if there was information needed. Unlike the laboratory scientist, we had to rely on the stores for the data. After the first week of interventions we got the relevant data from the convenience stores and supermarkets, and after about two weeks for each time period that was left for the experiments. This gave the possibility of seeing how the interventions worked out. For the budget stores, however, the data didn't arrive until after all the interventions had finished.

3.8 Summary

Chapter Three has discussed the open experimental questions, given detail of the methodology adopted, and how the in-store experiments and the data analyses differ from more characteristic behaviour analysis conducted in more closed settings. This has entailed discussions of the so-called Price, Place, and Promotion in-store experiments; including their sample, research setting, dependent variables, measurement, interventions, and the research design employed. Four examples of behaviour analytical data analysis have been presented, all viewing consumers' choices from the lens of matching; that is as choices of brands (reinforcers) in context. These are relative sales analysis, amount matching, cost matching, and probability matching. The next chapter will show the results of the three in-store experiments, before any particular behaviour analytical analyses or interpretations are performed. The chapter presents numerous tables containing raw sales data.

CHAPTER FOUR

DESCRIPTIVE STATISTICS

This chapter presents the sales data from each store for all of the in-store experiments. This means that no theoretical analysis or transformation, have been undertaken. In addition to presenting raw data; general descriptive statistics are presented to help the reader asses the internal validity and reliability of the research presented in Chapter Three. This chapter can be looked at as a preparation for the results in the next three chapters that show relative sales and matching analyses of the data, gathered from the three in-store experiments. As these are ratio analyses, it is not possible for the reader to see the raw sales that they are made up from. This is the reason why the raw sales data is presented here.

First, measures of central tendency are presented, and then variation. Both include important raw data relevant to the relative sales, and matching analyses. The central tendency chapter includes information about the following for each store used in each experiment:

- Total number of purchases of the target brand for the whole in-store experiment.
- Total number of purchases made for the whole in-store experiment.
- Total number of brands in each product category used in the analyses.

In addition to the total number, average statistics are used for further comparisons between stores, and store types. For the section on variation the following is presented in tables, as it is for each store and experiment:

- Total number of purchases of the target brand for each period (Monday to Thursday, Friday to Sunday) of the in-store experiment.

- Total number of purchases made for each period (Monday to Thursday, Friday to Sunday) of the in-store experiment.

In addition to the raw sales data a range statistic, giving the difference between the lowest and highest periodic sales, is presented. These raw data that are presented act as a means to asses the strength of the research, as there is a necessity to analyse a considerable range of sales in order to arrive at meaningful interpretations.

4.1 Descriptive Statistics

As mentioned, both the relative sales analysis and the matching calculations are done by transforming raw data into either ratio measurement. This is done because matching theory sees all behaviour in terms of choice (e.g., Herrnstein, 1997). When measures like sales of a target brand and total sales in a product category are combined into a ratio, the raw data is understandably hidden (unless it is purposely presented as is done here). This transformation into ratio scales can undeniabley hide weaknesses (or strengths) of the in-store experiments. This loss of information can possibly change interpretations regarding the scientific and applied value of the study (see Johnston & Pennypecker, 1993, for a discussion). For example, from a ratio analysis it is not possible to know if the relative sales of a target brand A have increased because its sales have improved or that sales in the product category have diminished. Another important aspect is that the effects of the independent variable cannot be clearly seen unless there is represent steady and considerable sales. As the research involves three different types of stores, where there are considerable differences in sales, it is possible to evaluate the impact and importance of sales volume on the ease of interpretation and inference. It is a given that very low sales will invite the problem of external factors, when inferring the effect of the independent variable on the dependent variable, as it will depend on more personal factors concerning the customers, rather than the factors under study.

4.1.1 Central Tendency

The tables in this section show how many individual sales were performed in each product category of the in-store experiments for every store.

4.1.1.1 Price, In-store Experiments

The Price in-store experiment is distinct from the other two experiments as it uses two product categories, shampoo and conditioner, instead of one, and is performed in four stores instead of six. First, tables representing the shampoo product category are shown, followed by tables for conditioner.

Table 4.1 shows total sales for the target brand and the whole shampoo product category in each of the four stores used in the Price in-store experiment. It also indicates how many brands were sold. It is apparent from Table 4.1 how much difference there is between the convenience stores and supermarkets in the measurements shown. The supermarkets have many more offers on brands and enjoy much higher sales. It is also important to notice how similar the stores in each type are. The convenience stores have low sales in this product category because customers like to buy it cheaper in the larger stores. In discussions with the store managers it was considered that those that buy product like conditioner have forgot to buy it in the larger stores (in their shopping trip there).

Table 4.1

Total Number of Purchases of the Target Brand (A), Total Purchases, and Total Number of Brands in the Shampoo Product category

Stores	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of brands
Convenience Store A	56	283	17
Convenience Store B	137	482	17
Supermarket A	375	3994	76
Supermarket B	309	3473	76
Average	**219**	**2058**	**47**

Regarding the conditioner product category there are similar patterns as in Table 4.1. This can be shown in Table 4.2 where there are fewer sales compared to the shampoo category, but the supermarkets have a much higher turnover and more variety of brands than the convenience stores.

Table 4.2

Total Number of Purchases of the Target Brand (A), Total Purchases and Total Number of Brands in the Conditioning Product Category

Stores	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of brands
Convenience Store A	49	91	10
Convenience Store B	93	153	10
Supermarket A	262	1822	43
Supermarket B	182	1586	43
Average	**147**	**913**	**27**

The stores within the same store type are similar. The low sales in the shampoo and conditioner product categories in the convenience stores is certain to be a problem when the relative sales and matching analysis are performed, threatening the validity and even the possibility of any inference of effects.

4.1.1.2 Place, In-store Experiments

Regarding the Place in-store experiment there was just one product category used, crisps, but there were more stores, as the shelf placement interventions were also performed in the budget stores. By looking at Table 4.3 it is apparent that the convenience stores sell a lot of crisps, much more than they do shampoo or conditioner. Table 4.3 shows that there is not a great deal of difference in total sales of crisps between the convenience stores and supermarkets. Variety of brands and sales of the target brand are also similar.

Table 4.3

Total Number of Purchases of the Target Brand (A), Total Purchases, and Total Number of Brands in the Crisps Product Category

Stores	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of brands
Convenience Store A	586	4531	23
Convenience Store B	533	5443	23
Supermarket A	545	7978	27
Supermarket B	641	8836	27
Budget Store A	1868	26172	24
Budget Store B	1406	21103	24
Average	**930**	**12344**	**25**

What is most important here is the sales difference between the budget stores, and the other types of stores. The budget stores have a similar variety of brands but sales are very much higher, indicating their importance for in-store experiments like these. However, it is important to mention that the in-store experiment took a longer time in the budget stores compared to the others (21 day longer with the extra line-up of the target brand at the entrance).

4.1.1.3 Promotion, In-store Experiments

The raw sales data from the Promotion in-store experiment show similar trends as for the Price and Place experiments. As Table 4.4 reveals, the convenience stores enjoy the lowest turnover. The supermarkets have reasonable sales but the budget stores have many times the sales of the other store types. As for the Place in-store experiment, this can, in part, be explained by the fact that the experiment was run longer in the budget stores than the others (110 days instead of 89), though this does not nearly cover it.

Table 4.4

Total Number of Purchases of the Target Brand (A), Total Purchases, and Total Number of Brands in the Washing-up Liquid Product Category

Stores	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of brands
Convenience Store A	141	182	3
Convenience Store B	232	266	3
Supermarket A	712	1489	11
Supermarket B	514	927	11
Budget Store A	1336	5184	8
Budget Store B	951	3007	8
Average	**648**	**1843**	**7**

Most consumers like to do their main shopping in the budget stores as they have the lowest price, and the same brands as the other stores, to a large degree. What is methodologically important in Table 4.4 is the low number of brands offered in the washing-up liquid product category in the convenience stores. The convenience stores have only three brands on the shelves; their own brand, Euro shopper, and two different kinds of Fairy®, which is the market leader. This is the store policy, they have a private label and the market leader in all product categories which are not their core competence, such as fast food or soft drinks. The convenience stores enjoy low sales in the washing-up product category, but it should be fine, in the supermarkets and budget stores, to make valid inferences about the effects of the advertisement on consumers' buying behaviour This will be clearer in Chapter Seven where the results for the Place in-store experiment are presented.

4.1.2 Variability

This section presents the frequency of purchases for the stores in each of the three in-store experiments. It displays some of the same measurements as section 4.1.1 (purchases of the target brand and total purchases in the product category). The difference to section 4.1.1 is that the tables presented here reveal these measurements for each experimental period employed in the study. Instead of summarising the results with an average statistic, a sales range is displayed. There are two methodologically important aspects connected to the tables presented. First, it is possible to see sales for each period in every store. This gives important information regarding the validity of the data from each store, because if there is no buying behaviour, or very low turnover, it will be problematic to infer effects of the different values of the independent variable. Second, it is possible to see differences between raw sales in the altered conditions of the in-store experiment and also the sales range. This reveals how much difference there is in customers buying behaviour. As previously mentioned, it is very efficient for the experimental inferences to transform the data into ratios, as it takes out many external factors that make the visual inspections of figures more difficult (e.g., more crisps sales during weekends). However, it is important to be able to see how many actual sales are behind these ratios, to assess their importance.

Section 4.1.1 above presented the sales volume for the stores for each of the in-store experiments. There it was apparent that the convenience stores attract considerably fewer consumers than the supermarkets (the budget stores were not used in the in-store price experiment). The problem of low sales turnover regarding possible inferences of effects is clear when there is only 1 to 3 items of the target brand sold for many weeks. This sales amount doesn't allow for much comparison.

4.1.2.1 Price, In-store Experiments

As for the section on central tendency, tables are first presented for the shampoo product category, and then for conditioner. Table 4.5 shows the frequency of sales for the target brand, and total sales in the product category for the shampoo product category.

Table 4.5

Frequency Distribution and range of Purchases of the Target Brand (A), and Total Purchases made in the Shampoo Product Category

Stores	Convenience Store A		Convenience Store B	
Periods	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of purchases of the target brand (A)	Total number of purchases made
1	4	9	6	19
2	2	15	4	8
3	0	2	6	10
4	3	6	7	16
5	2	9	5	5
6	3	15	6	19
7	3	9	3	16
8	4	15	9	29
9	4	9	7	13
10	2	4	4	24
11	0	12	4	18
12	1	16	5	21
13	1	4	3	35
14	1	14	4	40
15	0	8	6	10
16	2	13	6	8
17	1	6	4	16
18	3	16	10	26
19	2	12	1	9
20	2	7	7	26
21	7	24	6	20
22	2	18	10	28
23	1	8	3	16
24	3	16	4	23
25	3	11	4	11
Range	**7**	**22**	**9**	**35**

As mentioned, consumers' buying behaviour isn't great in this product category. Convenience store B enjoys slightly more customers in this section, and a higher sales range compared to convenience store A. Fortunately the picture is much better for the supermarkets (Table 4.6), where sales numbers and range should allow for a comparison between the different conditions of the experiment.

Table 4.6

Frequency Distribution and Range of Purchases of the Target Brand (A), and Total Purchases made in the Shampoo Product Category

Stores	Supermarket A		Supermarket B	
Periods	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of purchases of the target brand (A)	Total number of purchases made
1	8	140	10	139
2	14	156	12	97
3	19	130	22	161
4	21	151	8	84
5	14	124	29	138
6	26	137	9	76
7	10	138	23	146
8	21	216	13	137
9	14	173	11	150
10	27	175	6	108
11	6	132	8	140
12	23	188	5	113
13	7	125	19	148
14	21	156	10	111
15	12	119	12	166
16	12	132	6	123
17	20	157	17	206
18	22	230	10	153
19	7	146	10	172
20	19	243	12	206
21	6	82	13	101
22	7	183	11	151
23	8	134	5	142
24	18	178	10	104
25	3	153	13	140
Range	**24**	**161**	**24**	**130**

The two supermarkets are similar, with the same sales range for the target brand and alike in the sales range for total number of items sold in the shampoo product category.

When examining the conditioner product category there are similar patterns as for shampoo. Sales of conditioner are low in the convenience stores (Table 4.7), making a reasonably based comparison impossible.

Table 4.7

Frequency Distribution and range of Purchases of the Target Brand (A), and Total Purchases made in the Conditioning Product Category

Stores	Convenience Store A		Convenience Store B	
Periods	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of purchases of the target brand (A)	Total number of purchases made
1	5	6	3	4
2	3	8	1	1
3	3	3	6	10
4	2	6	4	7
5	0	3	4	5
6	2	3	2	5
7	1	2	4	7
8	4	8	6	9
9	3	3	7	11
10	1	4	6	8
11	0	2	2	6
12	0	0	3	4
13	1	1	0	2
14	1	3	3	3
15	0	0	6	8
16	3	5	1	1
17	1	4	2	3
18	1	3	7	10
19	3	4	1	2
20	2	3	6	10
21	5	6	3	7
22	3	5	5	6
23	1	1	1	4
24	1	3	2	6
25	3	4	4	9
Range	**5**	**8**	**7**	**10**

Regarding the supermarkets sales are much greater for the conditioner product category (Table 4.8), but the target brand is not particularly strong. This can either be an advantage or a problem. It is an advantage from the standpoint that the target brand's market share is low, presenting a considerable opportunity for improvement in sales. Meaning that testing the effects of price reductions for a brand with, for example, 80% market share, there isn't much chance for improvement.

Table 4.8

Frequency Distribution and range of Purchases of the Target Brand (A), and Total Purchases made in the Conditioning Product Category

Stores	Supermarket A		Supermarket B	
Periods	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of purchases of the target brand (A)	Total number of purchases made
1	7	57	6	53
2	10	61	7	46
3	8	69	10	56
4	14	65	8	42
5	11	57	10	53
6	8	58	8	37
7	8	57	14	58
8	17	94	10	63
9	14	72	9	60
10	15	79	3	55
11	4	48	7	59
12	15	88	1	47
13	8	62	11	59
14	13	92	6	48
15	9	59	7	77
16	9	67	3	43
17	9	69	9	99
18	20	114	7	79
19	11	61	5	77
20	11	106	7	100
21	5	20	5	46
22	8	100	8	88
23	6	61	6	83
24	11	79	7	53
25	6	76	6	74
Range	**16**	**94**	**13**	**63**

However the low market share of the target brand can also indicate that the brand simply lacks an important factor for the consumer, making it not functionally equivalent to the other brands, and most likely hindering any behavioural changes attributed to price.

4.1.2.2 Place, In-store Experiments

Sales of crisps are generally important for convenience stores and this can be seen in Table 4.9. Here the convenience stores have no problem with sales turnover and there are enough sales, both of the target sales, and total sales to make experimental inferences possible.

Table 4.9

Frequency Distribution and range of Purchases of the Target Brand (A), and Total Purchases made in the Crisps Product Category

Stores	Convenience Store A		Convenience Store B	
Periods	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of purchases of the target brand (A)	Total number of purchases made
1	28	223	27	254
2	23	138	10	122
3	23	192	5	219
4	21	114	1	113
5	29	219	15	228
6	14	103	9	118
7	17	178	1	202
8	19	131	8	119
9	37	214	10	233
10	17	114	7	140
11	23	203	10	243
12	15	97	11	132
13	13	188	26	253
14	8	117	48	157
15	27	179	37	223
16	17	106	22	156
17	26	193	30	245
18	14	140	19	159
19	30	238	18	246
20	39	248	24	267
21	49	376	49	502
22	21	189	33	265
23	20	189	26	240
24	17	136	35	171
25	23	247	41	354
Range	**41**	**279**	**48**	**389**

It is possible to say the same for the supermarkets (Table 4.10), where sales of the target brand are similar to the convenience stores, but total sales are much higher.

Table 4.10

Frequency Distribution and Range of Purchases of the Target Brand (A), and Total Purchases made in the Crisps Product Category

Stores	Supermarket A		Supermarket Store B	
Periods	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of purchases of the target brand (A)	Total number of purchases made
1	22	338	35	511
2	11	690	20	315
3	29	324	47	552
4	10	173	10	128
5	26	410	52	647
6	16	178	8	133
7	21	318	29	378
8	21	202	13	146
9	44	449	48	638
10	16	170	13	127
11	44	357	48	387
12	13	149	12	137
13	29	346	29	375
14	9	133	8	130
15	27	255	31	367
16	9	139	16	179
17	31	260	40	421
18	15	1440	16	787
19	26	272	21	424
20	38	327	44	500
21	9	126	15	299
22	18	196	18	237
23	21	208	25	333
24	7	139	8	151
25	23	257	25	434
Range	**37**	**1314**	**44**	**660**

If Table 4.10 is inspected, there sales are unusually high during the 18th period. What is responsible for this are the huge sales of Lay's crisps (an extraneous factor), attributable to many line-ups situated in many locations in the stores for one day (04.04.06). Although we were able to control many external factors this was not possible to stop.

Regarding the budget stores, sales of the target brand are considerably larger than the supermarkets, where there is large range in sales of the target brand (Table 4.11).

Table 4.11

Frequency Distribution and Range of Purchases of the Target Brand (A), and Total Purchases made in the Crisps Product Category

Stores	Budget Store A		Budget Store B	
Periods	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of purchases of the target brand (A)	Total number of purchases made
1	120	938	94	711
2	29	443	26	422
3	55	1100	58	767
4	25	486	32	443
5	84	1212	70	939
6	48	526	19	407
7	66	918	37	688
8	30	462	28	377
9	48	951	54	807
10	12	457	35	500
11	4	858	39	809
12	0	415	9	409
13	0	1008	26	747
14	21	561	16	391
15	48	762	32	767
16	23	396	16	393
17	32	947	37	851
18	20	587	29	467
19	33	1141	59	1043
20	72	1994	69	1386
21	10	365	13	280
22	46	538	27	434
23	28	856	29	582
24	34	476	18	384
25	183	1167	93	812
26	78	549	48	391
27	94	913	79	722
28	68	554	32	438
29	130	980	48	690
30	122	1462	41	1366
31	255	1816	142	1302
Range	**255**	**1629**	**133**	**1106**

These high sales should allow for a very good experimental comparison; showing the importance of budget stores with high sales turnover for a study like this.

4.1.2.3 Promotion, In-store Experiments

In the in-store Promotion experiment, performed in the washing-up liquid product category, there are similar problems with the sales turnover in the convenience stores (Table 4.12), as there were in the Price in-store experiment.

Table 4.12

Frequency Distribution and range of Purchases of the Target Brand (A9, and Total Purchases made in the Washing-up Liquid Product Category

Stores	Convenience Store A		Convenience Store B	
Periods	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of purchases of the target brand (A)	Total number of purchases made
1	4	4	6	6
2	3	3	12	12
3	5	5	9	9
4	3	3	6	6
5	1	1	11	11
6	4	4	16	16
7	1	2	8	8
8	6	7	14	14
9	7	9	10	10
10	5	8	11	13
11	3	3	10	10
12	9	11	12	15
13	6	9	7	7
14	6	6	5	6
15	5	6	0	1
16	8	11	9	10
17	5	9	4	5
18	4	6	5	9
19	8	11	6	7
20	8	12	17	20
21	9	11	17	18
22	12	14	12	17
23	6	8	8	13
24	6	9	11	16
25	5	8	3	4
Range	**11**	**13**	**17**	**19**

The sales are low, but unlike for the in-store Price experiment, the target brand, the market leader, enjoys nearly all of the sales; making the question of whether the in-store advertisement increases sales of the target brand difficult to answer, as it already accounts for nearly all of the sales.

The frequency of sales at the supermarkets can be seen in Table 4.13. There are both considerable sales volumes of the target brand, and also in total sales, making reasonable inferences possible.

Table 4.13

Frequency Distribution and range of Purchases of the Target Brand (A), and Total Purchases made in the Washing-up Liquid Product Category

Stores	Supermarket A		Supermarket B	
Periods	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of purchases of the target brand (A)	Total number of purchases made
1	13	47	11	31
2	39	77	15	30
3	22	52	37	49
4	50	69	20	30
5	31	61	30	45
6	31	60	21	36
7	25	56	22	40
8	46	79	16	35
9	36	66	26	51
10	37	67	29	50
11	22	48	21	29
12	35	67	10	26
13	21	46	15	32
14	27	58	15	31
15	14	48	23	35
16	26	91	17	24
17	20	47	20	36
18	24	61	13	28
19	22	47	18	37
20	28	65	28	54
21	22	36	17	35
22	37	62	18	34
23	19	40	20	43
24	30	72	16	33
25	19	37	26	38
Range	**37**	**55**	**27**	**30**

Here, the target brand has a strong position in the market, but there is still room for improvement.

And finally, the sales volumes for each period of the in-store experiment in the budget stores are presented in Table 4.14. As can be seen, total sales are higher than in the supermarket, but the target brand's market share is not as strong.

Table 4.14

Frequency Distribution and Range of Purchases of the Target Brand (A), and Total Purchases made in the Washing-up Liquid Product Category

Stores	Budget Store A		Budget Store B	
Periods	Total number of purchases of the target brand (A)	Total number of purchases made	Total number of purchases of the target brand (A)	Total number of purchases made
1	44	241	32	58
2	33	189	26	57
3	42	200	26	66
4	39	158	23	74
5	29	112	22	83
6	34	106	19	102
7	47	147	23	69
8	40	146	23	86
9	39	157	33	99
10	21	106	18	69
11	58	165	25	76
12	30	172	37	133
13	55	271	33	122
14	33	219	34	116
15	43	215	40	119
16	25	136	19	95
17	52	241	40	141
18	52	165	44	110
19	52	175	45	109
20	82	267	64	155
21	23	60	11	51
22	44	148	38	123
23	48	141	44	113
24	46	118	38	108
25	50	174	42	110
26	48	132	30	102
27	32	136	12	97
28	49	137	29	96
29	59	146	34	88
30	40	135	13	68
31	25	140	20	69
Range	**61**	**211**	**53**	**104**

The reason could be that the target brand is the highest priced and customers in budget stores are obviously looking for good deals. This makes it interesting whether the advertisement put up on the product category shelf, to point attention to the quality and durability of the target brand, has any effect on buying.

4.2 Summary

In Chapter 4 raw data was presented to give a clearer picture of the validity and reliability of the in-store experiments. The sales data for each store used were presented, revealing a good base (depending on sales) for interpretation from the supermarkets and budget stores, but methodological problems with the convenience stores. This holds for the in-store Price and Promotion experiments, but not for the effects of Place. The sales numbers for the Place in-store experiment were sufficient for experimental inferences to be made in the convenience stores. Other potential problems mentioned are the low market share of the target brand in the Price in-store experiment in the supermarkets, and to the high market share in the Promotion in-store experiment in the convenience stores; making little room for improvements in sales. Having said this, the raw sales tables do indicate a good base for inferences, especially for the budget stores, who enjoy high sales turnover. From the discussion above it is apparent that the presentation of the raw sales tables are important for any interpretation of the research results, the evaluation of the strength of the in-store experiments, and the interpretation made from them.

The methodology and raw data have been presented in Chapters Three and Four. The next three chapters will describe the results from the relative sales and matching analyses for each experiment. First, for the effects of shelf placements, then price, and finally in-store advertisements.

CHAPTER FIVE

RESULTS FROM SHELF PLACEMENTS

This chapter is dedicated to the aggregated (or group) relative sales and matching analyses of the results from the in-store Place experiment. This in-store experiment and its behavioural economic analyses are discussed in Chapter Three. The experiment, as mentioned, involved placing a target brand in the crisps product category, on the lowest, middle, and highest shelves of the three different types of stores (convenience stores, supermarkets, and budget stores). On top of this, the presentations of an extra line-up of the target brand at the entrance of the budget stores were tested.

Concerning the order of presentations, the analyses are shown separately for each store. Analyses from the convenience stores are in section 5.1, for the supermarkets in section 5.2, and finally for the budget stores in section 5.3. The analyses are supposed to back each other up in representing the effects of the experimental intervention on consumers' choices of the target brand, and the substitutability of brands in the product category used. First, results from each store's relative sales analysis are shown. It reveals how the brand placements (the independent variable) affect the consumers' relative purchases of the target brand measured against the crisps product category as a whole. Second, in accordance to section 3.2.2, one graph showing results from an amount matching analysis, the relationship between the amount paid ratio (behaviour) for the target brand and the relative amount bought of it ("reinforcement"), is displayed to make the point that the amount matching law is tautological, and that it is of rather limited value as an analytical technique in marketing. This is only done in the case of the first convenience store presented as the analysis is flawed. Finally, the probability matching analysis is shown. In previous consumer behaviour analysis this technique has been intened to reveal the relationship between the amount bought ratio of the target brand and the relative probability of reinforcement (see Foxall, Oliveira-Castro, James, & Schrezenmaier, 2007). This is a maximisation analysis which should denote how rational consumers' buying behaviour is in respect to the brands in the product category being gross complements. The consumer probability matching analysis, performed here in congruity to previous consumer behaviour analysis (see e.g., Foxall, Oliveira-Castro, James, & Schrezenmaier, 2007) is however only able to reveal if the target brand is cheaper than the average of the other brands in the relevant product category. Like for the amount matching analysis, this historical version of the probability matching analysis is only displayed once as the consumer behaviour analysis version of these techniques is seriously defected (see section 8.2.2).

It is important to realise that all data points in the relative sales analysis represent aggregated relative buying of the target brand against its product category for a particular experimental period. As mentioned in Chapter Three, these periods are calculated as relative sales from either Monday to Thursday, or Friday to Sunday. The data points shown in the matching figures represent the relevant relationship for each day for the duration of the experiment.

As is general in behaviour analytic research, the results for all three analytic chapters (Chapters Five, Six, & Seven) are presented graphically. The in-store experiments are conducted with repeated measures (single subject) experimental design, emphasising visual inspection of effects, instead of statistical measures to assess if there are changes in consumer behaviour as a consequence of a particular experimental condition. Interpretations of behavioural change should be based on three elements, the behavioural level, trends, and variability (e.g., Johnston & Pennypecker, 1993).

5.1 Convenience Stores

The three analyses, relative sales analysis, amount matching, and probability matching were performed for the convenience stores (as amount matching is tautological and the consumer behaviour analysis version of the probability matching analysis is flawed they are only included once [convenience store A] – as there is historical warrant for this kind of presentation, to allow comparison). Chapter Four showed that behind the ratios shown are relatively good sales of the target brand, and of the whole product category of crisps.

5.1.1 Convenience Store A

5.1.1.1 Relative Sales Analysis

The results from the relative sales analysis for convenience store A (Figure 5.1) show some variation during baseline (M = 13.57%, range, 6.91% to 18.42%). The range of variability is fairly constant, but if any pattern can be observed it is that relative sales of the target brand decrease slightly.

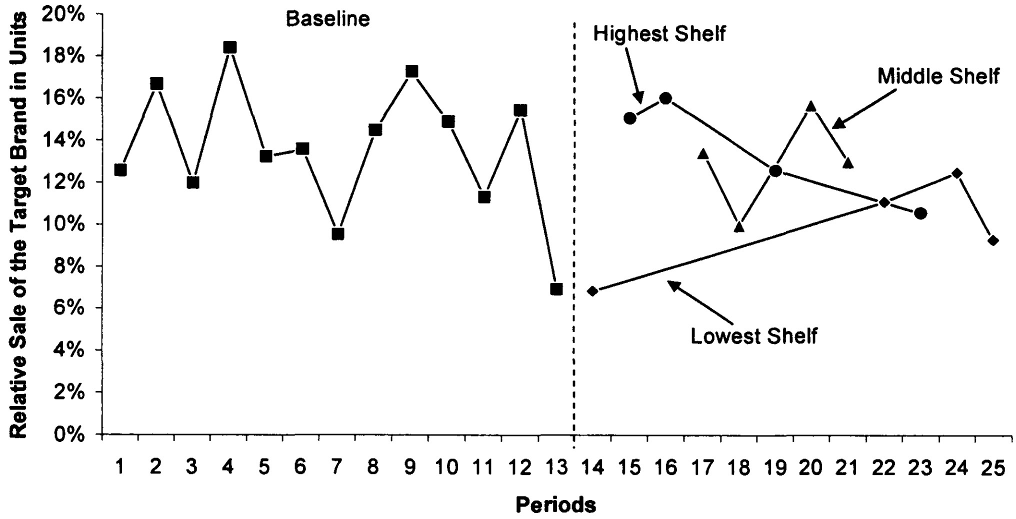

Figure 5.1. The target brand's proportion of sales at convenience store A (crisps)

The first intervention is to place the target brand on the lowest shelf and it can be seen that it does not change relative sales of the target brand, in comparison to the last baseline data point. What is apparent, during the experimental interventions, is that the range of variability decreases (each experimental condition compared to the baseline) which can be attributed to the controlling of factors mentioned in Chapter Three (such as availability of the target brand, prices, in-store promotions etc.). Regarding the impact of the shelf placements on relative sales, the target brand suffers the lowest sales when it is placed on the lowest shelf (M = 9.94%, range, 6.84% to 12.50%) but there is no difference between placing the target brand on the middle shelf (M = 13.06%, range, 10% to 15.73%), or the highest shelf (M = 13.58%, range, 10.58% to 16.04%). It is, though, important to beware of too strong an inference here. Figure 5.1 indicates that the target brand has lower sales when put on the lowest shelf, but it would be helpful to have more data points as there is some variation. Also, relative sales of the target brand on the lowest shelf increase while sales are decreasing for products on the highest shelf. It is also useful to compare these results with those gathered for convenience store B (section 5.1.2.1) which shows very clearly the advantage of placing the brand on the middle shelf, while sales are the same for the lowest and highest shelves. That is exactly the pattern which appears here, as relative sales are increasing for the middle shelf but the relative sales of the other two shelves are getting closer together. However, without more data points this is just speculation, which points to the importance of gathering more than four data points for each experimental condition of the independent variable in future consumer behaviour analysis.

5.1.1.2 Amount Matching Analysis

The results from the amount matching analysis (Figure 5.2) show, as would be expected, that the general matching equation explains the data very well - as the multiple coefficient of determination is between .89 and .94. All the matching curves, representing different shelf placements, show slight overmatching. The intercept, thought to indicate all fixed preference for the target brand, shows that, overall, consumers spend slightly more for the brand than they receive in quantity of it compared to the other brands in the product category.

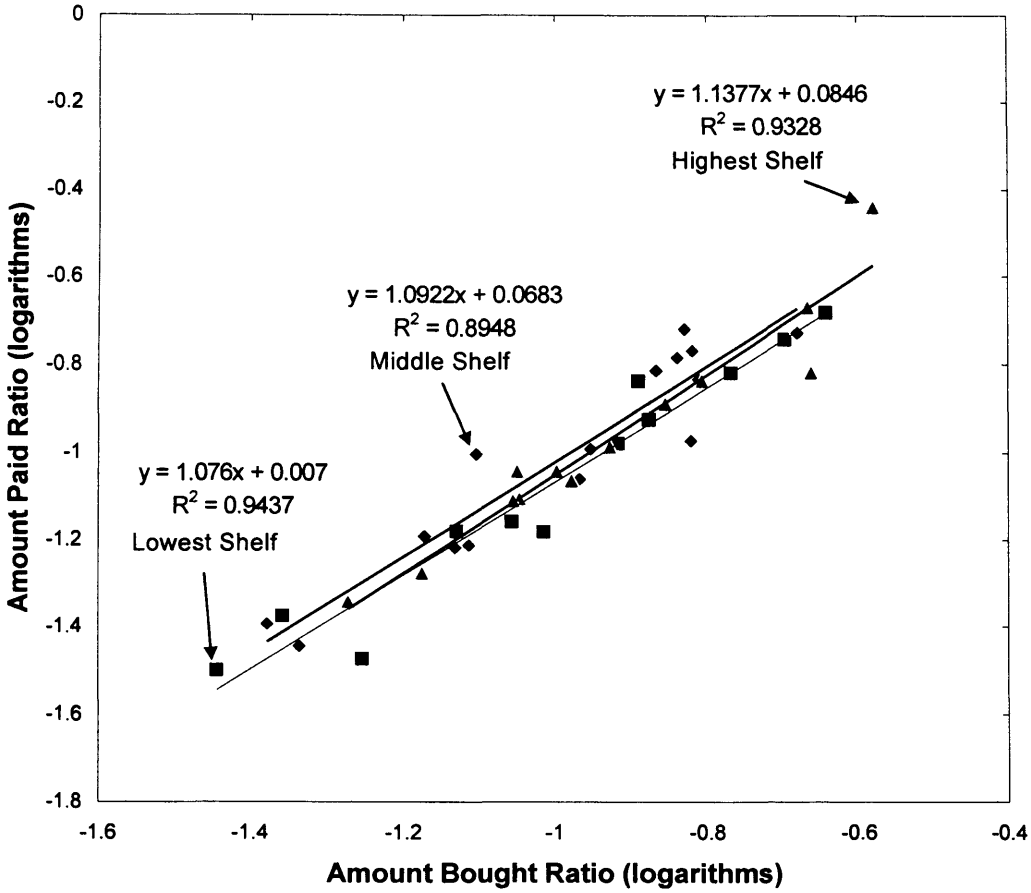

Figure 5.2. Amount matching analysis for convenience store A (crisps)

Although the matching relations are compelled, the shelf placements seem to affect the matching relations in an important way, as the intercept (stable preference) and slope (the effects of increased reinforcement on behaviour) are highest for the top shelf, then the middle shelf, and least for the lowest shelf. This order is in accordance with the results from the relative sales analysis where sales averages were also in this order. The reason for the different parameters is that when the consumers increase their relative consumption (amount bought ratio) of the target brand, the numerator (in the amount paid ratio) increases as more is relatively sold of the target brand, and the denominator decreases as consumers shift their consumption to less expensive brands (Appendix 3.1).

5.1.1.3 Probability Matching Analysis

Figure 5.3 shows the results from the probability matching analysis for convenience store A, performed here in congruity to previous consumer behaviour analysis (see e.g., Foxall, Oliveira-Castro, James, & Schrezenmaier, 2007)

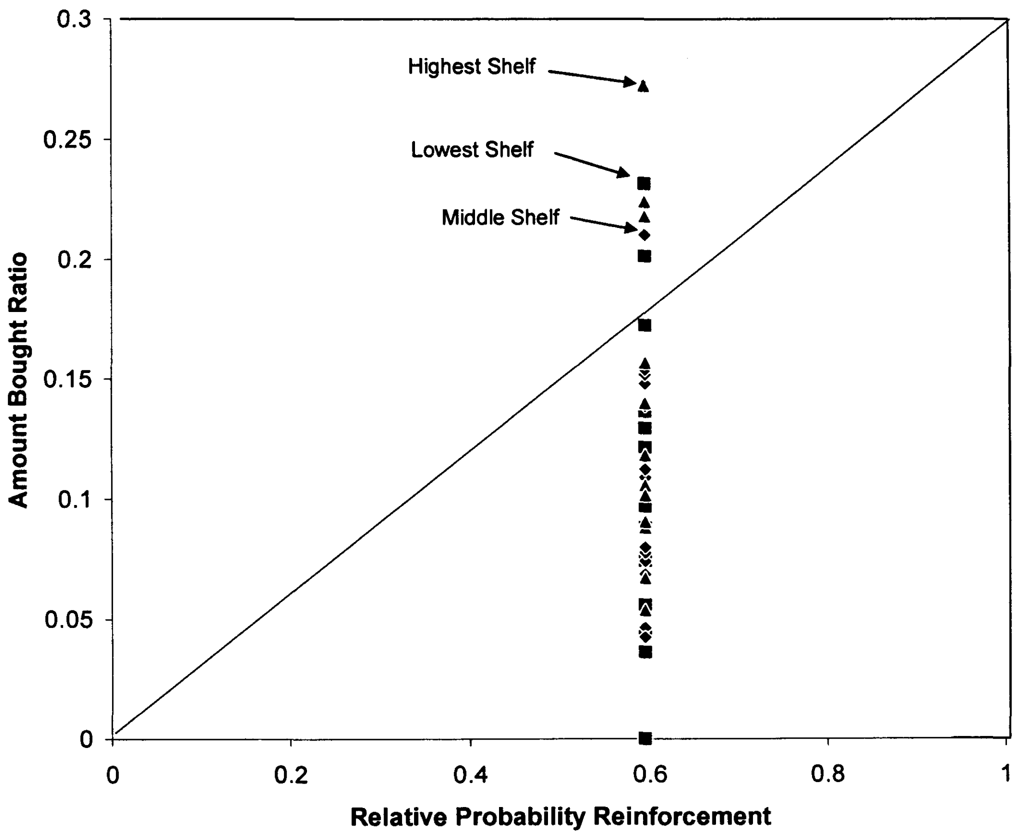

Figure 5.3. Probability matching analysis for convenience store A (crisps)

It is apparent from the figure that it does not bring out anything useful. This representation is at best able to reveal that the target brand is cheaper than the average price of all the brands in the crisps product category. This can be seen to be certain, as the relative probability of reinforcement is to the right of .5 on the x-axis. As there are no price changes during the Place in-store experiment the data points align vertically where the experimental conditions which had a higher relative amount of sales (the middle and highest shelves) rank higher on average than those who had a lower amount of sales (the lowest shelf placement). The probability matching analysis (or maximisation analysis) is intended to reveal whether consumer behaviour is maximising returns on price expended, but graphs such as Figure 5.3 hide the detail of the data and do not bring out anything useful. It is interesting to compare Figure 5.3 to Figure 5.4, which shows the connection between relative price and relative amount bought, and Figure 6.3 which shows a version which should be more in line with the purpose of a probability matching analysis.

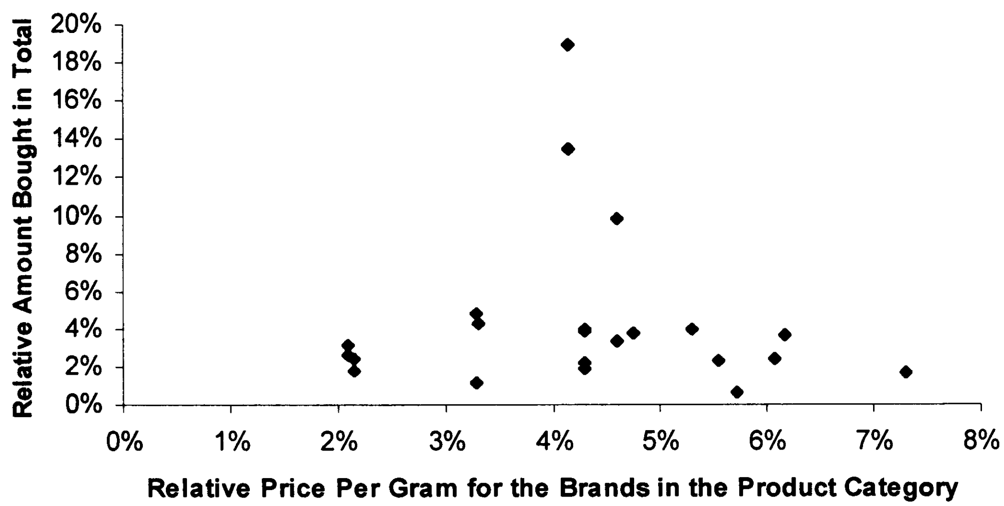

Figure 5.4. The Connection between relative price and relative amount bought

Figure 5.4 shows clearly that consumers are not, overall, buying the cheapest option. On the contrary, consumers seem to be looking at something other than price as their buying behaviour is spread out over the price axis; with a small tendency shown towards the middle price.

5.1.2 Convenience Store B

5.1.2.1 Relative Sales Analysis

Compared to the relative sales in convenience store A, those for store B (Figure 5.5) are much more stable and easier to interpret. The baseline shows some variation in sales of the target brand (M = 5.80%, range, 0.50% to 10.63%) where it sometimes nearly reaches zero.

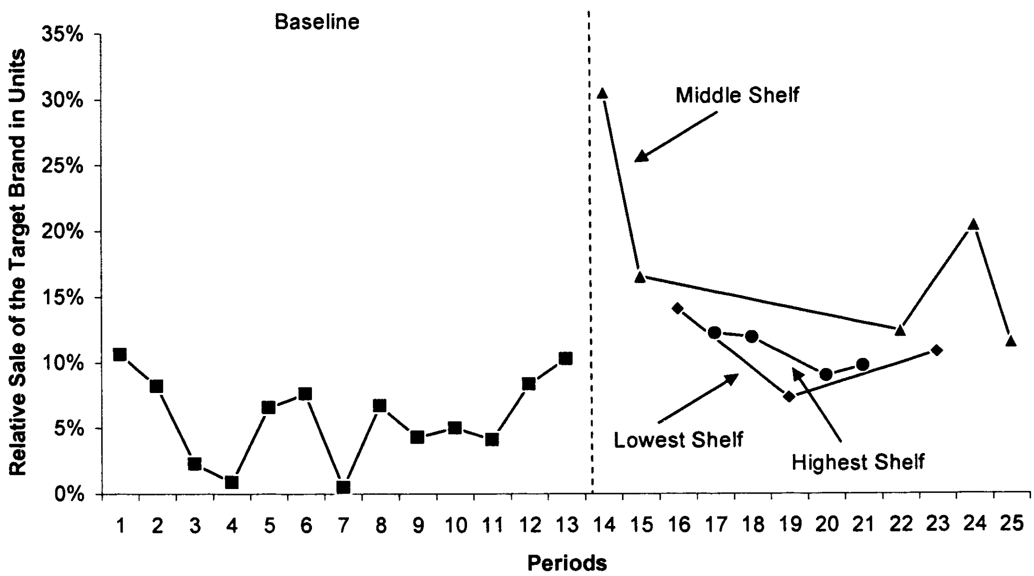

Figure 5.5. The target brand's proportion of sales at convenience store B (crisps)

This is explainable from the fact that the brand was not very well controlled. It sometimes went out of stock and it had little shelf space, where the competition tried to squeeze it to the end of the shelf, as there were not so many items of the brand on the shelf. As the experimental intervention starts the target brand is first placed on the middle shelf, which immediately results in a large increase in its relative sales. There is an increasing baseline trend for the last two data points before the transition, where the target brand goes from 4.12% to 10.28%. The middle shelf placement (M = 18.33%, range, 11.58% to 30.57%) enjoys better sales in every instance, compared to the highest (M = 8.99%, range, 7.32% to 12.24%) and lowest (M = 10.75%, range, 7.32% to 14.10%) shelves which remain remarkably stable, making inferences easy. The range variation on the middle shelf is, however, difficult to explain. The first and fourth implementations have considerably higher sales than those for implementations two, three, and five, which are very stable.

5.2 Supermarkets

5.2.1 Supermarket A

5.2.1.1 Relative Sales Analysis

In supermarket A (Figure 5.6), during baseline (M = 7.99%, range, 1.59% to 12.32%) there is some variation in the relative sales of the target brand where the trend is to an increased market share. The highest shelf (M = 7.30%, range, 5.04% to 8.95%) has lower sales than the middle shelf (M = 10.53%, range, 9.56% to 11.92%), where the sales of the target brand are higher in every instance.

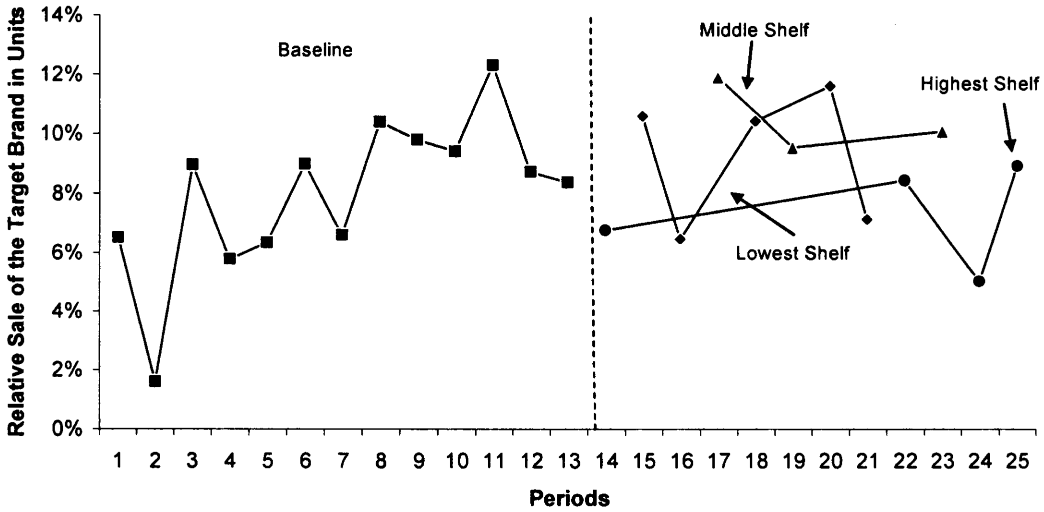

Figure 5.6. The target brand's proportion of sales at supermarket A (Crisps)

The lowest shelf (M = 9.25%, range, 6.47% to 11.62%) sometimes has higher sales than the highest shelf. It was higher in three instances, but similar in two periods. In line with behavioural analytic parsimony, which puts more reliance on graphically displayed data than statistics (e.g., Johnston & Pennypecker, 1993) it is here inferred that there is no difference between the lowest and highest shelf when it comes to relative sales of the target brand. More control over sales, and external variables needs to be achieved.

There are two important points regarding the results shown in Figure 5.6 which are important to mention. First, as mentioned in section 4.1.2.2, there were very unusually high sales of Lay's crisps on Tuesday, 04.04.06, attributed to many extra line-ups of the brand. To put this into some perspective, the sales of this brand (its sub-brands) were 18 the day before 04.04.06, and 4 the day after, but 1296 this particular day. As this represents an external factor having a very dramatic effect on the relationship between the independent and dependent variable, it was taken out of the dataset. Therefore, for period 18 there is data from three days (Monday, Wednesday, and Thursday) as the Tuesday has been taken out of the calculations. The effect is that the relative sales of the target brand are 10.43%, instead of being 1.04% during period 18, when the brand is placed on the lowest shelf, which is more in line with the other data points presented in Figure 5.6, representing the relative sales of the target brand when it is placed on the lowest shelf. Second, unlike the convenience stores which are open on most public holidays, the supermarkets were closed on the Good Friday and Easter Sunday. As a result of this, the data point number 21, representing the Easters weekend, should be taken with greater caution, as it involves data from only one day, instead of three (Friday to Sunday) or four (Monday to Friday) for others.

5.2.2 Supermarket B

5.2.2.1 Relative Sales Analysis

Regarding supermarket B (Figure 5.7), during baseline ($M = 8.22\%$, range, 6.02% to 12.40%) there is less variation in the relative sales of the target brand compared to supermarket A. The data is fairly stable and the relative sales don't change much from the baseline, in general, during the intervention phase.

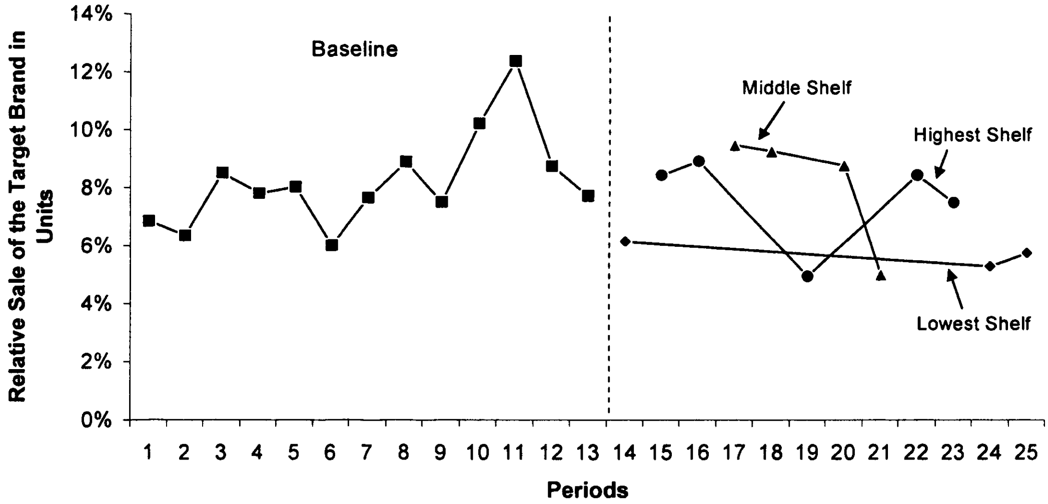

Figure 5.7. The target brand's proportion of sales at supermarket B (crisps)

Before examining differences between various shelf placements of the target brand it is important to mention that the same methodological points, discussed for supermarket A, hold here: There are also unusually high sales of the Lays brand on 04.04.06, making it necessary to remove it from the data set. As for supermarket A, for period 18, there are data from only three days (Monday, Wednesday and Thursday), as the Tuesday has been omitted from the calculations. The effects are that the relative sales of the target brand are 9.29%, instead of being 2.03% during the eighteenth period when the brand is placed in the middle shelf. This makes the relative sales of the target brand very similar to what it is for the middle shelf periods before and after this period. The results from supermarket B during interventions reveal that the lowest shelf (M = 5.74%, range, 5.30% to 6.15%), overall, has lower relative sales of the target brand compared to the highest shelf (M = 7.66%, range, 4.95% to 8.94%), and the middle shelf (M = 8.15%, range, 5.02% to 9.50%).

5.3 Budget Stores

5.3.1 Budget Store A

5.3.1.1 Relative Sales Analysis

In budget store A (Figure 5.8), baseline relative sales were variable (M = 5.18%, range, 0.00% to 12.79%). This is because there was hard competition for placements, and the target brand was sometimes out of stock. The relative sales of the target brand immediately became much more stable when the interventions were introduced. This can be attributed to the control of the store/shelf environment (e.g., in terms of availability and in-store stimuli) during the interventions. The relative sales of the target brand were different during the interventions, depending on whether it was placed on the middle shelf (M = 7.49%, range, 6.55% to 8.61%), the lowest (M = 3.99%, range, 2.89% to 5.81%) or the highest shelf (M = 3.28%, range, 2.74% to 3.61%). When the target brand was on the middle shelf its relative sales were higher in every instance compared with the lowest and top shelf. It is interesting to see how reliable the relative sales of the target brand were between the same shelf placements at different times.

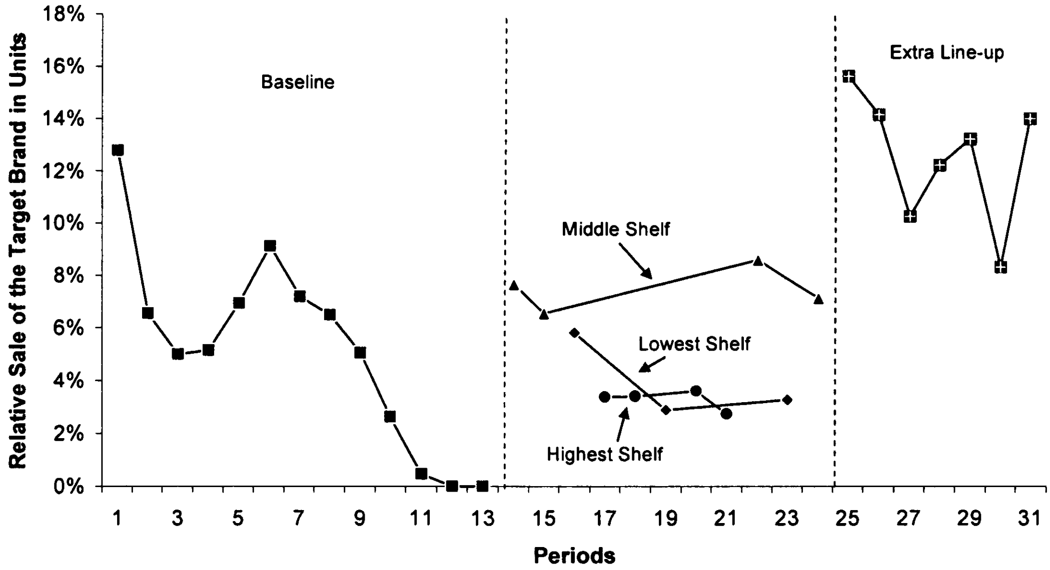

Figure 5.8. The target brand's proportion of sales at budget store A (crisps)

When the average relative sales of the target brand are considered during the extra line-up phase, where the brand was stacked at the entrance of the store, it was considerably higher (*M* = 12.59%, range, 8.34% to 15.68%).

There are two methodological matters that need to be mentioned regarding the results presented in Figure 5.8. Firstly, for the first condition, when the brand was put on the middle shelf, relative sales data from the first two days (Monday and Tuesday) were taken out and only data for the last two days are presented for this period (Wednesday and Thursday). This is done because the brand was out of stock (and therefore it was not possible to buy it) despite repeated requests and discussions concerning the matter. Secondly, as for the supermarkets, the budget stores are closed on the Good Friday and Easter Sunday. Because of this, data point number 21 only represents one day (only the Saturday of the Friday to Sunday period). This is worth mentioning, but should not be as much of a methodological problem as it was for the supermarkets. The sales are higher in the budget stores than in the supermarkets, and as a consequence, this one day has saw sales in the budget stores; making the threats of external factors lower, as the data set is richer (a larger sample). By looking at data point number 21, it is obvious that it is in accordance with others shown for the highest shelf.

5.3.2 Budget Store B

5.3.2.1 Relative Sales Analysis

The results for budget store B replicate those for budget store A in all major respects, although there is less of a difference in sales relative to shelf placement (Figure 5.9).

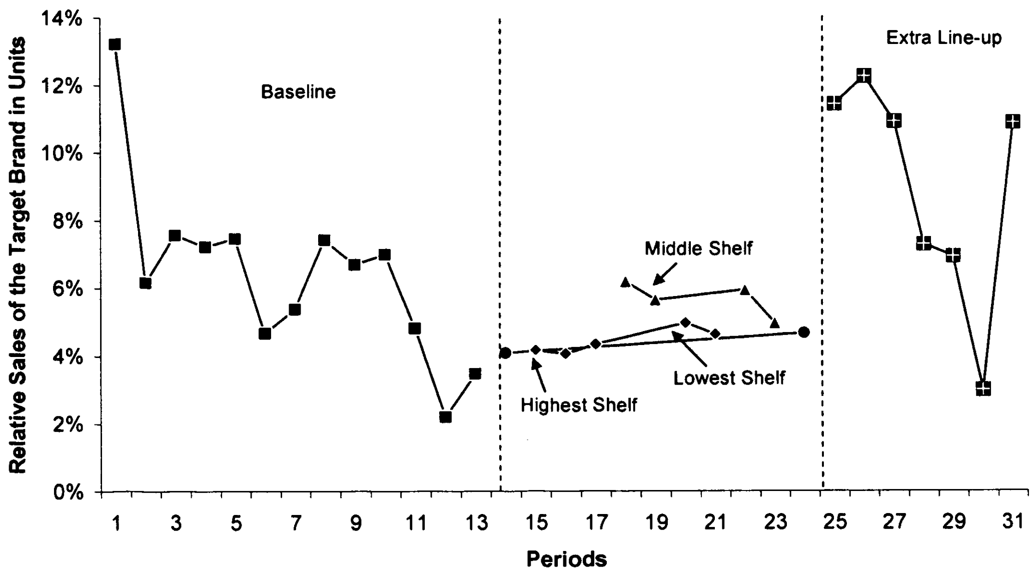

Figure 5.9. The target brand's proportion of sales at budget store B (crisps)

This strengthens the reliability of the research. There is, overall, much variation in the target brand's relative sales during baseline (*M* = 6.41%, range, 2.20% to 13.22%), but the two stable clusters, both consisting of three data points with a narrow range, are interesting and indicate a possibility of orderliness, with more control of the situation. This is actually the case, as relative sales of the target brand immediately become much more stable when the shelf placement intervention begins (the experimental control). Revealing that when the target brand is put on the middle shelf (*M* = 5.70%, range, 4.98% to 6.21%) it enjoys slightly more relative sales than when it is positioned on the lowest shelf (*M* = 4.44%, range, 4.07% to 4.98%), or the highest shelf (*M* = 4.39%, range, 4.09% to 4.69%), which are again comparable. It is interesting to see how small the variance is between the relative sales of the target brand within each of the three interventions (lowest, middle, and top shelf). This strengthens the internal validity of the research. Apparently, the effects of external factors (other than the independent variable) on the dependent variable have been minimised. The average relative sales of the target brand are 8.98% (range, 3.00% to 12.28%) during the extra line-up phase, indicating the maximum effect of the presentation of the target brand on consumers' choices.

5.4 Summary

Chapter Five has presented three different analyses of the data from the six stores used in the in-store Place experiment. The first to be performed was relative sales analysis which reveals overall higher relative sales of the target brand, within the crisps product category, when it is placed on the middle shelf compared to when it is placed on the highest or lowest shelves. This relationship is most clearly seen in the two budget stores, which also tested the effects of an extra-line up of the target brand at the entrance of the stores, which increased sales but with more variation compared to the experimental phase (lowest, middle, and highest). The second analysis tested the amount matching relations which confirmed as was expected, in line with previous consumer behaviour analysis research, a strong relationship between the relative amount bought of the target brand and the relative amount spent for it. Lastly, probability matching analysis was carried out. It showed, in line with previous research, that consumers' choices do not show probability matching, but that the relative probability of reinforcement for the target brand is over the .5 criteria, which should indicate maximisation of consumer choice in terms of price (consumers' choosing the target brand ("Brand A") as it is less expensive than the average price of the other brands ("Brand B"). This use and interpretation, which is in line with previous consumer behaviour analysis, is, however, questioned in section 8.2.2.

CHAPTER SIX

RESULTS FROM PRICE REDUCTIONS

Chapter Six shows the results from the aggregated relative sales and matching analyses from the in-store Price experiment. This in-store experiment and the behavioural economic analyses were discussed in Chapter Three. As previously mentioned, the experiment involved periodic reductions in the price of the target brand in two product categories (shampoo and conditioner), which were analysed separately.

The analyses are presented one by one for each store, first for the convenience stores and then for the supermarkets. The budget stores were not used in this in-store experiment. The results for the shampoo product category are given in Section 6.1, and for the conditioner product category in Section 6.2.

6.1 Shampoo

Chapter Four showed that sales were low in the shampoo product category for both convenience stores. Therefore, these results should be viewed with some scepticism.

6.1.1 Convenience Store A

6.1.1.1 Relative Sales Analysis

The results from the relative sales analysis built on data from convenience store A (Figure 6.1) show a very large variation during baseline ($M = 22.86\%$, range, 0.00% to 50.00%).

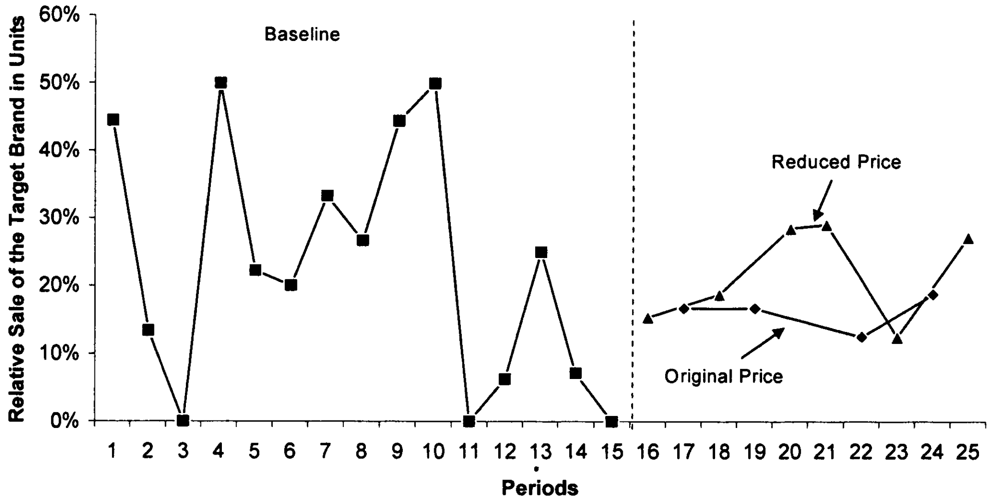

Figure 6.1. Relative sales of the target brand in convenience store A (shampoo)

It is not very promising to see such a high range of variation before implementing interventions, but it is important to remember that there is no control taking place in this situation. When the experimental interventions begin, the data transforms from being totally orderless into more stable patterns as variation severely decreases. Relative sales are similar during periods of original price (M = 16.15%, range, 12.50% to 18.75%), and when the price is reduced (M = 21.94%, range, 12.50% to 29.17%), relative sales go up and down. Why this pattern is observed is hard to tell. Half of the data points recorded during the reduced price phase are similar as those obtained when the original price was implemented, during the intervention phases. Therefore, it is hard to infer, with any certainty, whether the reduced price increases the brand's market share. In fact it is remarkable how orderly the data is during the intervention phase, taking into account the small-scale of the sales in the shampoo product category in convenience store A.

6.1.1.2 Cost Matching Analysis

Figure 6.2 shows the results from the cost matching analysis for convenience store A. It is quite interesting to see an upward sloping relative demand curve, where a considerable (20%) decrease in the brand's unit price leads to a decrease in the amount bought ratio of the target brand.

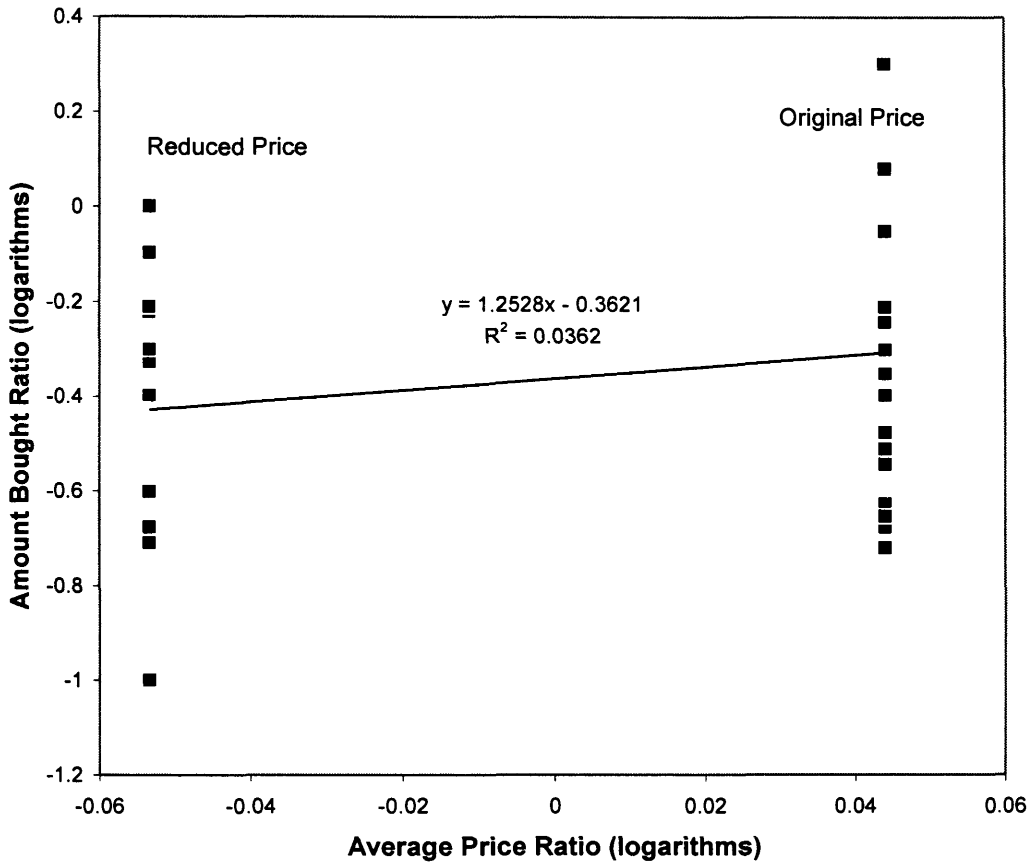

Figure 6.2. Cost matching analysis for convenience store A (shampoo)

Although the slope of the relative demand function is quite steep, the coefficient of determination shows that the relationship between the relative price of the target brand and its relative quantity demanded is weak, as the variance accounted for, is only 3.26 per cent. This shows that relative prices are not an important factor in accounting for consumer's relative purchasing behaviour with respect to the target brand in this case.

6.1.1.3 Probability Matching Analysis

Figure 6.3 shows the results from the probability matching analysis for convenience store A.

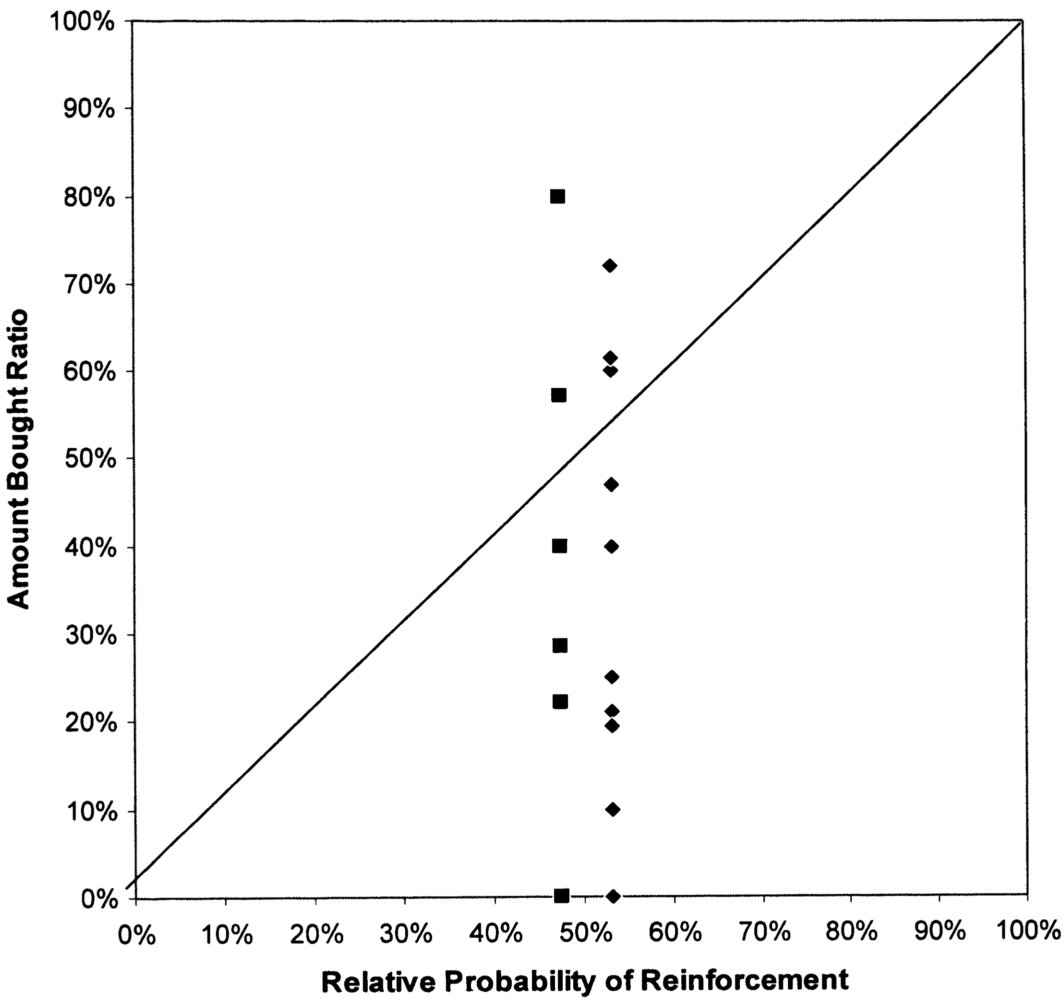

Figure 6.3. Probability matching analysis for convenience store A (shampoo)

During the original price period, in the experimental period, the price of the target brand was higher than the average price of the brands in the shampoo product category. The reduced price condition, however, changed the price of the target brand, so that it became cheaper than the average price in the product category. The data points align in a vertical line for both instances (original and reduced price), and there is not much difference in their variation. The price reduction makes this line shift to the right.

Chapter 5 presented a probability matching analysis (Figure 5.3) for one of the stores used in the shelf placement experiment. This analysis was performed in congruity to previous version used in consumer behaviour analysis (see Foxall, Oliveira-Castro, James, & Schrezenmaier, 2007). There are at least two problems with that version. (1) The meaning of the diagonal line as showed on Figure 5.4 is completely obscure; if the scales on both axes ran from zero to one, then the diagonal would represent some kind of probability matching relationship, but since the vertical axis has an arbitrary endpoint, the "diagonal" is not in fact a true diagonal, and has no obvious interpretation. (2) The piling up of points at a single value of the horizontal axis demonstrates that they had no possibility of free variation on this axis.

Figure 6.3 presents a slightly better version. By changing the y-axis from ratios (A/"B") to proportions (A/A+"B") both axis run from zero to one. This uniformity of axis is a prerequisite for a meaningful probability matching relationship for the diagonal line. Regarding the second point, the experiments were done with the relative sales analysis in mind. This means that brand prices were kept constant (or nearly so) to make a meaningful experimental inference possible. The only exception was the Price experiment, here presented, where the target brand's price was changed. However, as this target brand was never the cheapest one in its product category there is always a lower priced brand within the brands that make up the aggregated brand "B". Therefore, the probability matching analysis, here conducted, will not show if consumers' where maximising returns on price expended. However, the cost matching figures and Figure 5.4 all show price insensitivity on behalf of the consumers.

6.1.2 Convenience Store B

6.1.2.1 Relative Sales Analysis

The relative sales analysis performed for convenience store B shows a vast range of variation during baseline (*M* = 37.45%, range, 8.57% to 100.00%). When the shift into the experimental intervention takes place, the target brand enjoys a very high market share, but as its relative sales are increasing during the last baseline period it is hard to infer whether these high sales are because of the price reduction, or some other unknown factor.

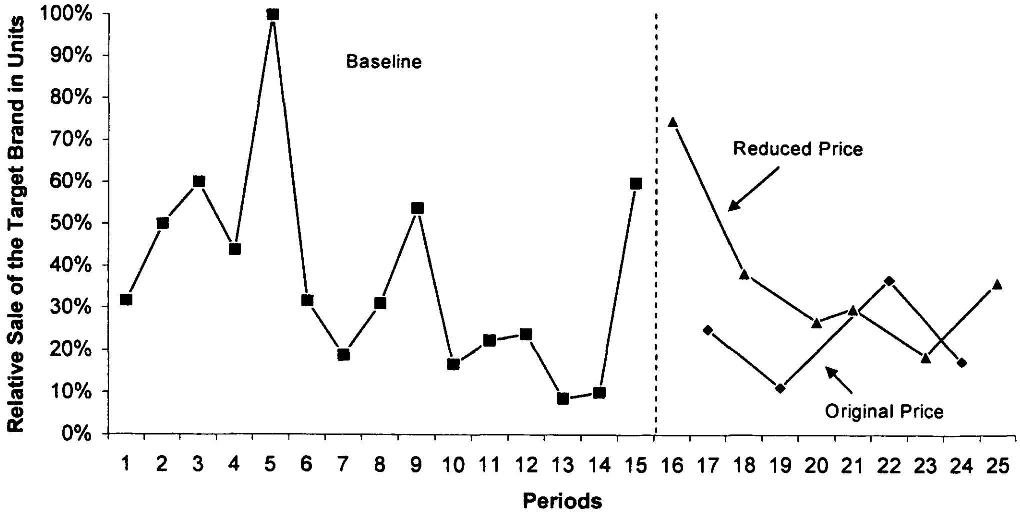

Figure 6.4. Relative sales of the target brand in convenience store B (shampoo)

The trend for the relative sales of the target brand during the price reduction phases are downward sloping, strengthening the idea that there is some other factor responsible for the vast increase in sales. Throughout the period when the experimental conditions are taking place the variation is less when compared to the baseline. If the first period of intervention is taken out, there is no difference between relative sales, on the brand, neither at the original price (M = 22.59%, range, 11.11% to 36.84%), nor at the reduced price (M = 37.58%, range, 18.75% to 75.00%).

6.1.2.2 Cost Matching Analysis

Figure 6.5 shows the results from the cost matching analysis for convenience store B. The relative demand curve shows a downward-sloping trend that contradicts the results obtained from convenience store A, but likewise the relative price factor has almost no effect on the relative buying of the target brand.

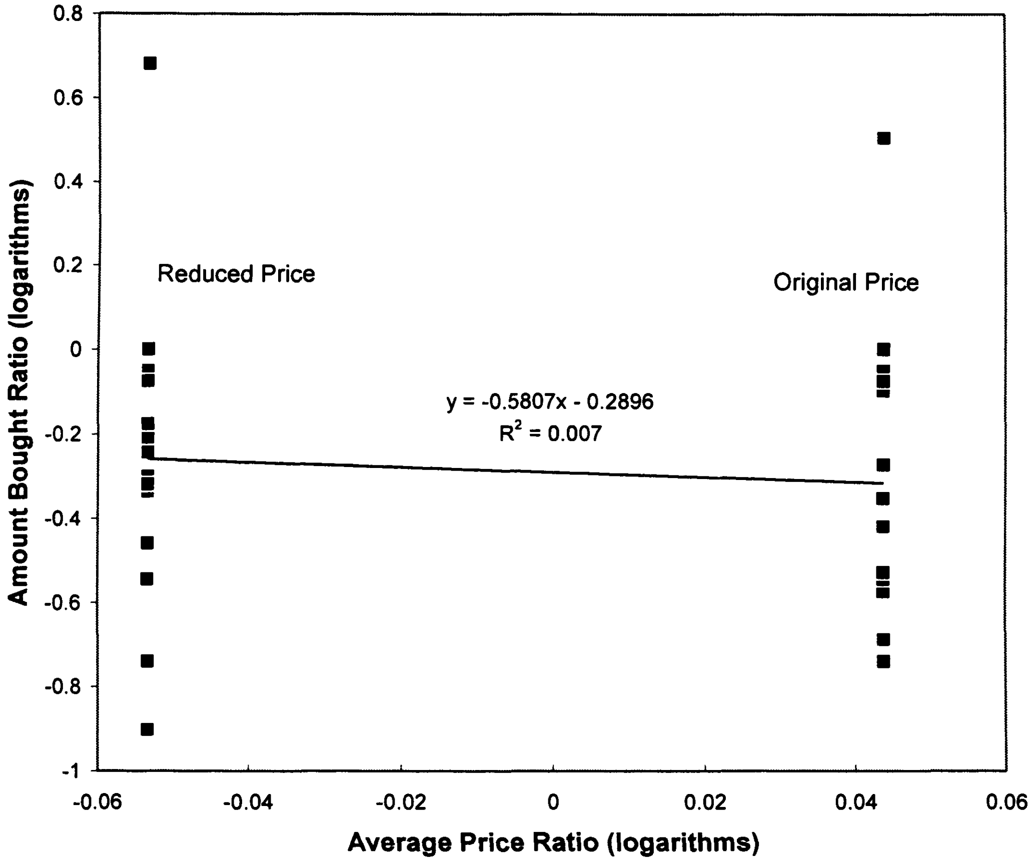

Figure 6.5. Cost matching analysis for convenience store B (shampoo)

6.1.3 Supermarket A

6.1.3.1 Relative Sales Analysis

The results from the relative sales analysis for supermarket A are interesting (Figure 6.6). There is some variation during baseline (*M* = 10.66%, range, 4.55% to 18.96%) but the trend is fairly stable, meaning that the relative sales are neither significantly increasing nor decreasing. Interesting results appear during the intervention period.

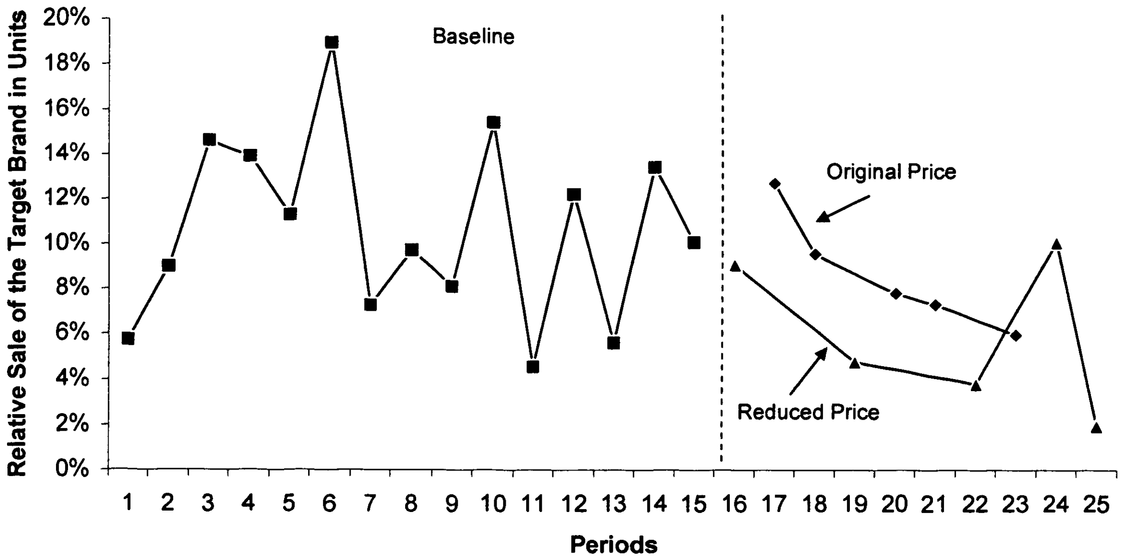

Figure 6.6. Relative sales of the target brand in supermarket A (shampoo)

The first thing to note is the relative sales of the target brand are higher during the original price phase (M = 8.68%, range, 5.97% to 12.74%), the higher non reduced price, compared to the conditions where the price of the target brand is reduced (M = 5.96%, range, 1.96% to 10.11%). Second, the relative sales of the target brand show a descending trend. This indicates not only the surprising result that the stores' customers are buying relatively less of the brand when it is priced lower, but also that the price reductions might be damaging the brand value (in terms of relative sales). Not taking one data point into account, relative sales of the target brand show a downward sloping trend for both the original price conditions and price reduction states. The brand damaging effect of the price reduction could thus be spilling over into the original price conditions.

6.1.3.2 Cost Matching Analysis

The results from the cost matching analysis for supermarket A are shown in Figure 6.7. The demand curve is upward sloping, which is very surprising.

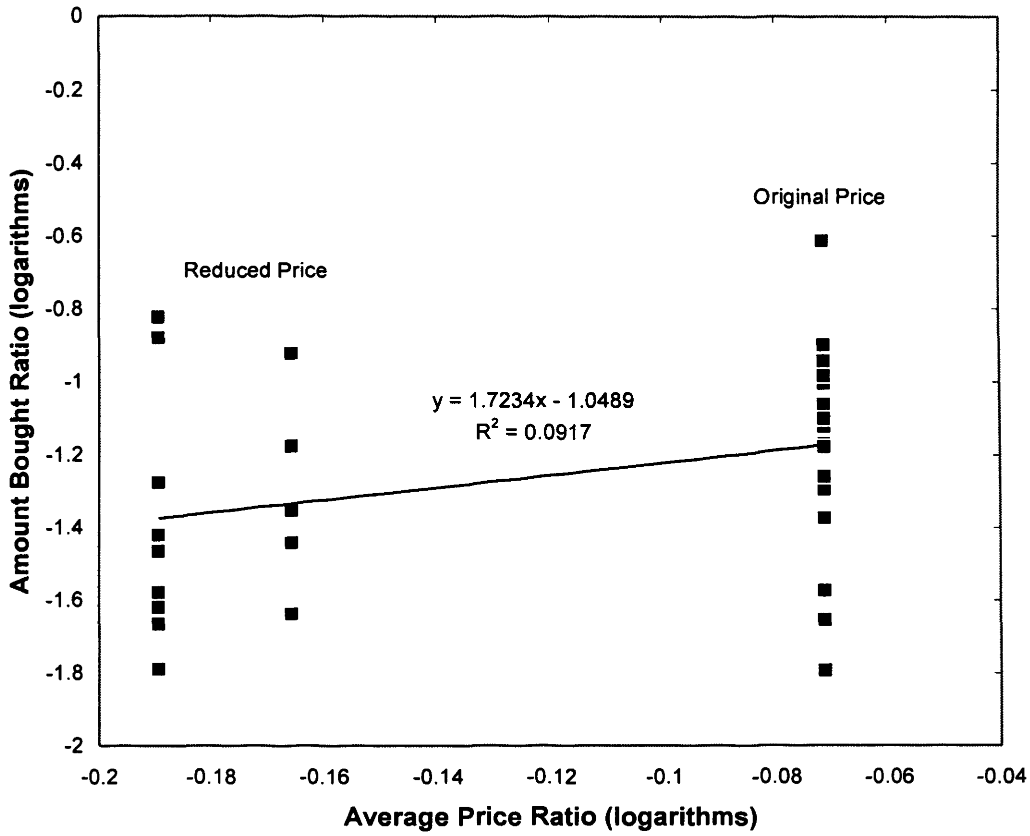

Figure 6.7. Cost matching analysis for supermarket A (shampoo)

It means that under the experimental conditions where the price was reduced, it generally lead to a lower amount bought ratio for the target brand. However, the relationship between relative amount bought and relative price weak ($R^2 = 9.17\%$).

6.1.4 Supermarket B

6.1.4.1 Relative Sales Analysis

For supermarket B relative sales analysis shows some variation under baseline conditions (*M* = 10.20%, range, 4.42% to 21.01%). During the intervention phase the relative sales of the target brand become fairly stable, notwithstanding period 21, which is the previously mentioned Easter period, during which the data point relates to only one day.

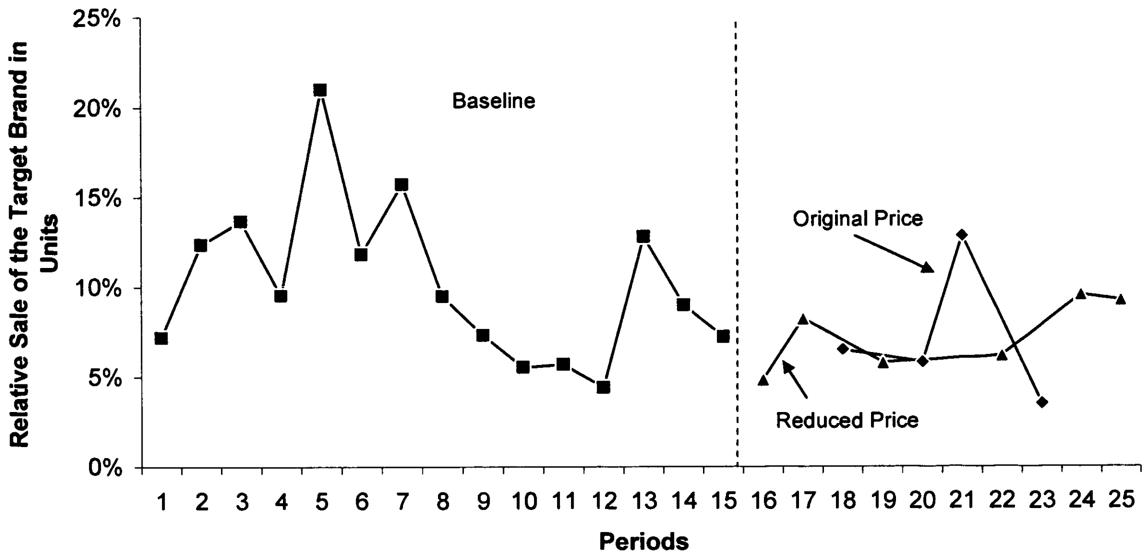

Figure 6.8. Relative sales of the target brand in supermarket B (shampoo)

There is no difference in sales between the original price phase (*M* = 7.19%, range, 3.52% to 12.87%), and the price reduction condition (*M* = 7.34%, range, 4.88% to

9.62%). Also, there is no indication that the price reduction is damaging the brand value, as could be interpreted for supermarket a.

6.1.4.2 Cost Matching Analysis

The cost matching analysis for supermarket B reveals a downward-sloping relative demand curve (Figure 6.9). The effects of the different average price ratio on the amount bought ratio of the target brand are nil.

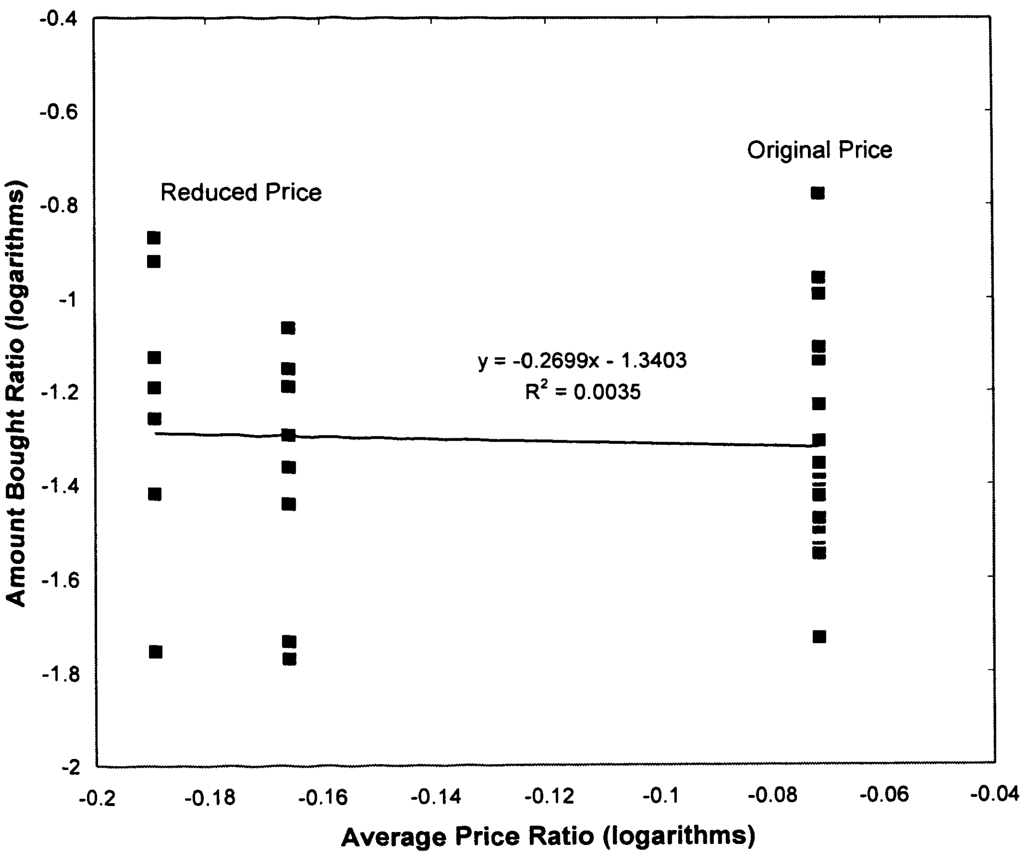

Figure 6.9. Cost matching analysis for supermarket B (shampoo)

6.2 Conditioner

6.2.1 Convenience Store A and B

Data for both convenience stores were joined together because sales were very small.

6.2.1.1 Relative Sales Analysis, Convenience Stores A & B

Results from the combined data set of both the convenience stores used in the in-store experiment (Figure 6.10) show a wide range that can be attributed to the small sample size.

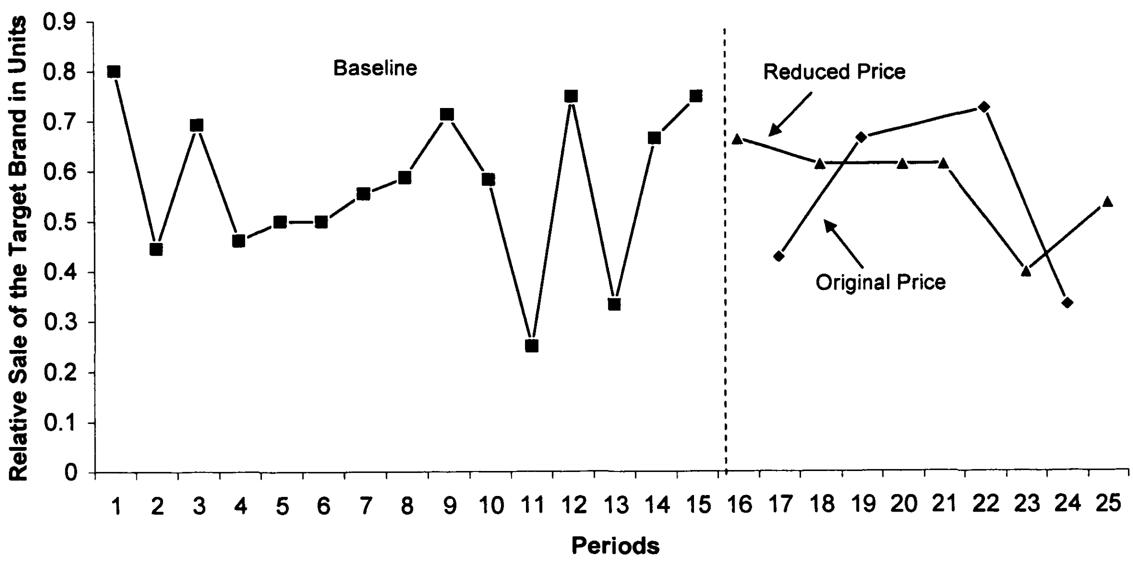

Figure 6.10. Relative sales of the target brand in convenience store A and B (conditioner)

The variation is very high during baseline (M = 57.26%, range, 25.00% to 80.00%), with the exception of an interestingly stable cluster of four data points at the central point of the vertical axis. During periods when the price of the target brand is reduced (M = 57.52%, range, 40.00% to 66.67%), relative sales of the target brand are steady for the first four periods when the reduction is implemented. However, the range increases during the last two stages. The experimental comparison, periods when the brand's price is put up again to its original value (M = 53.90%, range, 33.33% to 72.73%) show a large variation where the pattern is transitory (cf. Johnston and Pennypecker, 1993). This means that the data shows increasing relative sales, but returns to the original state by the end of the experiment. This should be attributed to the effect of an external factor on the dependent variable. It is hard to speculate what factor(s) are responsible, but the results' validity is vulnerable because of the small sample size. There is no difference in relative sales of the target brand in relation to its price and it is interesting to see how the data shows a similar central tendency (similar averages).

6.2.1.2 Cost Matching Analysis, Convenience Stores A & B

Results from the cost matching analysis for both of the convenience stores (Figure 6.11) reveals, in line with other relative demand curves presented in the dissertation, the insignificance of the average price ratio.

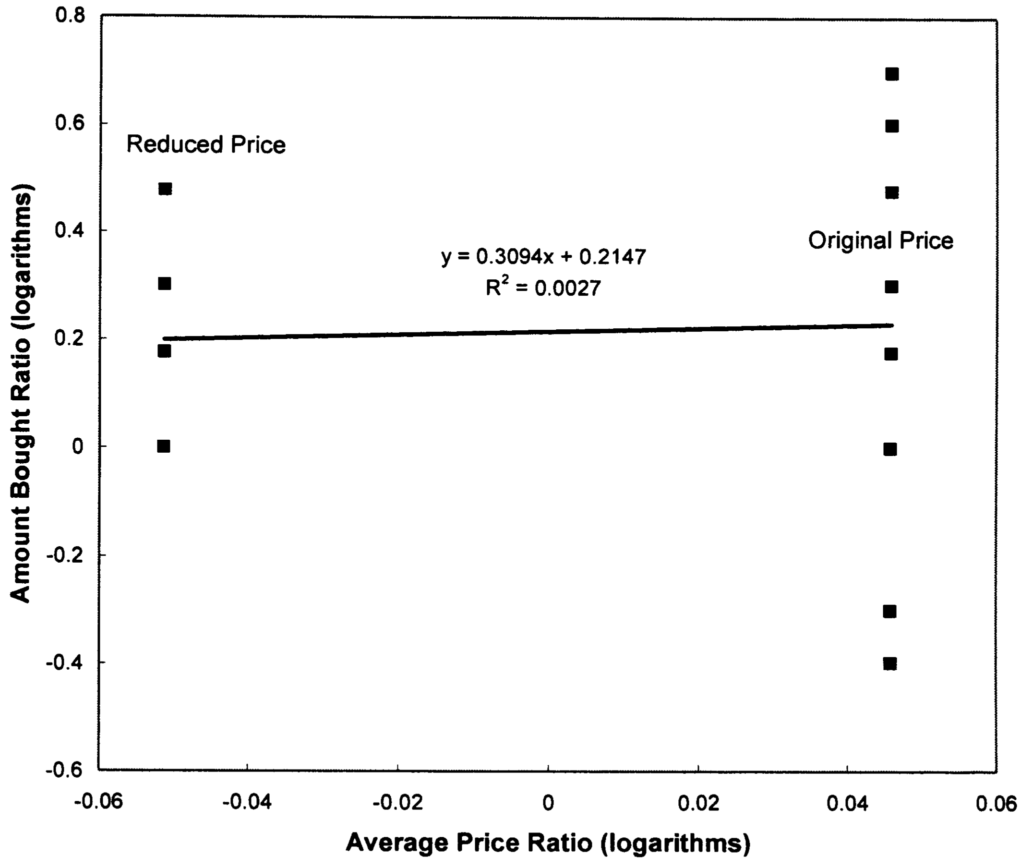

Figure 6.11. Cost matching analysis for convenience store A and B (conditioner)

6.2.2 Supermarket A

6.2.2.1 Relative Sales Analysis

The results from the relative sales analysis for supermarket A (Figure 6.12) show much less variation than for the convenience stores. What is interesting is that the range variation is similar between the baseline (M = 15.60%, range, 8.33% to 21.88%) and the two experimental conditions.

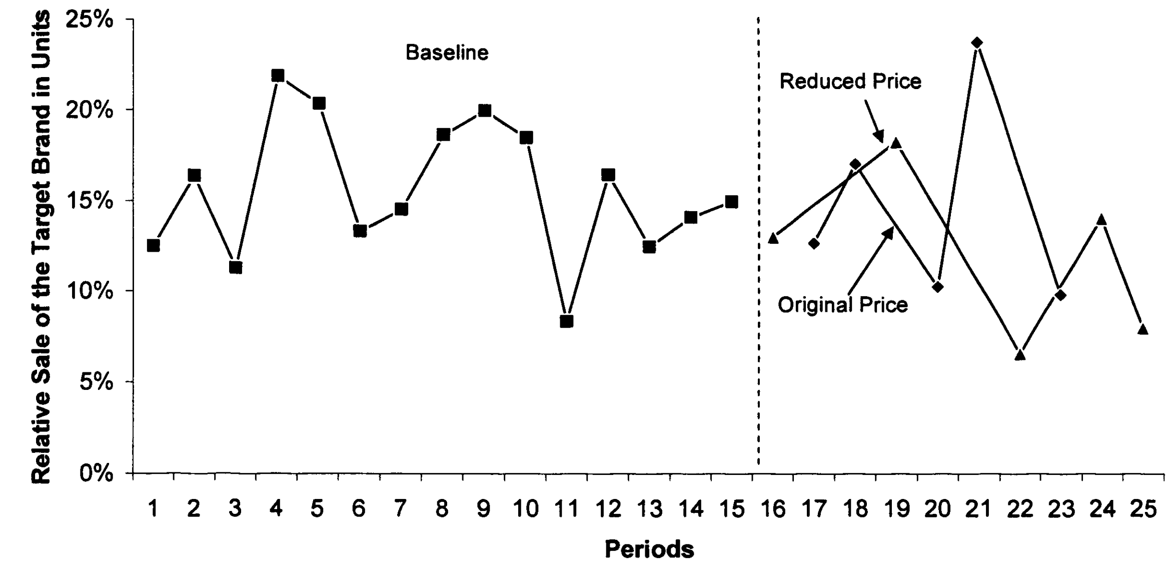

Figure 6.12. Relative sales of the target brand in supermarket A (conditioner)

This is unlike most other results from the relative sales analysis, where range variation generally decreases severely when the experimental conditions are introduced and the control situation is implemented. There does not seem to be a difference in the relative sales of the target brand whether at the original price (M = 14.74%, range, 9.84% to 23.81%) or the reduced price (M = 12.02%, range, 6.60% to 18.33%) during the experimental phase. The price reduction does not help the brand, and the relative sales trend for the price reduction condition is downward sloping.

6.2.2.2 Cost Matching Analysis

Figure 6.13 shows that the cost matching curve is upward sloping for supermarket A, but the average price ratio does not have much impact on the amount bought ratio of the target brand.

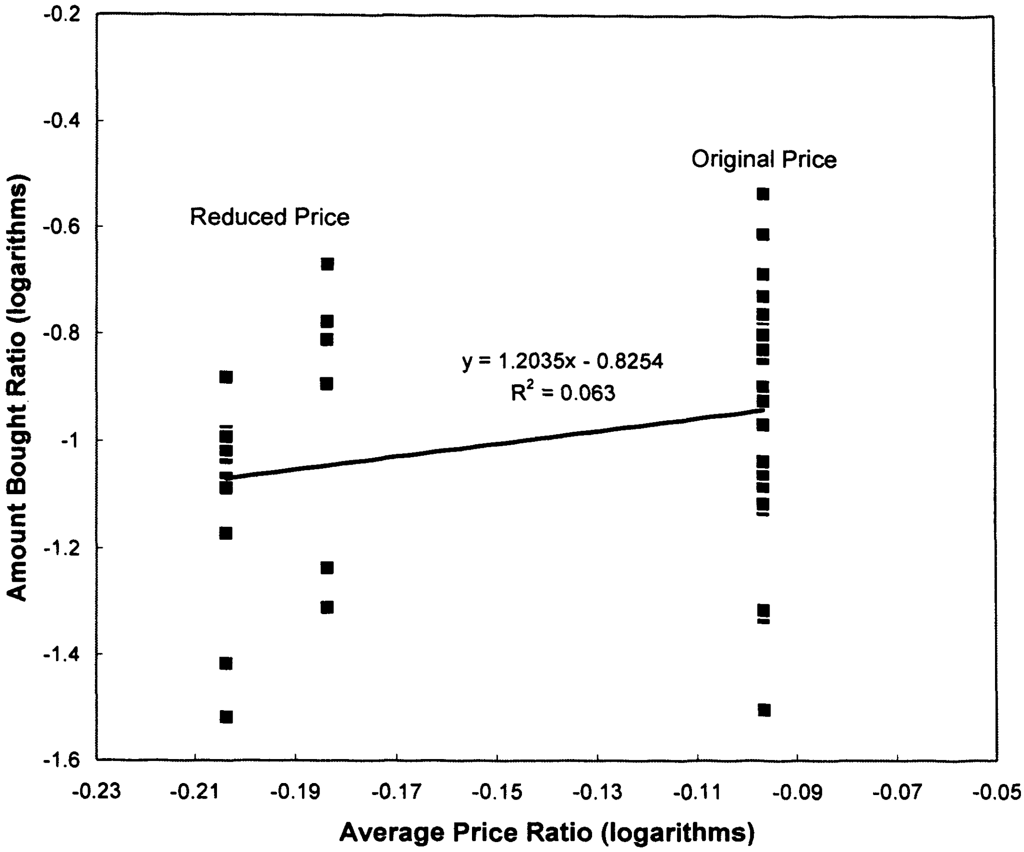

Figure 6.13. Cost matching analysis for supermarket A (conditioner)

6.2.3 Supermarket B

6.2.3.1 Relative Sales Analysis

The relative sales analysis for supermarket B (Figure 6.14) shows considerable range variation during baseline (M = 14.59%, range, 2.04% to 25.00%), but a very interesting steady pattern of increasing relative sales of the target brand during the first six (or seven) periods.

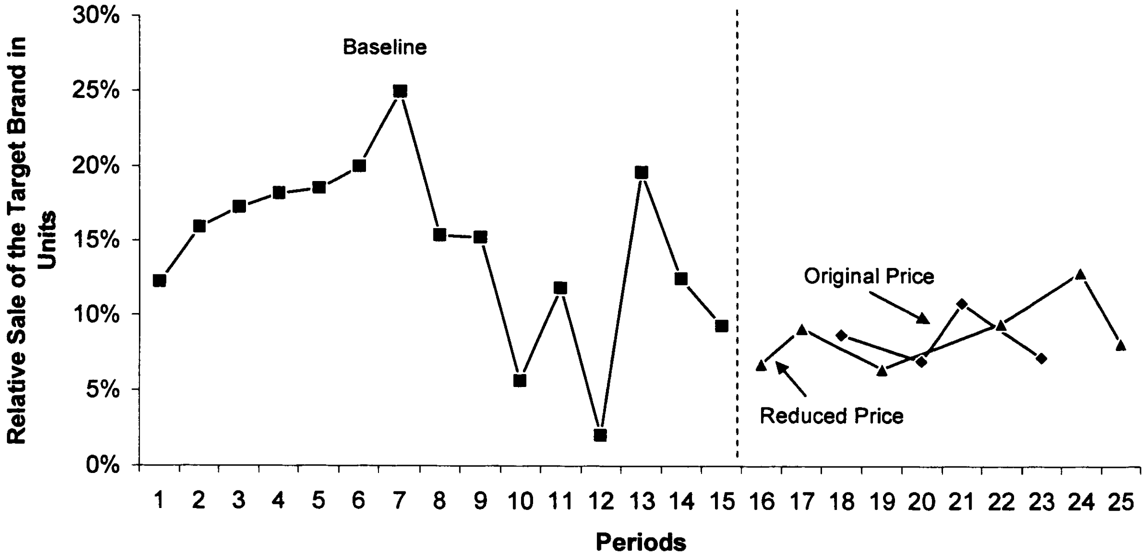

Figure 6.14. Relative sales of the target brand in supermarket B (conditioner)

The analysis reveals remarkably stable data during the intervention phase where relative sales of the target brand are similar for the conditions where the price is reduced (*M* = 8.87%, range, 6.49% to 12.96%), and those states when it is brought back to the original (or baseline) price (*M* = 8.46%, range, 7.00% to 10.87%).

6.2.3.2 Cost Matching Analysis

Figure 6.15 shows a downward sloping curve for cost matching. The average price ratio does explain the variance of the amount bought ratio data.

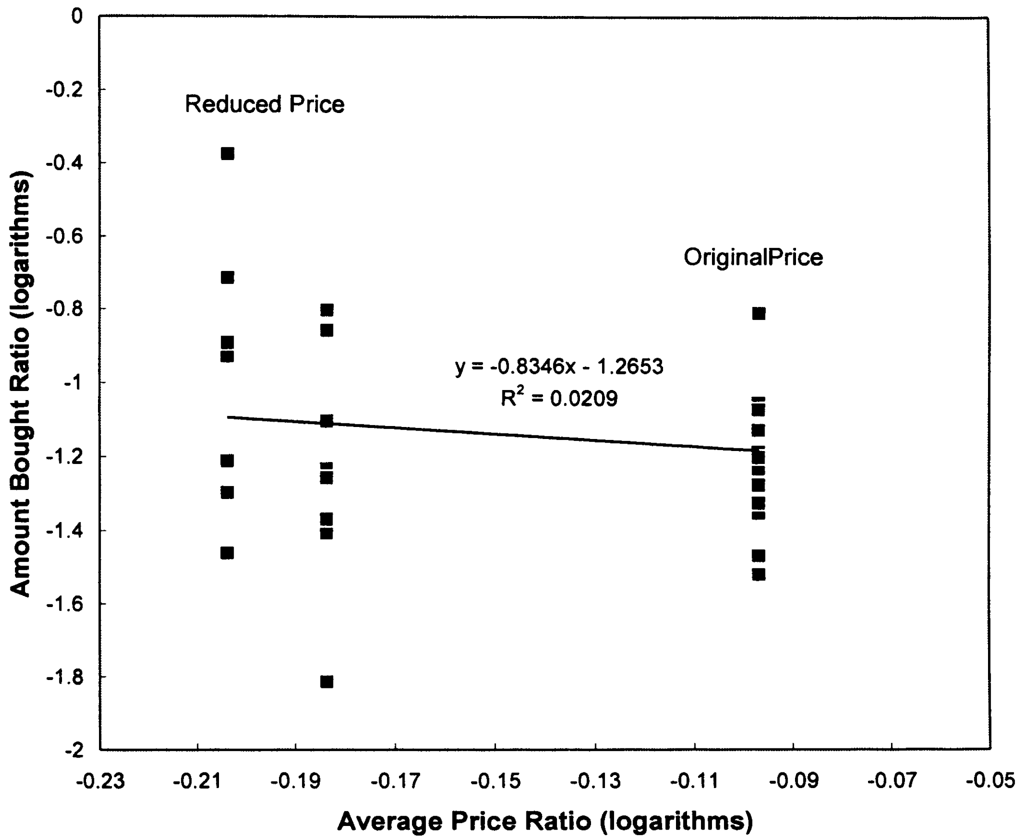

Figure 6.15. Probability matching analysis for supermarket B (conditioner)

6.3 Summary

Chapter Six has presented two different analyses for the data from the four stores used in the in-store Price experiment. This has been done both for the shampoo and conditioner product categories. In addition to this, the chapter showed one example of a probability matching analysis. This was done to show a more appropriate version of the probability matching analysis compared to the version shown in chapter 5 (Figure 5.3). The relative sales analysis was the first to be performed which revealed, overall, that the price reduction did not have an effect on the relative sales of the target brand. In one case (section 6.1.3.1) the price reduction led quite clearly to a reduction in the relative sales of the target price. The cost matching analysis came second. It generally showed that that the average price ratio had relatively no effect on the amount bought ratio of the target brand.

CHAPTER SEVEN

RESULTS FROM THE IN-STORE ADVERTISEMENT

Chapter Seven reveals the results of the aggregated relative sales from the in-store Promotion experiment. Both the experiment and the consumer behaviour analysis were discussed in chapter Three. As previously mentioned, the experiment involved the periodic presentations of an in-store advertisement aimed at increasing the sales of an international brand in the washing-up liquid product category. Results from the convenience stores are presented first, then the supermarkets and budget stores.

7.1 Convenience Stores

In the in-store Promotion experiment, performed in the washing-up liquid product category, there are similar problems with the sales turnover as in the Price in-store experiment. The sales are low, but unlike the in-store Price experiment the target brand, the market leader, constitutes nearly all of the sales. This makes the question of whether the in-store advertisement increases sales of the target brand more difficult to answer, as it already accounts for nearly all of the sales.

The convenience stores have only three washing-up liquid brands on their shelves. Two of them belong to the target brand (Fairy® Liquid and Fairy® Lemon), and the third is the competing brand (Euro shopper®). This makes the data from the convenience stores simpler for analysis and interpretation.

7.1.1 Convenience Store A

7.1.1.1 Relative Sales Analysis

Regarding the relative sales analysis for convenience store A (Figure 7.1), at the beginning of the baseline condition ($M = 87.33\%$, range, 50.00% to 100.00%) sales of washing-up liquid are entirely made up of the target brand. This is because it was the only brand available at that time.

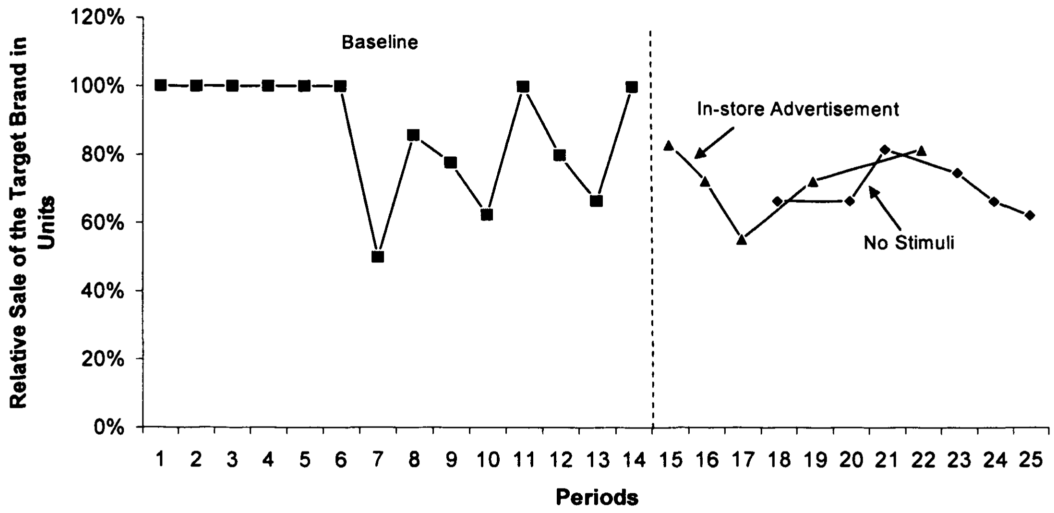

Figure 7.1. Relative sales of the target brand in convenience store A (washing-up liquid)

With the introduction of a private label as competition to the international brand, relative sales of the target brand diminish, in relation to their previous strong performance. Relative sales do not seem to be affected by the introduction of the in-store advertisement ($M = 73.23\%$, range, 55.56% to 83.33%). Sales are similar to those appearing when the stimuli is absent ($M = 69.89\%$, range, 62.50% to 81.82%) during the intervention period (after the baseline). The real difference between the baseline and experimental periods is the lower range variation for the latter, attributable to the control of the situation.

7.1.2 Convenience Store B

7.1.2.1 Relative Sales Analysis

Results for the relative sales analysis for convenience store B (Figure 7.2) show exclusive buying of the target brand for most of the baseline (M = 97.28%, range, 80.00% to 100.00%). As for convenience store A, this is also the case because the target brand is the only available washing-up liquid during the first periods of the baseline. It isn't until the 10th period that the convenience stores offer their own private label as competition to the target brand.

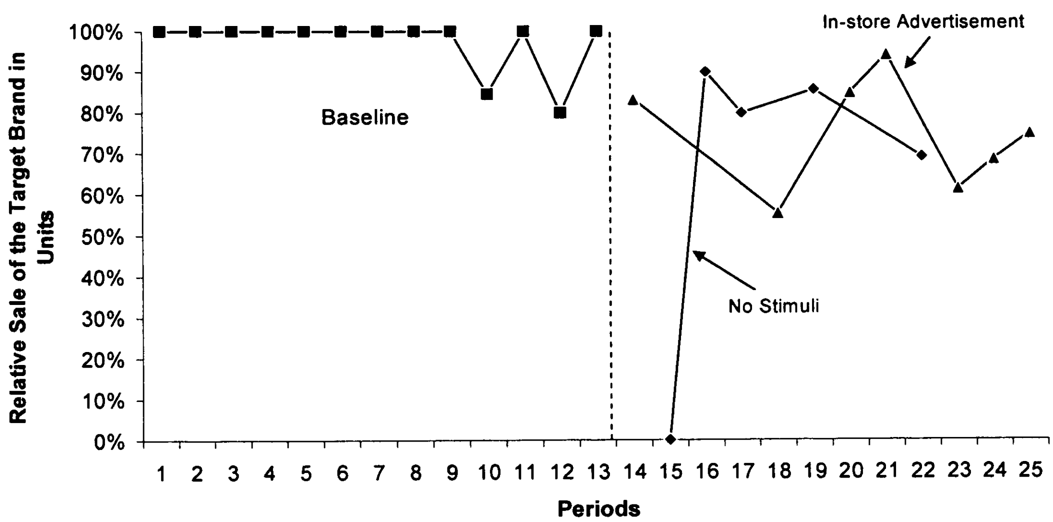

Figure 7.2. Relative sales of the target brand in convenient store B (washing-up liquid)

Understandably, this decreases the target brand's market share continuously during the intervention stage (after the baseline). As can be seen from Figure 7.2 there is no difference between relative sales dependent on the presence of the in-store advertisement (M = 74.80%, range, 55.56% to 94.44%), or its absence (M = 64.99%, range, 0.00% to 90.00%). For some reason, there is only one item of washing-up liquid sold during period number 15 (Friday to Sunday) in convenience store B. As this one item sold is of the private label, relative sales of the target brand drop to zero. There are six items sold over the same period in convenience store A. It is interesting to see how relatively stable the relative sales patterns are, as they are predicated on such a small amount of sales, but this invites strange outliers on occasions.

7.2 Supermarkets

7.2.1 Supermarket A

7.2.1.1 Relative Sales Analysis

The results from the relative sales analysis for supermarket A are interesting (Figure 7.3). During the baseline period (M = 49.89%, range, 27.66% to 72.46%) there is a large variation for the first periods, which stabilises before the intervention is introduced.

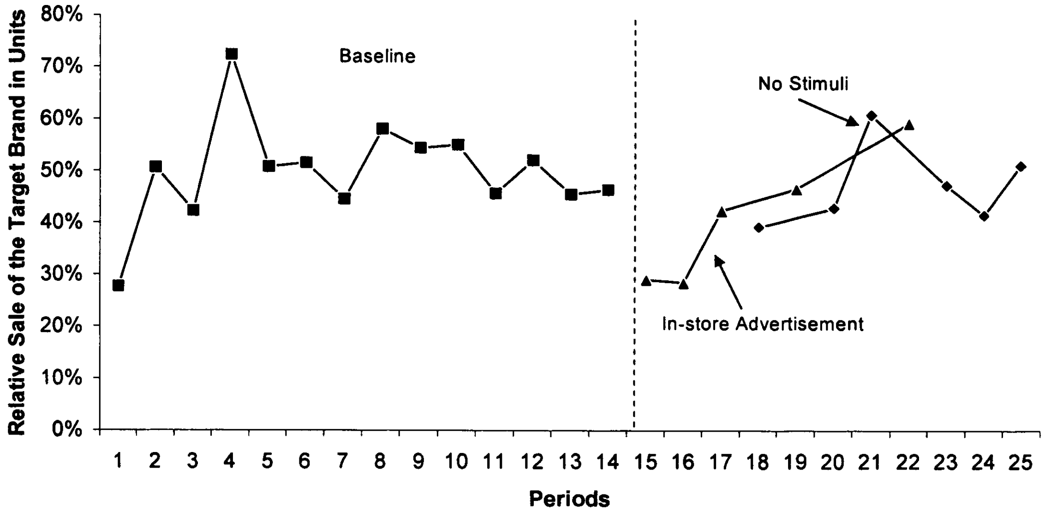

Figure 7.3. Relative sales of the target brand in supermarket A (washing-up liquid)

When the in-store advertisement is put up, relative sales drop immediately. They go from 46 per cent for two consecutive periods (baseline) to 29 per cent (also for two consecutive periods of the in-store advertisement). After that, the relative sales of the target brand slope upward, both for the advertisement periods (M = 41.33%, range, 28.57% to 59.57%) and the comparison - where there is no advertisement present (M = 47.34%, range, 39.34% to 61.11%). Relative sales for both conditions become similar, both to each other and to the relative sales percentage of the baseline before the intervention was introduced. There is a remaining question concerning the two intervention periods after the baseline. Did sales drop because of the presentation of the advertisement? Or was it because of an unexplainable external factor? As this is a group experiment done with a product that people do not buy every week, it is unlikely that these effects can be effectively attributed to a carry-over-effect.

7.2.2 Supermarket B

7.2.2.1 Relative Sales Analysis

The results from the relative sales analysis for supermarket B is shown in Figure 7.4. There is considerable variation during the baseline (M = 55.39%, range, 35.48% to 75.51%) which decreases a little during the intervention phase.

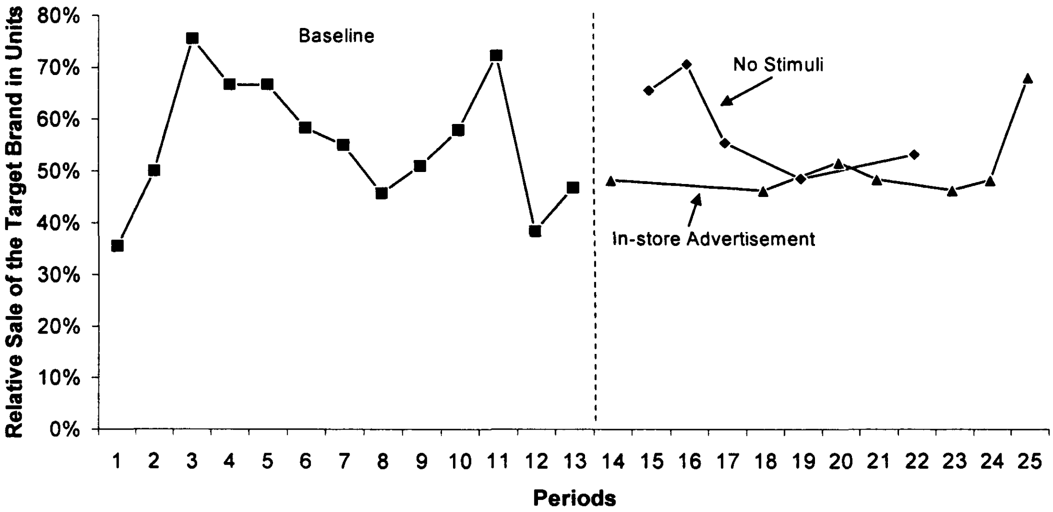

Figure 7.4. Relative sales of the target brand in supermarket B (washing-up liquid)

After the baseline the no-advertisement condition (M = 58.82%, range, 48.65% to 70.83%), has higher relative sales of the target brand than the "advertisement" periods (M = 51.24%, range, 46.43% to 68.42%), which are very steady. However, the relative sales for the no-advertisement periods decrease and meet the advertisement conditions for their last two periods, and the advertisement condition undergoes an increase in relative sales during the last period of the experiment. This makes it difficult to infer that relative sales are higher when the advertisement is absent.

7.3 Budget Stores

7.3.1 Budget Store A

7.3.1.1 Relative Sales Analysis

The results form the relative sales analysis for budget store A are quite interesting (Figure 7.5). During the baseline (M = 23.67%, range, 15.07% to 35.15%) the relative sales of the target brand see some variation, but overall the pattern is first upward and then downward sloping.

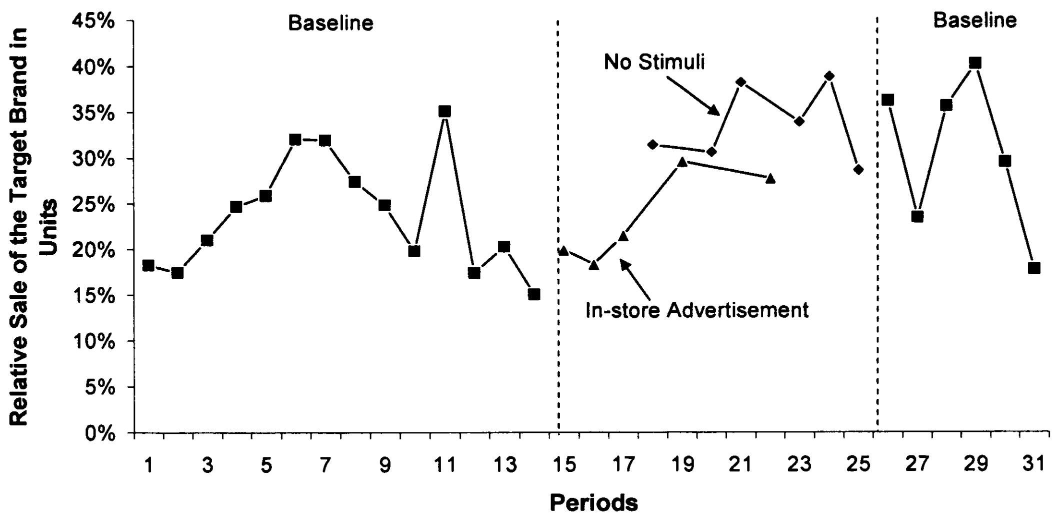

Figure 7.5. Relative sales of the target brand in budget store A (washing-up liquid)

There is no difference between the last three data points for the baseline and the first data points for the experiment condition (M = 23.51%, range, 18.38% to 29.71%).

After three periods of the POP display comes the first comparison period consisting of taking the display down, so that there is no stimuli (*M* = 33.72%, range, 28.74% to 38.98%). When this is done, the relative sales of the target brand rise from 21.58 to 31.52 per cent, and either remains in this range or increases during the "no display" periods that follow. The last two experiment periods also show increased relative unit sales, but not as much as the comparison. The baseline at the end (*M* = 30.59%, range, 17.86% to 40.41%) of the experiment consists of no display, but also no control of situations. It shows, overall, downward sloping relative sales for the target brand. It is possible that there is a spillover effect between different conditions, called the carry over effect. The higher relative sales for the "no stimuli" condition could be attributed, at least in part, to the presentation of the in-store experiment at the beginning of the experimental/intervention phase.

7.3.2 Budget Store B

7.3.2.1 Relative Sales Analysis

The results for the relative sales analysis for budget store B (Figure 7.6) show a slightly increasing trend for the relative sales of the target brand during the baseline (*M* = 53.78%, range, 40.54% to 65.22%). When the in-store advertisement is introduced, relative sales go from 62.30%, for the previous period, to 44.83%.

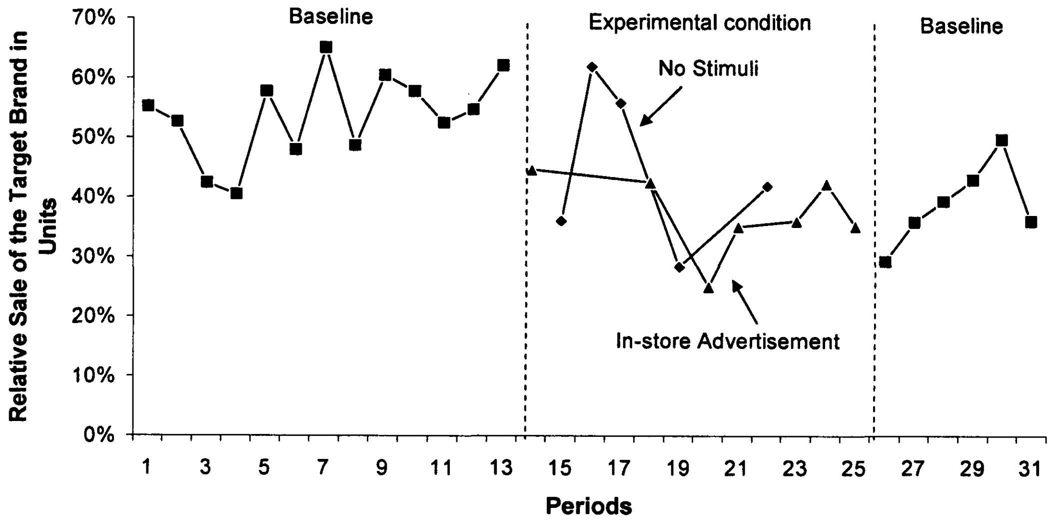

Figure 7.6. Relative sales of the target brand in budget store B (washing-up liquid)

During the intervention/experimental phase, there does not seem to be a difference (although the comparison has two out of five data points that are much higher than the average for the experimental condition) between the advertisement condition (M = 37.48%, range, 25.16% to 44.83%) and the "no stimuli" condition (M = 44.95%, range, 28.44% to 62.11%). Towards the end of the experiment there is a second baseline (M = 39.08%, range, 29.41% to 50.00%) which generally shows an upward sloping trend. In figure 7.6, the baseline conditions are upward sloping and sales drop considerably during the intervention, which indicates that the POP display does not have a positive effect on relative unit sales for the brand.

7.4 Summary

Chapter Seven has presented a relative sales analysis for the data from the six stores used in the in-store Promotion experiment. The relative sales analysis revealed that the in-store advertisement, intended to act like a motivational operation, generally had no effect on relative sales of the target brand within the washing-up liquid product category. The use of the alternating treatment design in the in-store experiment was successful in creating an evaluation of the relative sales effects and behavioural patterns attributable to the in-store advertisement. The fast alternations between conditions (display vs. no display) give many comparisons, which suggest that point of purchase displays as a stand alone marketing communication channel for the purpose of increasing sales has unreliable effects. The numbers of behavioural comparisons generated by the alternating treatment design in combination with the control of other point of purchase factors (such as brand price, quantity, & shelf space) is successful in revealing the inability of the in-store advertisement to accomplish its goal.

The experimental findings show not only the incapability of the in-store advertisement to increase sales, but also that results vary for the same type of condition (baseline, display, no display). This means that although the experimental condition did control for many elements within the marketing mix, unknown external factors are still having an impact on relative sales.

CHAPTER EIGHT

DISCUSSION AND CONCLUSIONS

This part of the dissertation examines the results from Chapters Five to Seven from a behavioural perspective. At this point, it is necessary to come back to the aims of the research presented in Chapters One and Three. As stated, it is of central concern how relevant it is to perform in-store behavioural experiments, with relative sales and matching analyses, to study consumers' brand choices. The term relevant is here used to refer to information that strengthens the general aim of behaviour analysis; which is to use precise logical terminology to define, measure, describe, predict, and control behaviour - and in that respect explain it. From this point of view, it is possible to utilise the work of basic consumer behaviour analysis research, which should make it possible to identify the appropriateness of methods and philosophies of behavioural analysis in the realms of consumer behaviour, and how it can be put to use and adjusted, if necessary. In this respect, Chapter Eight discusses to what extent it is possible to perform experiments on consumers' brand choices in the open settings of the retail environment, and the usefulness of the relative sales and matching analyses to account for consumers' buying behaviour. The question is whether the in-store experiments and the analyses can give valid answers, in terms of what effects the interventions have on consumers' choices, and if it is possible to scrutinise the behavioural processes involved.

8.1 Interpretation of Results

In Chapter One there is a quotation from Catania, where he mentions the limitations of extrapolating from the behavioural laboratory to the world outside. This makes up the importance of an "in the field" discipline like consumer behaviour analysis:

Where the question is; what can be used from the behavioural laboratory, and how far behaviour analysis can extend its reach in terms of predictions and control? To explore this question, three intensive in-store experiments were performed to test the effects of Place (different brand placements), Price (periodical price reductions), and Promotion (an in-store advertisement) on consumer choice. Each entailed a situational marketing mix factor, possibly affecting consumer buying behaviour, and the substitutability of brands (matching).

When interpreting the results from the behavioural in-store experiments it is important to ask what would have happened without the interventions, in terms of consumers' buying and spending behaviour. How did the interventions affect the relative sales and matching analyses? To answer these questions it is essential to look at the experimental conditions in each case, which were replicated a few times during every experiment. This replication also helps to give the researcher an indication of the effects of consumers' exposure to previous experimental conditions. The problem of a carry-over effect should not be underestimated, as first time consumers will possibly be more likely to buy the brand again than those who have never bought it. This is a methodological threat to the use of repeated measures experimental designs and could make its use inappropriate in consumer behaviour research. The results, however, do not show this to be a particular problem to internal validity. It should be noted that by half-randomising the order of experimental conditions, where different orders are used for each store, it is possible to see clearly if there is a carry-over problem. The results show that it is possible for an experimental condition to be replicated with similar results, both within the same store, and between stores - where the order is generally different. Overall, the results show very satisfactory replications within the same experimental conditions, and orderliness of data. The study, however, reveals the importance of sales turnover and number of replications for internal validity, which future research should be aware of.

8.1.1 The Main Results from the In-store Experiments

The results in Chapters Five to Seven have revealed that it is possible to perform in-store experiments, with alternating treatment designs, to identify important behaviour-environment relationships in a retail setting. The results from the Place in-store experiment confirm, overall, the importance of item placement as an important situational factor in consumers' buying behaviour. The results revealed most clearly the relative advantage of placing the target brand on the middle shelf and at the stores' entrance in the budget stores. Overall, the other two in-store experiments manipulating price and promotion showed the inability of the marketing mix factors tested, such as considerable periodical price reductions and the in-store advertisement, to affect consumers' brand purchasing. This reveals a surprising steadiness in the consumers' choices and resistance to change.

8.1.1.1 Main Results from the Place In-store Experiment

The Place in-store experiment investigated the effects of different shelf placements on consumers' brand choices. The product category used, crisps, is considered to be an "instant buy" and brand sales are thus supposed to be sensitive to their positioning on store shelves as a result. As this intervention changes behavioural effort it should alter the substitutability of brands (matching). The conditions consisted of placing the brand on the lowest, middle, and highest shelf in its product category. This was performed in convenience stores, supermarkets, and budget stores. In the case of the budget stores, the target brand was also placed at the store's entrance. Overall, the results from Chapter Five show that the target brand's relative sales against its product category are higher when it is placed on the middle shelf, compared to the highest or lowest shelf. The extra line-up intervention at the store entrance in the budget stores increases sales further, but with more variation compared to the experimental phase (lowest, middle, and highest). Despite this, the findings show more persistence in the consumers' choices than anticipated, based on the assumption that many consumers seem to buy potato chips impulsively. This indicates reinforcement strength for the target brand, as consumers seem to look for it. This could mean that although the buying of crisps, in general, is stimuli based, once they have decided many consumers look for their favourite brand (rule-governance). This interpretation is strengthened in the case of the relative sales; during the extra line-up, where not only response cost has been placed at a minimum, as it is almost impossible for consumers to escape seeing the target brand, but the setting has also been "closed" (Foxall, 1998), as there are no other brands present to look for. Placing the extra line-up at the entrance of the stores also possibly blocks stimulus control of other brands to some degree, as it is likely that prior choice of a brand in the crisps product category can act as a reinforcer-abolishing effect (Laraway, Snycerski, Michael, & Poling, 2003) for other brands within the same product category. This would be interesting to explore in further research.

The second analysis tested the amount matching relations which confirmed unambiguously, in line with previous consumer behaviour analysis research, a strong relationship between the relative amount bought of the target brand and the relative amount spent on it. However, of more value are the parameters from the matching equation for each shelf placement. There is generally not much difference between different shelf placements in terms of the slope of the line or its intercept, but these parameters can, however, indicate substitutability of brands in terms of how changes in the relative sales of the target brand affect the others brands. Section 5.1.1.2 discusses this possibility, analysing these differences in relative sales and the amount spent for each brand in the product category. From Appendix 3.1, it is possible to see the target brand's substitutes and complements, those brands that increase or decrease the most as relative sales of the target brand changes. The relative sales analysis (Figure 5.1) revealed that the target brand's relative sales were greater when it was placed on the middle and highest shelf compared to the lowest shelf. Appendix 3.1 highlights those brands that have more than 40% higher or lower relative sales, on both the middle and highest shelves compared to the lowest. These are brands that one would probably not think of as the best substitutes, or complements, for the potato crisps Pringles® target brand (e.g., tortilla chips). It is also apparent that changes in the relative sales of the target brand (caused by different shelf placements) have little or no effect on relative sales for most brands (including brands which are expected to be substitutes; e.g., Lays®). It has marketing value in being able to identify competing and complementary brands, but it depends on the generalisation of the findings to what is happening in other similar stores. Unfortunately, the results from the same kind of enquiry for convenience store B reveal other brands as competing and complementing.

8.1.1.2 Main Results from the Price In-store Experiment

The Price in-store experiment manipulated the price of a target brand in two related product categories, shampoo and conditioner. The price was periodically reduced by 15 to 26 per cent from the original price. According to economic theory, the price reduction ought to increase sales as the demand curve should be downward sloping for brands within the same product category ("substitutes"). Indeed the results from Chapter Six showed that the price reductions generally had no effect, or only a little, on the relative sales of the target brand. Figure 6.9, showing relative sales of the target brand in supermarket A in the shampoo product category, reveals lower relative sales in the case of the price reduction condition. These are surprising results and underline the need to examine all of the marketing mix factors, not only price, which - as Chapters One and Two revealed - has been the primary focus of economists, and in the field of behavioural economic research generally.

8.1.1.3 Main Results from the Promotion In-store Experiment

The in-store Promotion experiment introduced a point of purchase advertisement for the benefit of a particular brand. As typical marketing budgets are mostly spent on promotions, it was expected to increase sales. From a behavioural point of view, this is a question of whether the advertisement can function in a motivational way. The results showed clearly that the in-store advertisement did not increase relative sales of the target brand. The benefit of being able to use Fairy® liquid longer than the competition is a factor that takes time to teach the consumer. One possible way to research this further is to add free samples. Then there would be a stronger connection between the rule and the consequences. In essence, the in-store advertisement did not act as a motivational stimulus for the consumers of this particular brand. In line with the discussion in section 1.1.2.3, that revealed increasing concerns of marketing scientists for the value of advertising, the results from the in-store promotion experiment further question the effectiveness of the massive expenditure of marketing budgets on promotions.

8.2 Relevance of the Data Analysis

The relative response and matching analyses were originally employed in operant animal behaviour research at the Harvard pigeon laboratory (e.g., Baum, 2002a), but have since been used in various settings. This includes the work of the Consumer Behaviour Analysis Research Group, which this dissertation is a part of. The CBAR group has, in its previous work, accounted for consumer brand choices with consumer matching analyses, analogous to those originally used, and now has accounted for the relative response rate in the form of relative sales analysis. It is important to acknowledge that the particular consumer behaviour matching equations used differ in important ways from the original, more traditional ones discussed in Chapters One and Two. This research is, therefore, not only exploring the behavioural economic analysis in general, but also detecting its use and development in the realms of consumer behaviour.

There were four different kinds of analyses performed, where relevant, on the data from the in-store experiments; relative sales analysis, amount matching, cost matching, and probability matching. The main questions regarding these analyses from a consumer behaviour analysis perspective are; how valid is their representation of consumers' choices? And do they all give an indispensable account?

8.2.1 Relevance of Relative Sales Analysis

There is an important difference between the relative sales and the matching analyses in that the former gives more of a molecular account of consumers' choices in comparison to the matching analyses, which give a pure molar account. This difference between molar and molecular accounts of behaviour is central to modern behaviour analysis, where researchers debate the strengths and weaknesses of each form (see e.g., Baum, 2002b; Malone, 2004). The relative sales analysis is interested in behaviour as a consequence of functional relations, but not any overall behaviour-environmental correlation, which is the level of analysis looked at by molar matching. The relative sales analysis gives thus more of a traditional contingency-contiguity account of behaviour, which is the framework used primarily in introductory books and applied analysis. This molecular account of behaviour, built around the three-term contingency, has proven to be extremely effective for behaviour modification. Despite this, behavioural analytical research has shown that sometimes there is no immediate direct connection between behaviour and its consequences, which is essential for a successful molecular account, but there is still strong environmental-behaviour relationship (e.g., Epling & Pierce, 1988). This means that a researcher conducting a molecular (contingency-contiguity) analysis can miss important environment-behaviour relationships. It is important to explore these accounts within the realms of consumer behaviour analysis, which looks for the behavioural method and level of analysis that is most appropriate for consumer behaviour research, and reports its findings to the wider behaviour analytic community.

Relative sales analysis, the consumer behaviour analogous to relative response rate, was performed for all three experiments. As stated before, matching researchers look at all behaviour as a choice between different alternatives. Therefore, at the beginning of analysing data from each store, a more "molecular"[12] examination (contingency-contiguity), compared to matching analysis, was performed to reveal important information, such as behavioural level, trend, and variability. It is important to recognise that although the relative sales analysis is more of a micro (molecular) account of behaviour, it is not locked in the three term contingency completely as it resembles the relative response rate (which is comparable to the matching law, as it views every behaviour as choice). By looking at the graphs from the relative sales analysis it is possible to interpret the effects of the marketing interventions (e.g., different relative sales during the middle shelf placement and the observed trend) and the quality of the research from a behavioural perspective (e.g., variability and ease of inference). The introduction of the relative sales analysis to consumer behaviour analysis is one of the strongest justifications for this PhD dissertation, as such an examination has not been conducted before in the field, and compared to the molar matching account.

Results from Chapters Five to Seven show that the in-store experiments with relative sales analysis can, in most instances, reveal functional relationships, or lack thereof, between marketing mix factors within the retail environment and relative consumer buying behaviour. In the case of the Place experiment, the remarkable

12 The relative sale analysis, gives extra (more micro) information of what is functionally happening. Here I've used the same store and the same target brand, where previous research has put the stores together.

reliability of the target brand's market share in the budget stores (Figure 5.13 & 5.14) across the same interventions (lowest, middle, and top shelf) is of most interest. Figure 5.4 (convenience store B) also shows a clear advantage in using the middle shelf compared to stacking the target brand on the lowest or top shelf. Although there is some unexplained variance in the case of the middle shelf. In the case of the in-store Price experiment, Figure 6.9 shows interesting results where price reductions reliably, except for one outlier, lead to lower relative sales of the target brand. Figures 6.5, 6.13, 6.17, and 6.25 convincingly show the ineffectiveness of price reductions in increasing relative sales. For the promotion in-store experiment the relative sales analysis proved it equipped, especially Figure 7.1, to reveal the inadequacy of the point of purchase advertisement to increase sales. Figures 7.5 and 7.9 are interesting, but further research is necessary before it can be concluded with any degree of certainty that the stimulus is harming relative sales of the target brand.

In general, the findings show greater persistence in consumers' choices than anticipated. Of greatest interest is the reliability of the target brand's relative sales across the same interventions, given the complexity of the modern retail environment. In the case of the two budget stores, in the in-store Place experiment, the data shows surprisingly good experimental control; where orderliness of behaviour is apparent during the experimental interventions. This can be seen by comparing the variation of the relative sales of the target brand in the intervention periods with the baseline and the extra line-up phase, where the researchers did not intervene or control the setting (e.g., the availability of brands). It would be interesting to see if this orderliness of data would prevail in similar research with other product categories and budget stores.

The emphasis in behaviour analysis is to measure the variable that is to be affected, which in marketing is consumer behaviour. For example, in Chapter One there was a discussion about an interesting study done by researchers at Wal-Mart on consumers' attention to shelves when shopping. Its results point to the importance of the centre of any shelf studied, including the middle shelf. It is important to study consumer attention, but when sales are assessed in terms of different shelf placements the importance of brand strength is most important. It is likely that similar in-store experiments with an unknown brand (not an international brand) in the shelf placements would have a more significant effect. This points to the importance of the behavioural perspective (the three/four term contingency and the BPM), as measuring behaviour is essential where seeing stimuli (attention) is not enough, there has to be a reinforcement value. Instead of assuming a positive relationship between consumer attention and buying behaviour, in-store experiments lead to a more evidence-based approach to marketing.

8.2.2 Relevance of Matching Analyses

The matching analyses were put into operation in the same way as in previous consumer behaviour analysis research (for a review see Foxall, Oliveira-Castro, James, & Schrezenmaier, 2007). This stream of research, previously conducted on consumer behaviour in the United Kingdom, exploring matching in the retail environment has produced replicable data that shows a strong matching-like relationship between the amount paid ratio and the amount bought ratio. This strong relationship is confirmed here with the same kind of analysis done on consumers' buying data in Reykjavik, Iceland. It should be clear, as consumers' buying behaviour follows ratio schedules (the more you pay the more you get of a brand), that although the results show a matching-like relationship, as characteristic for behaviour on concurrent interval schedules, the data does not support the prediction of the matching law for equivalent brands. This is because, as should be expected for brands within the same product category (assuming they are nearly or totally equivalent), consumers do not exclusively choose the leaner schedule (cheapest brand). In fact, consumers behave as would be expected for matching data, for equivalent reinforcers, on concurrent interval schedules. This relationship is strong and pretty much replicable; it is not something to be concerned about. However, the real question is much more about what this relationship means. The consumer behaviour analysis research group has already revealed trivial factors regarding the use of the matching law in consumer behaviour research (e.g., Foxall, 1999c). The concern is that consumer matching, similar to what I have shown for sports matching (see also Vollmer and Bourret, 2000), is best characterised as being research on ratio schedules where matching is, in part at least, compelled as a higher response rate can only generate a higher reinforcement rate. This makes the matching law trivial and methodologically dangerous as reinforcement (the independent variable) and consumer choice behaviour (the dependent variable) are interdependent.

It has been advocated here that any study should explore consumer matching in an open environment, where many reinforcing and punishing factors are available, and can have an effect. If brand amount can, with validity, explain nearly all variation in the relative amount spent – then the environment can hardly be interpreted as open. It is peculiar that only the amount-reinforcer factor can explain nearly all variance in relative amount spent. In point of fact, this relationship is actually trivial. This can be rationalised on both logical and empirical grounds. The spending-buying relationship (behaviour-behaviour) is tautological in the sense that it not possible to spend without buying. Rather, with fixed store prices the "matching law" relationship becomes even more compelling. As stated before, the matching law predicts exclusive preference for the richest reinforcement brand on concurrent ratio schedules (e.g., Foxall, 1999c, Herrnstein, 1997, Pierce & Epling, 1999). This means that if the brands in the product categories are functionally equivalent (gross complements, or all concatenated matching equation factors are equivalent except the price schedule), or nearly so, then the matching law on concurrent ratio schedules predicts exclusive consumer preference for the least expensive brand.

The consumer matching research is vulnerable to techniques using correlation – the only type performed to date. There is little doubt about the general importance of brand amount as a source of reinforcement for consumer buying behaviour. However, when looking at amount matching (Figure 5.2), it is as if this factor (reinforcer-amount) is almost exclusively controlling consumers' choices – consumers always spend in proportion to the brand amount schedule. The coefficient of explained variation (R^2), should always show that the amount bought ratio is capable of explaining most of the amount paid ratio. This is of no value and misleading, as it indicates that a valuable independent variable has been found; which is really compelled correlation. The results from the relative sales analysis show that it is important to experiment with other important marketing mix or analogous concurrent matching law factors in order to understand consumers' choices.

The in-store experiments, the relative sales, and matching analyses were performed to explore further if the consumer matching relationship can tell us anything significant about the substitutability of brands, or other meaningfully important aspect of the behaviour-"reinforcer" relationship. In fact it can, but to a very limited degree. The two free parameters: *a* and *c*, supposed to represent the slope and bias of the generalised matching curve, are successful in indicating substitutability of brands to some degree. For instance it was possible to show that the shelf placements could affect the matching relations in accordance with the results from the relative sales analysis (section 5.1.1.2 & Appendix 3.1). Therefore, despite the truistic nature of the amount matching law and other troubles mentioned in Chapters Two and Three, it can nevertheless be useful, although to a limited degree, to conduct amount matching analysis in consumer behaviour analysis. There are two important aspects here that need to be mentioned. First, the amount matching law is not the first tautological law in the behavioural and social sciences (e.g., Rachlin, 1970, on the matching law; Smedslund, 1997, on psychology in general, & Foxall, 1999a, on marketing and economics). Tautological laws are also found in the physical sciences (e.g., the First Law of Thermodynamics). Second, although it may be some merit to the analysis, the relative sales analysis and the cost matching analysis are much more equipped to deal with environment-behaviour relationships within the retail envioronment. This is the reason for the exclusion of the analysis in this thesis (only showing the analysis for one store).

The cost matching analysis was only performed in the case of the Price in-store experiment. The results did not show downward sloping relative demand curves. The amount bought ratio was not sensitive to changes in the average price ratio within the shampoo and conditioner product categories. The benefit of the cost matching analysis is that the relationship between the independent and dependent variables is not compelling, as is the case for amount matching. This makes cost matching interesting, as it can reveal the relationship between relative punishment and behaviour from the matching standpoint. The value of the cost matching analysis is, however, more questionable in terms of being interesting for marketing research and application. The straight curve, produced with the generalised matching equation can hide important price – behaviour relationships. It is unsuitable to analyse the ups-and-downs in relative demand (e.g., as a consequence of what has been called psychological pricing). Because of this, it is appropriate to present the matching figures using also relative sales analysis.

The probability matching analysis, known as maximisation analysis in the consumer behaviour analysis literature, is intended to "reveal whether observed consumer behavior was maximising returns on price expended" (Foxall, Oliveira-Castro, & Screzenmaier, 2004, p. 237). This procedure is built on the pioneering work of Herrnstein and Loveland (1975), and Herrnstein and Vaughan (1980). They used the analysis to establish an empirical method to study if an animal was showing matching (probability matching) on concurrent ratio schedules. These studies revealed that the animals did not show probability matching, but did show maximisation, as "almost all the pigeons came at least close to exclusive preference for the smaller of a pair of variable-ratio schedules" (Herrnstein & Loveland, 1975, p. 112). This is the key point, as the analysis can properly explore if the subject is choosing the leaner (cheaper) schedule (Schedule A = Brand A), or the other schedule (Schedule B = Brand B). One of the difficulties with transferring this method to consumer behaviour analysis is that, unlike laboratory behaviour analysis, the consumer behaviour analyst is nearly always dealing with situations where the product category under study contains more than two brands. To deal with this, previous consumer behaviour analysis (Foxall, Oliveira-Castro, & Screzenmaier, 2004) has made an artificial brand, called brand "B", which is supposed to represent the average brand price (relative probability of reinforcement). The difficulty with this is that, if there are two brands, it is possible to determine if the consumers were maximising returns by choosing the lower priced brand, as it would show on the x-axis where the choices were to the right of the .5, and it would be attributable to this factor only (cheaper brand). Or if the data points were to the left of the .5, the consumers were choosing the more expensive brand, and this would be attributable to this brand only (the more expensive one). However in this study, where there is a particular target brand – not necessarily the cheapest one - when there are many brands and the data points line up to the right of .5 on the x-axis, it means that P_2 in the probability matching equation $[M_1/M_2 = 1/P_1/1/P_1+1/P_2]$ consists of the average price of the other brands. This means that data points to the right of the .5 on the x-axis can only be interpreted as the price of the target brand being lower than the average of the other prices. It is therefore silent about maximisation of returns on price, because it is always possible that some brand (which is calculated from the average price of the superficial, so called, "brand B" $[P_2]$) is cheaper than the target brand. This is not all, because the amount bought ratio of the target brand can only be a small percentage without the researcher identifying it, as this is ratio analysis (the target brand against all other brands $[M_1/M_2]$). The meaning of the diagonal line on Figure 5.3 is completely obscure; if the scales on both axes ran from zero to one, then the diagonal would represent some kind of probability matching relationship, but since the vertical axis has an arbitrary endpoint, the "diagonal" is not in fact a true diagonal, and has no obvious interpretation. It would be better to represent the amount bought of the target brand against the whole cake $[M_1/\sum_{i=m}^{n} M]$, that would make the y-axis range from 0 to 1 (this was done for Figure 6.3). This is as Herrnstein and Loveland (1975) represented it, because they used the classical formulation of the matching law (Equation 2.2). Doing this is more valid.

The consumer probability matching analysis used here is only able to identify if the target brand is less expensive than the average price for the other brands in the product category. Based on this, the conclusion is that the probability matching analysis (maximisation analysis), as represented here in accordance to previous consumer behaviour analysis research (see Foxall, Oliveira-Castro, James, & Schrezenmaier, 2007), [13] is of little value to behaviour analysis or marketing. Here, the probability matching analysis is unnecessary. It is inferior to the relative sales and cost matching analyses when dealing with the effects of price on consumer choice. The analysis does not on its own reveal any important environmental-behaviour relationships instrumental in influencing consumer choice. This is the reason for the exclusion of the analysis in this thesis (only showing the analysis for two stores, Figure 5.3 and 6.3).

A probability matching analysis can be useful in itself, it is just unhelpful how the experiments are conducted, and the analysis is presented here (Figure 5.3). There are many other probability analyses that can be of use. The version shown in Figure 6.3 is better than Figure 5.3, because it has some (but not enough) variation on the horizontal axis and the scales on both axes run from zero to one. The probability analysis conducted in Raineri & Rachlin (1993) is, however, an example of a much more successful probability matching analysis. It shows that a probability matching analysis can be an important analytical tool without the problems mentioned in relations to the probability matching analysis conducted here (1, group data instead of individual data.[14] 2, aggregation of the other choice probability ("B"). 3, ratio

[13] The target brand (brand A) is always the cheapest brand in previous conumer behaviour analysis research. This makes the probability matching analysis more valid, compared to using a specific target brand -used regardless of its price (as is the case in this study).

[14] It should be mentioned that previous consumer behaviour analysis reserch does not have this problem as it is both based on individual and aggregated data. But figures are generally based on agreggated data (e.g., Foxall, Oliveira-castro, & Screzenmaier, 2004).

reinforcement schedule which should lead to monotonical choice patterns not always suitable for a choice research, and (4) constant prices – and therefore only one stuck probability). To test a version of Mazur's hyperbolic discounting equation (see Mazur, 2001, for a review), which is derived from Herrnstein's matching law (see Herrnstein, 1981). Rainer and Rachlin (1993) asked human subjects to make a series of hypothetical choices between probabilistic and delayed rewards. Their probability analysis contained none of the critical difficulties mentioned in the probability matching analysis displayed in Figure 5.3. Reinari and Rachlin used individual data instead of group data. The reinforcement schedule was time based, but not ratio. They always presented a discrete choice between only two possibilities (not between a series of brands), and titration procedure was used instead of just one fixed probability (constant prices). This means that the choices of the experimental subject were basically used as a scale to balance the probabilistic and delayed rewards controlled by the researchers. Further research in consumer behaviour analysis would be better advised following these lines by experimentally presenting two identical brands with different delivery time. This could for instance be experimentally done in a simulated e-commerce study (see Smith & Hantula, 2003).

8.3 The Importance of the Research

> There are three questions of paramount concern in evaluating in evaluating experimental findings: (a) the scientific importance of the data; (b) their reliability, and (c) their generality. (Sidman, 1960, p. 1)

Previous nonexperimental consumer behaviour analysis has described consumer behaviour in terms of interesting matching relations. To further examine the importance of this relationship, and to be able to make stronger claims regarding functionality, further study - using experimental methods - was conducted. This involved in-store experiments to test and compare the validity of choice analysis (relative sales), and the matching law in the retail environment.

The main conclusion from the study is that it is possible and useful to perform in-store experiments where it is valid to represent results with relative sales analysis. However, the validity of the matching analyses is questionable. The amount and probability matching analyses bring neither scientifically important nor valid data, in terms of representing consumers' brand choices and the variables affecting them. As matching analyses had already been repeatedly used in consumer behaviour analysis, the main addition to the existing knowledge system was to put forward the idea of how it is possible, methodologically, to perform in-store behavioural experiments. In other words, to point to the need to perform field experiments, and try to add experimental techniques, so important in behaviour analysis, to the research on correlation already performed. In this respect, the term behavioural experiments means single-subject research designs where the aim is to show unambiguous behavioural patterns and interpretation. Stemming from such a concern, alternating treatment design was used because it is one of the most appropriate designs to control the impact of external factors and because of its many replications (fast alternations). Although the use of alternating treatment design was successful, it remains to be seen if this is the best experimental devise to use in further consumer behaviour analysis research. The data analyses from the in-store experiments came from previous consumer behaviour analysis matching research, or grew out of more basic behaviour analytic research (the relative sales analysis). The results add to the general body of the consumer behaviour analysis research program, and experimentally test speculations (section 3.1) regarding the effects of marketing factors on matching relations. It adds to the understanding of previous data analysis techniques by manipulating important factors in the retail environment, and examining how the matching equations can account for consumers' choices by comparisons between different equations. This study reveals that increases in reinfocer-effort (different shelf placements), punishment/reinforcer-cost (brand price), and intended establishing operations (in-store advertisement) do not have an impact on the variance accounted for (R^2).

The dissertation introduces the relative sales analysis and contrasts it to the more traditional consumer behaviour analysis research framework of the matching law. Within the paradigm of choice behaviour, the relative sales analysis offers a more molecular analysis of consumer behaviour, which in combination with experimental manipulations, is well equipped to reveal the strengths and weaknesses of the matching framework in the realms of consumer behaviour.

The purpose of the study was to explore the usefulness of behavioural analytical methodology to study consumer choice by investigating the effects of different marketing mix factors on relative sales and matching relationships. The in-store experiment presented here is unexplored territory for behaviour analysis, the relevance of which to marketing is its ability to use precise, logical terminology to define and measure consumer choices and to identify the environmental stimuli that influence them. The scientific, or behavioural analytical importance of the execution of the in-store experiments, and the resulting data, lies in comparing the behavioural variability during the "baseline" to those of the controlled experimental phases. The results show that the interventions and manipulations of the in-store experiments are, overall, successful in permitting refined experimental control over consumers' relative buying behaviour. The results from the in-store experiments often show persistence in consumers' choices and can provide criteria in terms of reliability and generalisation of data for similar research in the future.

8.4 Applications

> From Watson to Skinner, whether they studied rats, pigeons, or people, the leading behaviourists were all preoccupied with practical results. Their facts were at least real facts: running speed in a maze, key pecks in a Skinner box, and so on. But their interests were utopian-to change the world, not to understand it-so they vaulted from fragmentary knowledge to sweeping recommendations about social policy and private action. Its weak philosophy and grandiose claims made behaviourism a soft target, even for the poorly guided missiles directed against it...
> (Staddon, 2001, p. 179).

Staddon is right that behaviourists have gone too far in extrapolating from the laboratory, or other strictly controlled environments. In his early career, Skinner (1938) was more cautious about transferring behavioural principles from the laboratory, but later heavily extrapolated and advertised (as Watson did) the behavioural principles he discovered. This does not change the fact that these behaviourists were pioneers that demanded experiments be performed and an overall natural science approach to psychology. They exaggerated to grab the attention of other scholars and the public.

Over recent decades, important steps in analysing more complicated forms of human behaviour have been taken. This research is pioneering in its search for more control over important human behaviour in open real environments; in-store behavioural experiments have been unexplored territory up to now. In addition to the general marketing management applications of this kind of research, it is possible to claim socially important aspects to the study, such as analysing the access to goods which society considers harmful in some way over a long period or because of their excessive consumption (cigarettes, wine, and confectionary). These are products which society has tried to regulate by controlling access, handling, price, and advertising (Place, Price, & Promotion). These problems consist of behavioural excesses and shortages, which applied behaviour analysis is ideally suited to deal with (see e.g., Hursh, 1991) and especially consumer behaviour analysis. This research is crucial in establishing further methodological grounds for the application of operant psychology (behaviour analysis) to consumer and social marketing.

8.5 Further Research

The next steps should be to advance the behavioural control and data analysis techniques further. In the swamp of theoretical activity within marketing, it is of primary importance to consumer behaviour analysis to develop behavioural control techniques suitable for discovering functional relations which will form the basis for a behavioural theory of consumer and marketer behaviour. This search of environment-behaviour relationships should continue to be guided by the marketing mix factors

(Product, Price, Place, and Promotion), and the BPM (concurrence of reinforcing and punishing consequences; physical, social, temporal and rule-based contexts and bifurcation of utilitarian/informational consequences). It should be possible to aid behavioural in-store experiments with greater control of the situation, in terms of more systematic procedures (e.g., more frequent store visits and elaborative checks) in addition to observations (e.g., video recording or documented observations). This can make the effects of the retail environment clearer, but it is also necessary in order to expand explanatory strength, by adding to the system a treatment of the personal level of analysis (Foxall, 2003). This makes for further methodological challenges in terms of research methods. The in-store experiments give objective, verifiable data suitable to refute predictions and explore general behavioural processes, but the explanatory stance of the experiments can be limited. For instance, it is not known why consumers bought relatively more of the shampoo target brand at the original price (higher price) than when it was reduced in price in supermarket A (Figure 6.9). It could be interpreted that the price reduction hurt the brand value (e.g., price = quality), but this is purely a speculation, as there are many other possibilities (e.g., "snob" value). If there is no difference between relative sales of the target brand dependent on its price (e.g., Figure 6.25), is it attributable to utilitarian/information factors cancelling each other out, or is it simply because consumers didn't notice any price changes - as they do not look at prices? It is necessary to talk to consumers, which does not have to mean stepping out of the behavioural analytical system ("inner behaviour"), if one wishes to remain entirely within the boundaries of Skinnerian psychology. It is necessary to add inspections at another level to aid the description, prediction, and control of consumer behaviour even further (beyond pure in-store experiments). It could be practical to use qualitative research, for example in the form of self reports (see Poling, Methot and LeSage, 1995). This can give a more complete analysis, as for instance, an idea of previous behavioural patterns, rule-governance on the behalf of the consumer, or other factors that are not measured in in-store experiments.

A successful in-store experiment makes a virtue of replicating the same conditions and having the same or orderly effects, which are easy to interpret, built onto behavioural analytical terminology. The research has shown that this can be accomplished within the retail environment. Further research has to make advances in scrutinising consumer behaviour. The lack of data from individual consumers in the study can be seen as a deficiency in experimental control. Such behaviour has not been placed under experimental control in real settings as it is extremely difficult and time consuming to do so. Hopefully, this study can serve as a stepping stone in the direction of an experimental analysis of consumer behaviour at the individual level.

8.6 Main Conclusion from the Research

The dissertation has pointed to the need for a behavioural marketing which can serve as a critical standpoint against other influences, such as cognitive psychology and economics do in marketing. Cognitive psychology is prevailing in consumer research in marketing, but does not always serve the discipline, as it pays great attention to internal variables which often have little effect on consumer choice. Mainstream economics is also very influential in marketing, but its heavy reliance on grand theories (e.g., rational choice theory) can misguide researchers away from the real behavioural patterns of consumers. From this perspective it is important to assess the value of behaviour analysis which focuses on environmental control and studies behaviour for its own sake, not as a representation of the mental or rational. It is central to behavioural analytical research to look for behavioural controlling variables, how they operate and their lawfulness, and as such the field can provide premises for a marketing explanation of marketer-consumer interrelationships. From this standpoint, the branch of consumer behaviour analysis has risen audaciously with choice analyses, originally developed in the behavioural laboratory, adjusting to consumer behaviour in the modern market place. To study brand choice three different kinds of matching, or matching related, analyses have been performed, based on consumer panel data, in a few studies in correlation (Foxall, Oliveira-Castro, James, & Schrezenmaier, 2007); employing amount matching, cost matching (relative demand), and probability matching (maximisation) analyses. The study has been built on this foundation, and has tested these methods further with the aid of field experimental control. The ingathering is a new in-store behavioural experimental project which can further develop the arguments of consumer behaviour analytical advantages and fallacies, seen through the lenses of field experimental techniques, logic, and the inclusion of a relative sales analysis in consumer behaviour analysis. The conclusion is that there is a crucial difference between the amount matching analysis and the cost matching analysis as represented in the work of the CBAR group. The first analysis has the amount bought ratio as an independent variable, but the latter uses average price ratio. The difference is that the first analysis intends to have the reinforcer-amount as its independent variable, but there is no amount that is not bought (paid for). However, there are prices that are not used, as the average price ratio is a variable independent from the behaviour that it is intended to explain.

Overall the relative sales analysis portrays the relationships between the marketing interventions and consumer buyer behaviour very efficiently. It is the most appropriate method for detecting the environmental-behaviour relationships under study. This is this dissertation's most valuable contribution to knowledge in consumer behaviour analysis; further integration of consumer behaviour analysis and marketing application. It is the ability of the in-store experiments with relative sales and cost matching analyses to demonstrate a reliable control of the marketing variables over relative consumer buyer behaviour, or lack thereof, which advances knowledge and verification in consumer behaviour analysis and marketing. Prediction and control are, perhaps, not a means to understanding everything – but to behaviour analytical influences in marketing, their utilisation is a matter of survival.

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APPENDICES

APPENDIX 1

IN-STORE ADVERTISEMENT


FAIRY
heimsmeistari
í uppþvotti
FAIRY
LIQUID
NEW THICKER FORMULA
Samkvæmt heimsmetabók Guinness á Fairy þátt í umfangsmesta diskauppþvotti sem sögur fara af.
Fairy fjölskyldan
Í bókinni segir um heimsmetið: „Brobyværkiþróttafélagið vaskaði upp 23.892 diska á Langolandshátíðinni í Rudkøbing, Danmörku, 28. júlí 2004. Aðeins einn lítri af uppþvottalegi var notaður við verkið“.

APPENDIX 2

EXPERIMENTAL DESIGNS

Place: Shelf Placements
Crisps

BASELINE 13/19
TREATMENT 12

1 =Lowest shelf
2=Middle shelf
3=Highest shelf

Brand (product category)

	3. Feb- fri-sun 1 BASELINE	6. Feb- mon-thurs 2 BASELINE	10. Feb- fri-sun 3 BASELINE	13. Feb- mon-thurs 4 BASELINE	17. Feb- fri-sun 5 BASELINE	20. Feb- mon-thurs 6 BASELINE	24. Feb- fri-sun 7 BASELINE	27. Feb- mon-thurs 8 BASELINE
Con, A								
Con, B								
Sup, A								
Sup, B								
Bud, A								
Bud, B								

	3. March- fri-sun 9 BASELINE	6. March- mon-thurs 10 BASELINE	10. March- fri-sun 11 BASELINE	13. March- mon-thurs 12 BASELINE	17. March- fri-sun 13 BASELINE	20. March- mon-thurs 14 TREATMENT	24. March- fri-sun 15 TREATMENT	27. March- mon-thurs 16 TREATMENT
Con, A						1	3	3
Con, B						2	[illegible]	1
Sup, A						[illegible]	[illegible]	[illegible]
Sup, B						[illegible]	[illegible]	[illegible]
Bud, A						[illegible]	[illegible]	[illegible]
Bud, B						[illegible]	[illegible]	[illegible]

	31. March- fri-sun 17 TREATMENT	3. April- mon-thurs 18 TREATMENT	7. April- fri-sun 19 TREATMENT	10. April- mon-thurs 20 TREATMENT	14-17 April fri-mon 21 TREATMENT	18. April- thu-thurs 22 TREATMENT	21. April- fri-sun 23 TREATMENT	24. April mon-thurs 24 TREATMENT	28-30 April fri-sun 25 TREATMENT	
Con, A	2	2	3	2	SAME (Easters)	1	3	1	1	
Con, B	[illegible]	[illegible]	1	3	SAME (Easters)	2	[illegible]	2	2	
Sup, A	[illegible]	1	2	1	SAME (Easters)	[illegible]	2	3	3	
Sup, B	[illegible]	[illegible]	[illegible]	2	SAME (Easters)	[illegible]	3	1	1	
Bud, A	[illegible]	[illegible]	[illegible]	[illegible]	SAME (Easters)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bud, B	[illegible]	[illegible]	[illegible]	[illegible]	SAME (Easters)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Price: Price Reductions
Shampoo & Conditioner

BASELINE 15
TREATMENT 10

1=Original Price
2=Reduced Price

	3. Feb- fri-sun 1 BASELINE	6. Feb- mon-thurs 2 BASELINE	10. Feb- fri-sun 3 BASELINE	13. Feb- mon-thurs 4 BASELINE	17. Feb- fri-sun 5 BASELINE	20. Feb- mon-thurs 6 BASELINE	24. Feb- fri-sun 7 BASELINE	27. Feb- mon-thurs 8 BASELINE
Con, A								
Con, B								
Sup, A								
Sup, B								

	3. March- fri-sun 9 BASELINE	6. March- mon-thurs 10 BASELINE	10. March- fri-sun 11 BASELINE	13. March- mon-thurs 12 BASELINE	17. March- fri-sun 13 BASELINE	20. March- mon-thurs 14 BASELINE	24. March- fri-sun 15 BASELINE	27. March- mon-thurs 16 TREATMENT
Con, A								2
Con, B								2
Sup, A								2
Sup, B								2

	31. March- fri-sun 17 TREATMENT	3. April- mon-thurs 18 TREATMENT	7. April- fri-sun 19 TREATMENT	10. April- mon-thurs 20 TREATMENT	14-17 April fri-mon 21	18. April- thu-thurs 22 TREATMENT	21. April- fri-sun 23 TREATMENT	24. April-28. mon-thurs 24 TREATMENT	28-30 April fri-sun 25 TREATMENT
Con, A	1	2	1	2	Same (2) (Easters)	1	2	1	2
Con, B	1	2	1	2	Same (2) (Easters)	1	2	1	2
Sup, A	1	1	2	1	Same (1) (Easters)	2	1	2	2
Sup, B	2	1	2	1	Same (1) (Easters)	2	1	2	2

Promotion: In-store advertisement BASELINE 13/19 1=No Advertisement
Washing-up liquids TREATMENT 12 2=Advertisement

	3. Feb- fri-sun 1 BASELINE	6. Feb- mon-thurs 2 BASELINE	10. Feb- fri-sun 3 BASELINE	13. Feb- mon-thurs 4 BASELINE	17. Feb- fri-sun 5 BASELINE	20. Feb- mon-thurs 6 BASELINE	24. Feb- fri-sun 7 BASELINE	27. Feb- mon-thurs 8 BASELINE
Con, A								
Con, B								
Sup, A								
Sup, B								
Bud, A								
Bud, B								

	3. March- fri-sun 9 BASELINE	6. March- mon-thurs 10 BASELINE	10. March- fri-sun 11 BASELINE	13. March- mon-thurs 12 BASELINE	17. March- fri-sun 13 BASELINE	20. March- mon-thurs 14 TREATMENT	24. March- fri-sun 15 TREATMENT	27. March- mon-thurs 16 TREATMENT
Con, A						1	2	2
Con, B						2	1	1
Sup, A						1	2	2
Sup, B						2	1	1
Bud, A						1	2	2
Bud, B						2	1	1

	31. March- fri-sun 17 TREATMENT	3. April- mon-thurs 18 TREATMENT	7. April- fri-sun 19 TREATMENT	10. April- mon-thurs 20 TREATMENT	14-17 April fri-mon 21 TREATMENT	18. April- thu-thurs 22 TREATMENT	21-23 April fri-sun 23 TREATMENT	24-27 April mon-thurs 24 TREATMENT	28-30 April fri-sun 25 TREATMENT	26 BASELINE
Con, A	2	1	2	1	SAME (Easters)	2	1	1	1	
Con, B	1	2	1	2	SAME (Easters)	1	2	2	2	
Sup, A	2	1	2	1	SAME (Easters)	2	1	1	1	
Sup, B	1	2	1	2	SAME (Easters)	1	2	2	2	
Bud, A	[illegible]	1	2	[illegible]	SAME (Easters)	2	1	1	1	1 X 6
Bud, B	[illegible]	2	1	2	SAME (Easters)	1	2	2	2	1 X 6

APPENDIX 3

ADJUNCT DATA

Appendix 3.1

Changes in Amount Bought Ratio for Each Brand,

Prices, and Amount (section 5.1.1.2)

10-11 stadarberg, ML analysis, substitutabiloity of brands

	lowest shelf	Middle shelf	highest shelf		price per pack	Weight per pack
Þ. B brugður, 140g	0.03953468	0.02967886	0.04305434		299	140
Þ. B. Skrúfur með papriku, 140g	0.02416008	0.03589071	0.04109733	↑	299	140
Stjörnu, osta stjörnur, 90g	0.01341355	0.0110926	0.01195177		228	90
Stjörnusnakk, papriku skrúfur, 150g	0.01647278	0.03919384	0.04822645	↑	288	150
Maarud, salt, 175g	0.03020011	0.04400063	0.03791718		279	175
Maarud, paprika, 175 g	0.08172854	0.10943216	0.09815132		279	175
Maarud, sourcream and onion, 200g	0.04078975	0.03648232	0.04193605		368	200
Maarud, salt and pepper, 175g	0.02823906	0.03253828	0.02236589		368	175
Maiachi, tortilla chips, 453g	0.05330122	0.0245664	0.04116023		329	453
Mariachi, tortilla chips cheese, 453g	0.04619439	0.0245664	0.01899703	↓	329	453
Lays, cheese and onion, 200g	0.0172572	0.02563622	0.02376376		298	200
Lays, salted, 200g	0.03451441	0.05028644	0.04333392		298	200
Doritos, dippas, 200g (teir segja 150	0.01882604	0.01380412	0.02096802		298	200
Doritos, cool American, 200g	0.14433297	0.12620909	0.15236764		288	200
Doritos, Nacho cheese, 200g	0.18041621	0.17550952	0.12580814		288	200
Pringles sour, 200g	0.03608324	0.04831442	0.04333392		**229**	200
Pringles, original, 200g	0.0470651	0.05324446	0.0615062		**228**	200
Pringles, paprika, 200g	0	0	0		**228**	200
Pringles, paprika 50g	0.00313767	0.00813457	0.00663987		**99**	50
Doritos, sweet chilli pepper, 200g	0.04078975	0.03648232	0.04193605		298	200
Maarud, SPRQ Mix, 200g	0.05177161	0.02169219	0.0307531	↓	329	200
ES KART.FLÖGUR PAPRIKU 200G	0.02823906	0.03253828	0.02236589		149	200
ES KART.FLÖGUR SALT 200GR	0.02353255	0.02070618	0.02236589		149	200