

Do Loyalty Programs Enhance Behavioral Loyalty? A Market-Wide Analysis Accounting for Endogeneity

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ABSTRACT

This paper studies the effects of loyalty programs on behavioral loyalty using market-wide panel data on supermarket purchases. We present a conceptual framework relating loyalty program membership to share-of-wallet. To account for the two-sided causality between these variables, we specify a model for the loyalty program decision and use instrumental variables such as privacy concerns and loyalty program enjoyment. In general, loyalty programs are shown to influence share-of-wallet positively; ignoring endogeneity leads to substantially overestimate of effects. Not all loyalty programs are effective, however; four out of seven loyalty programs under study give greater value away to their members than they earn back in terms of additional customer revenues. The effectiveness of loyalty programs increases with value given through saving features. In contrast, the effectiveness of a program diminishes with higher price discounts to program members.

INTRODUCTION

In recent years many retail companies have introduced loyalty programs with the goal of enhancing customer revenues. Loyalty programs are currently available in many industries -- such as supermarkets, gasoline stations, and clothing stores -- and have become almost common property in some of them (Lewis 1997). Loyalty programs provide members with benefits such as promotions and saving features, which make these programs popular among consumers (Liebermann 1999). In the United States, almost 80% of all households have at least one supermarket loyalty card, and in Canada this is even 90% (*ACNielsen, Consumer Insight 2002*). In addition, many households are members of multiple loyalty programs simultaneously (*ACNielsen, Consumer Insight 2002*). Although loyalty programs have attained a prominent position in the marketing-mix of retailers, and loyalty cards have infiltrated customers' wallets, it is still not evident whether loyalty program memberships actually affect purchasing behavior (Dowling and Uncles 1997). Extant empirical research provides mixed evidence of their effectiveness. Some previous studies found positive effects of retail loyalty programs on customer purchasing (Bell and Lal 2003; Mägi 2003), whereas others report the absence of any effects (DeWulf, Odekerken-Schröder, and Iacobucci 2001; Sharp and Sharp 1997). This ambiguity relates, at least partly, to the fact that data and methodology limitations hinder proper assessment of the effects of loyalty programs.

An important methodological issue arises, because a positive relationship between loyalty program membership and customer purchasing does not prove the loyalty program's effectiveness, as the direction of the causality is unclear. Loyalty programs aim to enhance customer purchasing, but it is particularly the company's best customers that are most likely to subscribe as members. It is thus unclear to what extent differences between members and non-members are driven by the effects of the loyalty program itself or by the selection of most loyal customers into the loyalty program. Existing research has ignored this causality, or

endogeneity problem, as argued by Bolton, Lemon, and Verhoef (2002). They argue that a thorough solution for the endogeneity problem is needed before any conclusion can be made on loyalty program effectiveness. Our study provides such a solution.

Concerning data requirements, a proper assessment of loyalty program effectiveness requires competitive information, both on customer purchases at the competitors and the marketing-mix usage of competitors. In retailing, most consumers buy frequently from different stores (Drèze and Hoch 1998) and make transactions varying in size (Kahn and Schmittlein 1992). As proposed by several authors (Ailawadi, Lehmann, and Neslin 2001; Berger et al. 2002; Verhoef 2003), the share-of-wallet that a customer gives to a company under such circumstances is the appropriate indicator of behavioral loyalty, reflecting the divided loyalty and fuzzy choices of most consumers (Rust, Zeithaml, and Lemon 2000). To model share-of-wallet appropriately, researchers need market-wide marketing instruments to explain the relative attraction of the several retail companies. One important marketing-mix instrument to account for is competitive loyalty programs, because multiple loyalty program memberships are widespread nowadays (Mägi 2003; Passingham 1998). Existing studies make at best limited use of competitive information on purchasing, loyalty program memberships and other marketing mix elements (Mägi 2003; Verhoef 2003). Our study is the first to use complete market-wide data.

Experimental research indicates that the effectiveness of loyalty programs depends on the program's design (Kivetz and Simonson 2002a; Roehm, Bolman Pullins, and Roehm 2002; Van Osselaer, Alba, and Manchanda 2003). Specifically, considerable attention has been given to the trade-off between immediate rewards (through promotion features) and delayed rewards (through saving features) (Roehm, Bolman Pullins, and Roehm 2002; Yi and Jeon 2003; Zhang, Krishna, and Dhar 2000). Differences in program effectiveness as found in existing empirical field studies may be driven by differences in design components. A call has

been recently made for further research on the effectiveness of various loyalty program designs (Jain and Singh 2002). Though experimental research exists on this issue, no evidence from field data is available. Such a comparison of the effectiveness of loyalty program designs would require data on more than one loyalty program simultaneously.

This paper assesses the effects of loyalty programs. To summarize, we contribute to the existing literature in the following ways:

1. The paper provides an estimate of loyalty program effects that accounts for causality problems between loyalty program membership and purchasing behavior. We do so by using instrumental variables such as loyalty program enjoyment and privacy concerns to explain the loyalty program membership decision.
2. The study uses market-wide data on competitive purchasing and marketing-mix instruments such as competitive loyalty programs. Competitive purchasing information enables us to use share-of-wallet as the dependent variable of key interest.
3. The paper uses loyalty program design characteristics to explain differences in loyalty program effectiveness.

Our study uses household panel data from the Dutch supermarket industry. Seven of the twenty largest Dutch supermarket chains use loyalty programs. For 1926 households, information is available on purchasing behavior and loyalty program memberships in all twenty supermarket chains during a two-and-a-half-year period. Substantial overlap of loyalty program memberships exists, and about 50% of the households have multiple memberships. To assess the effects of loyalty programs on purchasing behavior we use a Tobit-II model with instrumental variables (IV) (Woolbridge 2002, p.567-571). The Tobit-II model includes a selection equation for supermarket choice, and an attraction specification for share-of-wallet. We account for endogeneity by first estimating a model for loyalty program membership using instrumental variables, and then imputing predicted rather than observed

loyalty program memberships in the Tobit-II model. Finally, we control for relevant marketing-mix factors of supermarket chains, and socio-demographic characteristics of panel households. We find that loyalty programs increase share-of-wallet by 8.3% (1.8 percent points) on average.

The remainder of the paper is structured as follows. Section 2 develops a conceptual framework on the relation between loyalty programs and purchasing behavior, and formulates hypotheses. Section 3 discusses the data of our empirical study, and Section 4 describes the Tobit-II model with instrumental variables. A presentation of the results follows, and we conclude with a discussion.

CONCEPTUAL FRAMEWORK

This section presents a framework that makes it possible to study empirically the effectiveness of loyalty programs in a retail market. In line with previous research (e.g. Sharp and Sharp 1997; Yi and Jeon 2003), we define a loyalty program as *an integrated system of marketing actions that aims to make member customers more loyal*. To take advantage of the loyalty program, a customer must become a member and must identify himself as such at every purchase occasion. In retailing, most loyalty programs use loyalty cards for identification and registration.

Effectiveness measurement: the causality puzzle

A unique trait of a loyalty program is that customers decide explicitly whether or not to participate in the program. Retailer companies can assess program effectiveness by evaluating behavioral differences between member and non-member customers. However, a simple comparison of the differences in purchasing behavior between these groups may lead to an overestimation of the loyalty program effect, because customers do not become loyalty

program members randomly. Rather, a customer becomes a member of the loyalty program if the expected benefits are higher than the expected costs, a choice that is partly driven by the attraction of the chain itself to a customer (Mauri 2003). For example, customers who live close to a given supermarket and already frequent the chain may derive relatively high benefits from the loyalty program without even changing their behavior. Thus, because loyal customers derive the highest benefits from a loyalty program, those customers who are already loyal are most likely to participate (Bolton, Lemon, and Verhoef 2002).

From an econometric perspective, this comes down to a causality or endogeneity problem. The relevant issue is that in a model with customer purchases as the dependent variable, and loyalty program membership as an independent variable, the loyalty program membership variable and the error term of the model are positively correlated. The violation of the model assumption of independence between the independent variables and the error term leads to biased parameter estimates (Greene 2000, p.370). Specifically, in case of a positive correlation between loyalty program membership and the error term, the influence of loyalty program membership is overestimated (Verbeek 2000, p.121). Including additional explanatory variables that drive customer purchasing (such as location or price) may mitigate the problem, but the problem itself will not disappear until all variables playing a role in the purchasing decision are available. Because this is practically impossible, alternative solutions should be found to estimate the loyalty program effect unbiasedly.

A first option is to analyze changes in purchasing behavior after a customer has entered the loyalty program. However, this does not solve the causality problem for two reasons. First, changes in loyalty program memberships can be endogenous as well. The drivers of the decision to become a loyalty program member could be factors that stimulate share-of-wallet as well, such as a residential move, the opening of a chain outlet nearby, a change in income, etc. Second, households that become loyalty program members long after

the launch of the program are atypical. Allaway, Berkowitz, and D'Souza (2003) show that late adopters of a loyalty program live further away from the chain outlet, are less convinced of the program's benefits, and perceive a program membership as riskier. So because of potential endogeneity problems and non-representativeness of late adopters, we do not consider the analysis of loyalty program membership changes to be an appropriate reflection of program effectiveness.

A second option is to analyze store-level sales patterns as done by Sharp and Sharp (1997), and to compare these to norms, such as those provided by Dirichlet models. A caveat of this approach is that one cannot distinguish between the effects of the loyalty program and those of other marketing-mix elements. In the absence of household-level information, one cannot distinguish between households that are loyalty program members (and thus exposed to the program incentives) and others households (Bell and Lal 2003; Drèze and Hoch 1998; Sharp and Sharp 1997). In other words, household-level data are important for ascribing customer-purchasing patterns to loyalty programs.

The most general applicable solution is to use instrumental variables, as we do in this study. One or more variables (instruments) must be found that influence the loyalty program membership decision of a household, but that are also unrelated to the household's purchasing decision. In marketing, instrumental variables have recently been introduced in the area of price promotions to model the endogeneity of a manager's price promotion decision (Chintagunta 2001; Villas-Boas and Winer 1999). However, the methodology could also be applied to household-level decisions. First, a model of loyalty program membership must be estimated, with the instruments and other available variables as explanatory variables. The predicted values from this model should then be imputed in the main model for customer purchasing as an independent variable (instead of the observed loyalty program memberships). The procedure will be discussed in further detail later in this paper.

Figure 1 presents our conceptual framework, the components of which are discussed in the remainder of this section. We start by explaining our key dependent variable, and then discuss the loyalty program membership decision and loyalty program effects, followed by a presentation of other store and household characteristics in the framework.

[Figure 1 about here]

Customer Loyalty

Loyalty programs aim primarily to stimulate customer purchasing at the retail company in a structural way, which comes down to improving behavioral loyalty. The marketing literature provides a wide range of loyalty measures (Odin, Odin, and Valette-Florence 2001), the usefulness of which depends on the specific market and study objective. In grocery retailing, purchasing behavior is characterized by high buying frequency and variation in basket sizes (Kahn and Schmittlein 1992). Further, consumers are often regular buyers at different companies (Kahn and McAlister 1997), a phenomenon referred to as polygamous loyalty (Dowling and Uncles 1997). Given these characteristics, share-of-wallet is the most suitable measure for behavioral loyalty (Berger et al. 2002; Mägi 2003). Share-of-wallet measures the share of category expenditures spent on purchases at a certain company, which integrates choice behavior and transaction sizes during a certain time period into one single measure. Equivalently, in brand management the share-of-category requirements is often used, calculated as the average proportion of the brand's customers' category purchases over all customers, as a measure of brand loyalty or even brand health (Ailawadi, Lehmann, and Neslin 2001; Bhattacharya et al. 1996).

The share-of-wallet a household gives to a store chain depends on its attraction to the household compared to the attraction of the competitors. In order to analyze the effects of loyalty programs on share-of-wallet, we need to understand 1) what drives customers to

become loyalty program members, and 2) how loyalty program membership affects share-of-wallet.

Loyalty Program Membership

When deciding whether to participate in a company's loyalty program, a customer compares the expected benefits and costs. The economic benefits of a loyalty program increase with a customer's share-of-wallet with the company. The share-of-wallet a customer had with the company in the past is an indicator of the expected benefits s/he will derive from the loyalty program. The initial share-of-wallet is thus expected to be positively related to a customer's loyalty program membership decision. Further, existing research has found that some consumers intrinsically enjoy participating in marketing actions, such as coupons (Mittal 1994), price promotions (Chandon, Wansink, and Laurent 2000), or shopping in general (Reynolds and Beatty 1999). The same intrinsic enjoyment could exist for participation in loyalty programs. So, customers may derive non-economic benefits from a loyalty program membership, when they intrinsically enjoy loyalty program participation.

Most retail loyalty programs do not require membership fees, so that customers do not face economic costs concerning a loyalty program membership. However, customers entering a loyalty program usually have to complete a subscription form in which s/he must provide personal data, such as address information and household composition. A company can use this information in combination with purchase data as registered through the loyalty cards to target households for direct mailings or to apply micro marketing. Some customers may not be very willing to provide personal information, especially if this concerns personal identifiers such as address information (Phelps, Nowak, and Ferrell 2000). This reluctance is caused by consumer's need for control and a negative attitude towards direct marketing (Phelps, D'Souza, and Nowak 2001). Some customers thus perceive giving away privacy as a

non-economic cost, and will allow this cost to negatively influence loyalty program participation. In sum, we advance the following hypotheses:

- H1a:** Initial share-of-wallet has a positive influence on the likelihood of a customer becoming a loyalty program member.
- H1b:** Loyalty program enjoyment has a positive influence on the likelihood of a customer becoming a loyalty program member.
- H1c:** Privacy concerns have a negative influence on the likelihood of a customer becoming a loyalty program member.

For methodological reasons (Woolbridge 2002, p.567-571), we also include in the model the available store- and household characteristics for loyalty program membership (see Figure 1).

Loyalty Program Effects

In essence, loyalty programs enhance customer loyalty because they increase the utility of the company's offering. Loyalty programs could enhance customer loyalty through several economic, psychological and sociological drivers. Two economic drivers particularly enhance the effectiveness of loyalty programs. First, a loyalty program provides member customers with economic value in the form of *rewards*. In general, the magnitude of the rewards relates positively to the share-of-wallet to the company, thus providing incentives for customer loyalty. Second, loyalty programs create *switching costs*, because loyalty program members lose value if they stop purchasing from the company. The value lost could consist of saving point credits or a good purchasing track record that ensures privileges. Especially economic-oriented research has used this argument as a rationale for the existence of loyalty programs (Kim, Shi, and Srinivasan 2001; Klemperer 1987; Kopalle and Neslin 2003). Because of the rewarding and especially switching costs, a loyalty program can create a certain degree of calculative commitment or stickiness in customers' relation with the company (Johnson et al. 2001). Calculative commitment can be defined as the extent to which consumers perceive the

need to maintain a relationship, given the significant termination or switching costs associated with leaving (Geyskens et al. 1996).

Further, several psychological drivers can enhance customers' calculative commitment, and make loyalty program effects stronger than could be expected from a purely economic point of view. First of all, consumers appreciate rewards -- not only absolutely, but also relatively to other consumers (Feinberg, Krishna, and Zhang 2002). Knowing that you are provided with better value than others excites feelings of being a preferred or special customer -- even if the group of others is relatively small. Given that loyal customers receive the most rewards, this will enhance feelings of fairness and customer loyalty as a result. Second, loyalty program incentives can induce smart shopper feelings (Kivetz and Simonson 2002b), and pride about being economical (Chandon, Wansink, and Laurent 2000; Schindler 1998). Consumers may derive a special sense of satisfaction at having achieved or won something without having to pay the normal price or currency. For some of them, the effort of obtaining the reward may even justify luxury consumption (Kivetz and Simonson 2002a). Third, existing research shows that customers overvalue the rewards to be obtained, as they tend to maximize the value offered by the medium (the loyalty program), rather than the final outcome (Hsee et al. 2003; Van Osselaer, Alba, and Manchanda 2003). This implies that customers aim to maximize promotions and saving points, where it would be rational to assess the utility of the final product minus the disutility of its costs.

Loyalty programs can also have sociological effects. They create affective commitment, a generalized sense of positive regard for, and attachment to, the organization (Geyskens et al. 1996). In this way, loyalty programs not only buy, but also earn, customer loyalty (Edvardsson et al. 2000). DeWulf, Odekerken-Schröder, and Iacobucci (2001) show for relational investments in consumer-firm relationships the existence of a reciprocity norm: customers evoke obligation towards those who treat them well or provide value. In addition,

customers that become members of the loyalty program are likely to identify more strongly with the company, because the membership relates them to a group of privileged customers (Bhattacharya, Rao, and Glynn 1995; Oliver 1999). The need to belong to groups is a fundamental human motivation (Baumeister and Leary 1995), and identification with *commercial* organizations is intensifying due to the growing centrality of consumption and materialistic desires in society (Fournier 1998; Muniz and O'Guinn 2001). Most loyalty programs use loyalty cards, and this explicit token of membership strengthens a customer's sense of belonging to the company, or makes their attitude towards the company more accessible (Dick and Basu 1994). Bhattacharya and Sen (2003) propose that strategies to develop customer identification are especially beneficial in industries where consumers purchase frequently, and differentiation between suppliers is low.

Overall, a large number of drivers exist that can make a loyalty program effective. This research does not aim to assess the relative importance of each driver, but rather to give a rationale for loyalty program effectiveness, and to provide a proper empirical assessment of this. The importance of the drivers might also depend on loyalty program type (Bolton, Kannan, and Bramlett 2000). The focus of our research is on loyalty programs that provide predominantly economic (tangible) rewards, but enrich them with social (intangible) rewards. Because the drivers discussed all point in the same direction, we hypothesize:

H2: A loyalty program membership enhances the share-of-wallet of a household with the company.

Loyalty program design

The effectiveness of a loyalty program is likely to depend on its design (Dowling and Uncles 1997; Jain and Singh 2002). An important element is how much rewarding value the loyalty program gives to its members, and in which form. Key design elements of the loyalty program are the promotion and saving features (Yi and Jeon 2003).

A promotion feature gives price discounts on certain items of the assortment exclusively for loyalty program members. In this way, a promotion feature supplies member customers with immediate rewards for their purchases (Yi and Jeon 2003), and provides them with privileges over non-members. The promotion feature stimulates customers to purchase the items on promotion, to buy categories they usually buy in other stores (Drèze and Hoch 1998) or to show stockpiling behavior (Chandon, Wansink, and Laurent 2000).

A saving feature gives loyalty program members saving points, dependent on the monetary amount spent at the company. A program member can redeem these points for a reward, such as a free product, after s/he has reached the minimal redeeming threshold. This threshold is typically such that the customer must spend a considerable total monetary amount. The saving feature stimulates customers to show loyal purchasing behavior in order to reach certain levels of saving points. Further, a saving feature can create switching costs. When a consumer stops buying he loses the saving points enclosed in his saving balances.

The question whether either a saving feature or a promotion feature is more effective is theoretically undefined. A saving feature stimulates purchases of the entire assortment and not only of specific items (as the promotion feature does). Very importantly, a saving feature creates switching costs (Zhang, Krishna, and Dhar 2000). Obtaining saving rewards requires considerable consumer effort, so that we expect stronger feelings of uniqueness and pride (psychological drivers). A price promotion has, in contrast with saving points, a direct negative effect on share-of-wallet. On the other hand, the perceived value of the promotion feature is found to be higher than an equivalent saving feature among consumers, since customers prefer to obtain a reward immediately over getting it sometime in the future. (Yi and Jeon 2003). Further, the promotional feature directly supports the supermarket chain's value proposition (Dowling and Uncles 1997). In sum, both saving and promotion features

contain attractive aspects to consumers, so that no ex-ante expectation exists in favor of either the saving or the promotion feature. We hypothesize:

- H3a:** Promotion rewards enhance the effect of loyalty programs on share-of-wallet.
- H3b:** Saving rewards enhance the effect of loyalty programs on share-of-wallet.
- H3c:** Promotion rewards and saving rewards are equally effective in enhancing share-of-wallet.

Store variables

A store chain's attractiveness depends on the benefits of the attributes offered by the store. Two important store attributes are location and price level (Kahn and McAlister 1997). Existing research has found that households with different socio-demographic characteristics derive different benefits from the same store attributes, e.g. because of variation in opportunity costs (Bell and Lattin 1998). We expect therefore that the relationship between a store variable and share-of-wallet is moderated by socio-demographic characteristics¹.

Location relates to the transaction costs of shopping, because households incur travel costs to visit a store. A high density of outlets of a chain enhances its attraction, because the expected travel costs are lower. However, a high outlet density is less important if the potential benefits of visiting a store far away are higher. These expected benefits are higher for large basket sizes, which are associated with large households (Bell and Lattin 1998). For high-income households, different effects might counterbalance each other: these households have high marginal costs of time, but the possession of cars and storage space diminish travel costs and increase basket sizes (Mittal 1994). In sum, we expect a positive effect of outlet density on share-of-wallet that is moderated negatively by household size and undeterminably by household income.

We expect a negative relation between a chain's price level and share-of-wallet, because high prices relate to higher shopping costs. Low-income households are especially

¹ The nature of the model (attraction model) prevents us from including the main effects of socio-demographic variables, because they drop out of the model (see also model section).

price sensitive because of their limited budgets. Further, high prices might also correlate with better quality and luxury assortment, which is especially appreciated by high-income households (Mulhern 1997). Regarding household size, large households can benefit more from low prices because of larger basket sizes (Bell and Lattin 1998). In sum, we expect a negative effect of price on share-of-wallet that is positively moderated by household income and negatively moderated by household size.

Several other store variables and household characteristics drive the attraction of a company. To account for the remaining heterogeneity in households and store chains, we include the share-of-wallet in the initialization period previous to the modeling period as an explanatory variable (Bucklin, Gupta, and Siddarth 1998; Guadagni and Little 1983).

DATA DESCRIPTION

To test the hypotheses, we conduct an empirical study on the Dutch supermarket industry. Consumers make transactions in supermarkets frequently, and face only low switching costs, which make supermarkets an appropriate market for our study of loyalty programs. We have panel data on purchasing behavior of 1926 Dutch households in supermarkets during a period of 2.5 years. The panel members provide purchasing information by scanning all their supermarket receipts with a home scanner. The data cover the period January 1998 until July 2000, and were provided by *GfK PanelServices Benelux*. The first six months are used as an initialization period. For each of the remaining two years, we know for each household the total yearly expenditures in each supermarket chain. We use data on expenditures in the largest twenty supermarket chains; these comprise 92.8% of the entire market sales.

Seven of the twenty supermarket chains have loyalty programs, all of which use loyalty cards for identification and registration. Typically, a loyalty program provides saving rewards through a saving points feature and price discounts through a promotion feature. The

saving feature provides saving points linearly dependent on the amount spent. Members must spend a considerable amount to reach the minimal redemption threshold and to exchange points for gifts or free products. The promotion feature gives price discounts on a varying set of items of the assortment, only announced within the store. On their receipts, customers find the number of points saved and the total discount earned with the loyalty card. In addition, the specific loyalty programs give also other rewards such as lotteries, direct mailings or member web pages. Both large and small supermarket chains have introduced loyalty programs, and some of the largest chains in the Netherlands do not have a loyalty program.

Table 1 shows the loyalty programs with their designs, the market shares of the supermarket chains, and some customer base characteristics. The customer base of a supermarket chain is defined as those households that visited the chain at least once during a certain year. Consumers visit on average 4.2 different supermarket chains per year (median = 4). We limit the discussion of the loyalty program design to the promotion and saving features, because no systematic variation of interest exists for the other design elements.

[Insert Table 1 about here]

Panel households complete a yearly questionnaire in which they report on their loyalty program memberships at supermarkets. On average, 67% of the customer base are loyalty program members, but this number varies between supermarket chains from 52% (Konmar) to 83% (Albert Heijn). Most panel households do not change their loyalty program memberships during the observation period, but some households enter or quit a loyalty program. About 88% of the panel households are members of at least one supermarket loyalty program. The duplication rate of loyalty program memberships is substantial: 33% of the panel households have two loyalty programs, 16% have three, and 4% have four or more loyalty programs. On average, a household holds 1.68 loyalty program memberships. The questionnaires were administered in January 1999 and 2000, and the information from each

questionnaire is applied to a yearly interval, starting six months before until six months after measurement. To operationalize all variables, an extensive additional data collection took place, which we discuss below (Appendix A provides an overview of data sources).

Dependent variable

We measure purchasing behavior as the share-of-wallet in a supermarket chain in a specific year:

SOW_{ist} = Share-of-wallet of household i in store s during year t ,

$i = 1, \dots, I; I = 1926$ (households),

$s = 1, \dots, S; S = 20$ (supermarket chains),

$t = 1, \dots, T; T = 2$ (years).

Independent variables: Loyalty program memberships

We have information on loyalty program memberships of households in each of the seven loyalty programs. As discussed, we need instrumental variables that can explain loyalty program membership. We use information from a survey held in November 2000 among the households in the panel to obtain the variables loyalty program enjoyment and privacy concerns. Loyalty program enjoyment is measured by three items (Cronbach's alpha = .79), and privacy concerns by a single item (see Appendix B). In sum, the following loyalty program variables are introduced:

LP_{ist} = 1, if supermarket chain s has a loyalty program and household i is member during year t ; 0 otherwise;

$ENJOY_i$ = Enjoyment of loyalty program membership by household i ;

$PRIV_i$ = Privacy concerns of loyalty programs by household i ;

Independent variables: Store characteristics

We include the store characteristics location and price level as independent variables in our model. We obtained the number of outlets of a supermarket chain in each of the twelve provinces of the Netherlands in 2000 from *Elsevier Business Information*. Some supermarket chains are exclusively located in a limited number of provinces, while others are available nationwide. For each province, the distribution density is measured as the number of outlets of a supermarket chain divided by the sum of outlets over all chains. This measure is applied to an individual household, based on its province of residence.

We use Dutch Consumer Reports to determine the price level of the supermarket chains. The Dutch Consumer Association regularly compares the price of a fixed basket across all large supermarket chains, with a sample of five outlets per chain. We construct a categorical price variable with three levels (low, medium, high), in which all levels include approximately the same number of chains (8, 7, 8). In sum, we introduce the following set of store characteristics:

$DENS_{ist} =$ Number of outlets of supermarket chain s as a fraction of the total number of supermarket outlets, in the province of residence of household i in year t ;

$PH_{st} =$ 1 if supermarket chain s is high-priced during year t ; 0 otherwise;

$PL_{st} =$ 1 if supermarket chain s is low-priced during year t ; 0 otherwise.

Independent variables: Household heterogeneity

Our model accounts for both observed and unobserved household heterogeneity. Socio-demographic information is available on household size and net household income of panel

members². The socio-demographic variables are included in the model as moderators of the store variables. The variables household income and household size are measured as deviations from the sample average. By operationalizing the variables in this way, the main effect of a store characteristic measures the effects for an average household. To account for unobserved heterogeneity, we include share-of-wallet during the initialization period as an additional explanatory variable. No random effects are used in our model, due to the limited number of observations per household (two). We therefore introduce:

$HHSIZE_{it}$ = Number of persons in household i in year t minus average number of persons in a household;

$HHINC_{it}$ = Monthly net income in 1,000 Euros of household i in year t , minus average monthly household income;

$SOWI_{is}$ = Share-of-wallet of household i in store s during the initialization period.

MODEL

A model on the effects of loyalty programs on share-of-wallet yields specific challenges. To be logically consistent, the model must produce estimates between 0 and 1 (*range constraint*), and the sum of estimates over all stores must equal 1 (*sum constraint*) (Hanssens, Parsons, and Schultz 2001, p.121). Because a linear regression model does not meet these constraints, an attraction model is used instead. Attraction models have been widely used for modeling market shares (Leeflang et al. 2000, p.171), but they can also be applied to household-level share-of-wallets. The basic idea is that the share-of-wallet of a store depends on its relative attraction to a consumer:

² We tried to include additional household characteristics in the model, such as the presence of young children in the household and the educational attainment of the housewife. Because none of the characteristics showed significant effects and theoretical arguments for them were not very strong, we dropped them from the final model.

$$(1) \quad SOW_{ist} = \frac{A_{ist}}{\sum_{s=1}^S A_{ist}}.$$

The attraction of a store (A_{ist}) is a function of loyalty program membership and store characteristics³. We specify the attraction function as a Multi Nominal Logit Model, so that it becomes:

$$(2) \quad A_{ist} = \exp(\beta_1 + \beta_{2s}LP_{ist} + \beta_{3it}DENS_{ist} + \beta_{4it}PH_{st} + \beta_{5it}PL_{st} + \beta_6SOWI_{is} + v_{ist}),$$

with

$$(3) \quad \beta_{mit} = \gamma_{m1} + \gamma_{m2}HHSIZE_{it} + \gamma_{m3}HHINC_{it}, \quad m = 3,4,5.$$

The attraction model is non-linear, and must be rewritten to enable estimation of the parameter coefficients. Using the method of log-centering (Nakanishi and Cooper 1982), we obtain a log-linear specification from which we can estimate the parameter coefficients:

$$(4) \quad \log \frac{SOW_{ist}}{(\prod_s SOW_{ist})^{1/S}} = (X_{ist} - \overline{X_{i,t}})' \beta_{ist} + u_{ist},$$

$$\text{with } X'_{ist} = (1, LP_{ist}, DENS_{ist}, PH_{st}, PL_{st}, SOWI_{is}),$$

$$\text{and } \overline{X_{i,t}} = \frac{1}{S} \sum_{s=1}^S X'_{ist}.$$

This model as presented in equation (4) suffers from endogeneity problems, because of the variable loyalty program membership, as discussed in a previous section. Further, in contrast to market shares, share-of-wallets will often be 0 (namely in case a specific chain is not patronized by a household during an entire year). An attraction model does not allow for these zeros, because the attraction of a supermarket chain cannot be zero (see equation (2)). To solve both issues, we follow the procedure for type-II Tobit models with endogenous

³ Socio-demographic variables show up exactly in the same manner in the nominator and the denominator of the model, and cancel out in the equation. So, in our model socio-demographic variables are only included in interaction with the store variables.

variables as recently proposed by Woolbridge (2002, p.567-571).

The first step consists of predicting loyalty program memberships from instrumental variables, as discussed in the conceptual section of the paper. The explanatory variables in the model for share-of-wallet are included as well. The equation becomes:

$$(5) \quad LP_{ist} = \alpha_1 + \alpha_2 SOWI_{is} + \alpha_3 ENJOY_i + \alpha_4 PRIV_i + \alpha_{5it} DENS_{ist} + \alpha_{6it} PH_{st} + \alpha_{7it} PL_{st} + u_{ist};$$

$$(6) \quad \alpha_{mit} = \varphi_{m1} + \varphi_{m2} HHSIZE_{it} + \varphi_{m3} HHINC_{it}, \quad m = 5, 6, 7.$$

Although loyalty program membership is a dichotomous variable, we should use linear regression analysis here (Woolbridge 2002, p.569). The model provides a linear projection for loyalty program membership from its instruments, which will be imputed in the main model that explains SOW_{ist} . In other words, we replace LP_{ist} in equation (2) with the predictions from the regression model in equation (5) (\hat{LP}_{ist}).

Another issue is that the dependent variable share-of-wallet is zero in a large number of cases, because a household patronizes only a limited number of supermarket chains. Analyzing only those observations with a positive share-of-wallet is not a good solution. That is, share-of-wallet is positive conditional on the store being chosen, and we expect that the factors that influence a household's store choice influence the share-of-wallet of chosen stores as well. Therefore, the error terms of both models are most likely correlated, and if we do not account for this dependency, the parameter estimates of a model for share-of-wallet are likely to be biased (Greene 2000; Thomas 2001). A model must therefore combine both share-of-wallet and store choice.

A selection variable $CHOICE_{ist}$ is thus introduced, which indicates whether store s is in the choice set of household i during quarter t . We assume that a consumer chooses to visit a supermarket chain ($CHOICE_{ist}=1$) if the underlying utility $CHOICE_{ist}^*$ is positive. We let

$CHOICE_{ist}^*$ be linearly dependent on the same store characteristics and household characteristics as used in the attraction function (see equations (2)-(4)), but replace share-of-wallet in the initialization period with a similar choice variable ($CHOICEI_{is}$). Further, the instrumental variable procedure of Woolbridge (2002) requires that we also include the two instruments ($PRIV_i$ and $ENJOY_i$) as explanatory variables. We combine store choice and attraction in a Tobit-II model (Verbeek 2000, p.209), which consists of a selection equation (store choice model) and a quantity equation (attraction model) (see Appendix C).

The Tobit-II model is estimated with maximum likelihood (the likelihood function is presented in Appendix C). The model corrects for the interrelation between store choice and share-of-wallet, because both decisions are integrated into one model. The model accounts for the fact that households differ in the number of stores they visit, because the share-of-wallet of a household is modeled as the attraction of the specific store divided by the sum of the attractions of the stores chosen by this particular household. In this way we also account for competitive loyalty programs, because these enhance the attraction of the competition. The model also corrects for endogeneity in the relation between loyalty program membership and share-of-wallet by including the predictions from instrumental variables as an explanatory variable, rather than loyalty program membership itself.

RESULTS

As a first step we estimate a model of the loyalty program membership decision, with the instrumental variables as the independent variables. The results are presented in Table 2. The model is overall significant ($F(16205,13) = 168.29, p < .001$), with a model fit of $R^2 = .20$. Share-of-wallet in the initialization period has a significant positive influence on loyalty program membership ($\hat{\alpha}_2 = .483, p < .001$), which confirms Hypothesis 1a. Loyalty program enjoyment positively affects loyalty program membership ($\hat{\alpha}_3 = .097, p < .001$), meaning that

enjoyment of participation in loyalty programs is a consumer trait that enhances participation in such programs (Hypothesis 1b confirmed). Privacy concerns influence loyalty program membership negatively ($\hat{\alpha}_4 = -.024, p = .012$), implying that privacy concerns indeed withhold customers from participation in loyalty programs (Hypothesis 1c confirmed). Because both loyalty program enjoyment and privacy concerns are significant in the model, we may conclude that they are appropriate instruments to tackle the endogeneity problem.

[Insert Table 2 about here]

In the second step we include the predictions from the regression model in the Tobit-II model. The Tobit-II model is overall highly significant ($\chi^2 = 16891.4, p < .001$). The likelihood ratio test of independent equations is rejected ($\chi^2 = 1121.2, p < .001$), implying that independent estimation of the selection and quantity equations would have led to significant biases. The pseudo R^2 of the model is .89, calculated in the manner proposed by Laitila (1993). The parameter estimates of the model are reported in Table 3. In the store choice equation, outlet density has a positive influence and price has a negative effect. Store choice is also strongly positively related to choice in the initialization period. Since the store choice equation is merely included to obtain unbiased effect estimates for the share-of-wallet equation, discussion of the latter will be our focus.

[Insert Table 3 about here]

We find that loyalty program membership influences store attraction positively for all seven loyalty programs, but that the effect is significant for only four loyalty programs (left-hand side of Table 3). The loyalty program coefficient is significant at the 5% level for two loyalty programs (LP3 and LP4), and even at the 1% level for two other loyalty programs (LP2 and LP7). This means that Hypothesis 2 is confirmed for four out of seven loyalty programs. As a benchmark, a model was also estimated with one pooled loyalty program membership variable. In this model, loyalty program membership has a significant positive

effect ($\hat{\beta}_2 = .180, t = 4.82, p < .001$), which also supports Hypothesis 2. However, a likelihood ratio test between this model and the model with store-specific loyalty program effects shows that loyalty program effects differ significantly between store chains ($LR = 111.3, p < .001$). This justifies the inclusion of store-specific effects. All store characteristics and their socio-demographic moderators have the expected signs, but only price level and share-of-wallet in the initialization period have a significant effect on store attraction.

Effect size and profitability

The magnitude of the effects are not directly apparent from the parameter estimates, due to the non-linear nature of the model. Further, the coefficients represent the effects of variables on attraction and not on share-of-wallet, which complicates interpretations. To gain better insight into loyalty program effects, we perform what-if simulations for the households in the database. We compare the model predictions of the entire customer base of supermarket chains for the present situation (the supermarket chain has a loyalty program) with the hypothetical situation in which the chain does not have a loyalty program. The hypothetical situation is simulated by removing the loyalty program from the chain under consideration, and keeping all other loyalty programs and explanatory variables unchanged. The model predictions thus represent the situation of a comparable chain in terms of the marketing mix, customer base, and competitive environment, but without a loyalty program. We calculate the average share-of-wallet, or the share-of-category requirements, for both situations. Subsequently, this is done for all supermarket chains with a loyalty program, and the effect size is calculated as the difference between the predicted share-of-category requirements in the present situation and the fictive situation without loyalty program (Table 4).

[Insert Table 4 about there]

Our results show that the share-of-wallet of a company's customer base is positively related to the presence of a loyalty program. For all supermarket chains, the average predicted share-of-wallet of customers is higher when a loyalty program is available. Over all seven loyalty programs, the average share-of-wallet of the customer base is 0.018 (or 8.3%) higher compared to the situation without a loyalty program. Once again clear differences exist between loyalty programs, with effect sizes varying between 2.4% and 26.6%. The two loyalty programs with the highest parameter coefficients (LP2 and LP7) also show the highest effect sizes.

Aside from share-of-wallet, how do loyalty programs affect customer revenues? Additional revenues depend on the loyalty program effect on share-of-wallet, but also on customers' total supermarket expenditures. The additional revenues from a household due to the loyalty program are calculated as the estimated effect of the loyalty program on share-of-wallet times the household's total supermarket expenditures. On average, a loyalty program yields €113.36 additional revenue per customer per year, but again strong differences exist between supermarket chains (see Table 4). Overall, loyalty programs that are effective in terms of share-of-wallet show large revenue effects as well -- but some deviations exist. In particular, LP1 generates relatively high additional revenues, because the customers of that chain (Albert Heijn) have supermarket expenditures higher than average.

Until now we have ignored the fact that loyalty programs relate to substantial costs. Marketers should consider the profitability of marketing actions, and should avoid giving away more value to customers than the additional revenues they receive back from them. Our data enable us to calculate if loyalty programs generate net additional revenues by looking at the rewarding costs. Rewarding costs are calculated as the reward rate times the yearly purchase quantity per customer. The reward rate is the sum of the discount rate and the saving rate. The saving reward rate (SAV_s) is calculated as the monetary value given away per euro

spent through the saving feature (Liston-Heyes 2002). Although the saving rewards consist of presents or free products, it was possible to determine their monetary value. We used web sites and contacted managers to obtain this information. Dutch Consumer Reports (2000) measured the discount rate ($DISC_s$) of the loyalty programs by taking a sample of loyalty program members' receipts and calculating the average discount percentage obtained per loyalty program. Table 4 provides the average yearly rewarding costs of the customers per supermarket chain. The net revenues, calculated as the difference between the average additional revenues minus the rewarding costs, show a mixed picture (far right-hand column of Table 4). On average, a loyalty program enhances the net yearly revenues of a customer with € 31.18. However, the loyalty programs of four out of seven chains lead to lower net customer revenues. One loyalty program with a significant positive effect on share-of-wallet appears not to realize positive net revenues (LP3).

Loyalty Program Design

Our analyses show a wide variation in loyalty program effectiveness between the different programs. This could very well be caused by differences in program design. To investigate this, we estimate a regression model with program effectiveness of the seven loyalty programs as the dependent variable, and discount rate and saving reward rate as explanatory variables. We use generalized least squares to account for differences in variances between loyalty program effectiveness coefficients and covariances between them (Verbeek 2000).

The model is significant ($F(7,3) = 6.627; p = .039$), and the fit is high ($R^2 = .73$). We obtained the following estimated equation (t-values between brackets):

$$(7) \quad \hat{\beta}_s = .376 \quad -.100 * DISC_s + .133 * SAV_s + \omega_s .$$

(3.67) (-4.00) (1.90)

The analysis shows that a higher saving rate enhances loyalty program effectiveness ($\hat{\theta}_1 = .133; p = .028$), so that we can confirm hypothesis 3b. On the other hand, the discount rate has a significant negative influence on loyalty program effectiveness ($\hat{\theta}_2 = -.106, p < .001$), and we cannot confirm hypothesis 3a. We also find that the saving reward rate influences loyalty program effectiveness significantly better than the discount rate ($t_{\hat{\theta}_1 - \hat{\theta}_2} = 2.71, p = .004$), which implies that we also have to reject the neutrally formulated hypothesis 3c. Companies seeking to realize maximal effectiveness of their loyalty programs should thus put more value into saving rewards than into promotion rewards⁴. Loyalty programs that give too much value through the promotion feature may become ineffective and may even generate negative net revenues. Apparently, the price reductions from the program lead to a decrease in share-of-wallet that is not compensated by an increase due to loyalty enhanced.

[Insert Table 5 here]

Benchmark model

We argue that accounting for endogeneity problems is important in order to obtain an unbiased assessment of loyalty program effectiveness. To explore to what extent ignoring endogeneity leads to substantial biases, we compare our model with a benchmark model that does not account for endogeneity. This model uses the observed loyalty program membership observations instead of the predictions from the loyalty program membership model. In the benchmark model all seven loyalty programs have a significant positive influence on share-of-wallet ($p < .001$). In our original model this was the case for only four out of seven

⁴ We also estimated a model in which we added an interaction term between the saving and discount rates. The interaction term turned out to be insignificant, while the conclusions concerning the main effects remained the same.

programs. Thus three chains would have incorrectly judged their loyalty programs as effective if endogeneity had been ignored.

[Insert Figure 2 about here]

The estimates of the benchmark model were also used to simulate the effect on the average share-of-wallet (see graphical presentation in Figure 2). The benchmark model overestimates the loyalty program effect considerably for all seven programs. The effect size is between 1.4 and 7.9 times as high as the effect measured according to the original model. Thus, a model that does not account for endogeneity overestimates the loyalty program effect structurally. No systematic pattern is apparent, however, in the differences in the magnitude of the biases between the loyalty programs.

DISCUSSION

We studied the effects of seven loyalty programs on share-of-wallet using market-wide panel data on supermarket purchases. Our study is the first to account for the two-sided causality between loyalty program membership and share-of-wallet by specifying a model for the loyalty program decision and using instrumental variables such as privacy concerns and loyalty program enjoyment. Loyalty programs are generally found to influence share-of-wallet positively. Moreover, we find that ignoring endogeneity leads to a substantial overestimation of the effects. Our model revealed that three out of seven loyalty programs in the study are not effective. Giving rewarding value through direct discounts to program members seems to harm loyalty program effectiveness. In terms of profitability, we find that four programs give more rewards away to their members than they earn back through additional customer revenues.

Managerial implications

The results of this study could help managers to improve their decisions concerning loyalty programs. A company (re)considering the use of such a program should realize that loyalty programs are generally effective in enhancing share-of-wallet, but not for each store chain. A company that runs a loyalty program should therefore closely monitor its effectiveness. Our results show that this is not trivial. Loyalty programs aim to enhance customer purchasing, but the company's best customers are the most likely to subscribe as member. This leads to causality problems, which invalidate a simple comparison of purchasing behavior of loyalty program members versus non-members. Valid assessments can be obtained only through studies using market-wide data and extensive customer background information. Because individual companies possess mainly company-specific data, cooperation with market research companies that hold consumer panels is an option.

Further, a company should pay careful attention to loyalty program design, as this is proven to influence effectiveness. When focusing on the trade-off between direct and delayed rewards, managers are advised to invest rewarding money predominantly in delayed rewards, such as a saving feature. The loyalty program designs studied here are fairly basic and similar, and companies could gain through differentiation of their design. A more unique loyalty program could cause customers to specifically favor a particular loyalty program, to the extent of keeping them from competitive memberships as well. One direction worthy of further investigation is refinement of loyalty incentives by progressive saving point schedules or customer tiers (silver, gold and diamond members), as often seen in frequent flyer programs. Managers could use field experiments in test markets to measure customer reactions to such refinements.

Managers should also incorporate the costs involved in the loyalty program into their decision process. Our data reveal that four out of seven loyalty programs in the study are not

profitable. Managers should avoid giving away more rewarding value than they earn through additional revenues that are generated. Where possible, companies should also aim to control the costs involved, e.g. by cooperating with other parties (Cigliano et al. 2000) .

Finally, our analyses show that privacy fears still prevent some customers from loyalty program participation. This implies that part of the customer base is not exposed to loyalty programs that could enhance customer loyalty. Current privacy legislation protects customer privacy to a great extent, and some of their fears might be irrational. In order to reduce customers' privacy fears, a retail company should invest in proper communication to customers about privacy protection guarantees and the constraints on data usage (Phelps, Nowak, and Ferrell 2000).

Limitations and further research

We undertook a market-wide study of all loyalty programs in the Dutch supermarket industry and found overall positive effects of programs on share-of-wallet. Given that the relationship proneness and product category involvement of consumers is low in this industry, we could expect these effects to be even larger in other industries, such as clothing retailing (De Wulf, Odekerken-Schröder, and Iacobucci 2001). Further, the loyalty programs are fairly basic and could be even more effective if the loyalty incentives are further refined (with progressive saving point schedules or customer tiers, for example). More research is required as well on the effects of social benefits (e.g. special shopping nights or newsletters for members) on affective commitment and customer loyalty.

We focus on share-of-wallet as our dependent variable, but loyalty programs might also affect total category expenditures. In fact, Kopalle and Neslin (2003) find that the elasticity of category demand can be one of the drivers of loyalty program success. This topic is definitely worth further empirical study. We believe that the issue of category elasticity is

especially relevant for shopping goods (such as apparel), and less relevant for the grocery product that are the topic of this study.

Further, share-of-wallet is a behavioral loyalty measure, and the development of attitudinal loyalty is also relevant (Yi and Jeon 2003). Behavioral loyalty not supported by attitudinal loyalty is spurious (Dick and Basu 1994), in the sense that it can easily be attacked by competitors. More research is needed into the extent to which attitudinal versus behavioral loyalty is enhanced by loyalty programs. Also of interest is the question to what extent the various drivers (economic, psychological, and social) play a mediating role in forming behavioral loyalty. In particular, it would be interesting to study the proposed development of belonging, identification or reciprocity. A fruitful extension to current research on these issues would be an examination of how customers deal with multiple memberships. How do positive attitudes towards a company develop if several companies provide loyalty benefits at the same time?

Another limitation of our study is that we were not able to incorporate all costs related to the loyalty program. We studied the profitability of loyalty programs by measuring the effects on purchasing behavior versus the rewarding costs. However, a loyalty program also incorporates maintenance costs, such as operation of data warehouses, administration of rewards, logistics of availability of the rewards in the stores, etc. We had no access to estimates of such costs, which might diminish the profitability of the loyalty programs even further. On the other hand, we assumed that all saving points were redeemed, which is usually not the case (Drèze and Hoch 1998). However, our current benefit-cost comparison may reveal to what extent additional revenues compensate the additional rewards given to the customer.

Some additional benefits may be derived from the loyalty program as well. Our study focused on loyalty programs as a means of improving loyal behavior, but did not consider that

a company might be motivated to introduce a loyalty program in order to obtain purchase data (Day 2000; Mauri 2003). A loyalty program provides the company with full information of customers' purchasing behavior, and could be enriched with socio-demographics and causal information such as price promotions. Rossi, McCulloch, and Allenby (1996) show the value of using this information for target marketing to certain customer groups. Such a strategy of direct marketing fulfills customer needs more specifically, so that marketing budgets are spent more efficiently.

Overall, our research shows that loyalty programs are effective, especially when they provide value through saving features. The effects are easily overestimated, however, when bilateral causality is ignored. Taking into account costs is essential to evaluate not only the effectiveness but also the profitability of loyalty programs.

FIGURE 1
Conceptual Framework

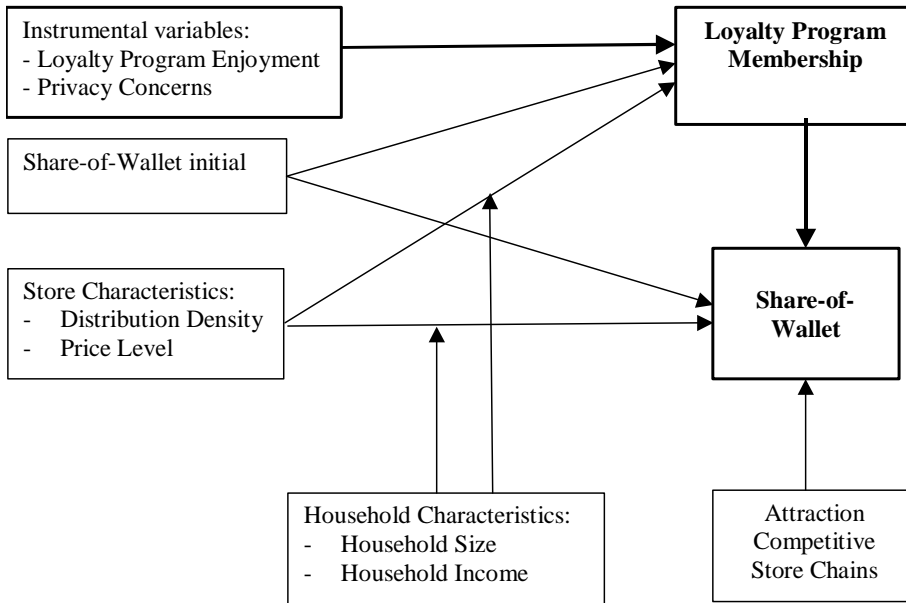


FIGURE 2
Changes in Share-of-Wallet of the Customer Base
Due to Loyalty Program

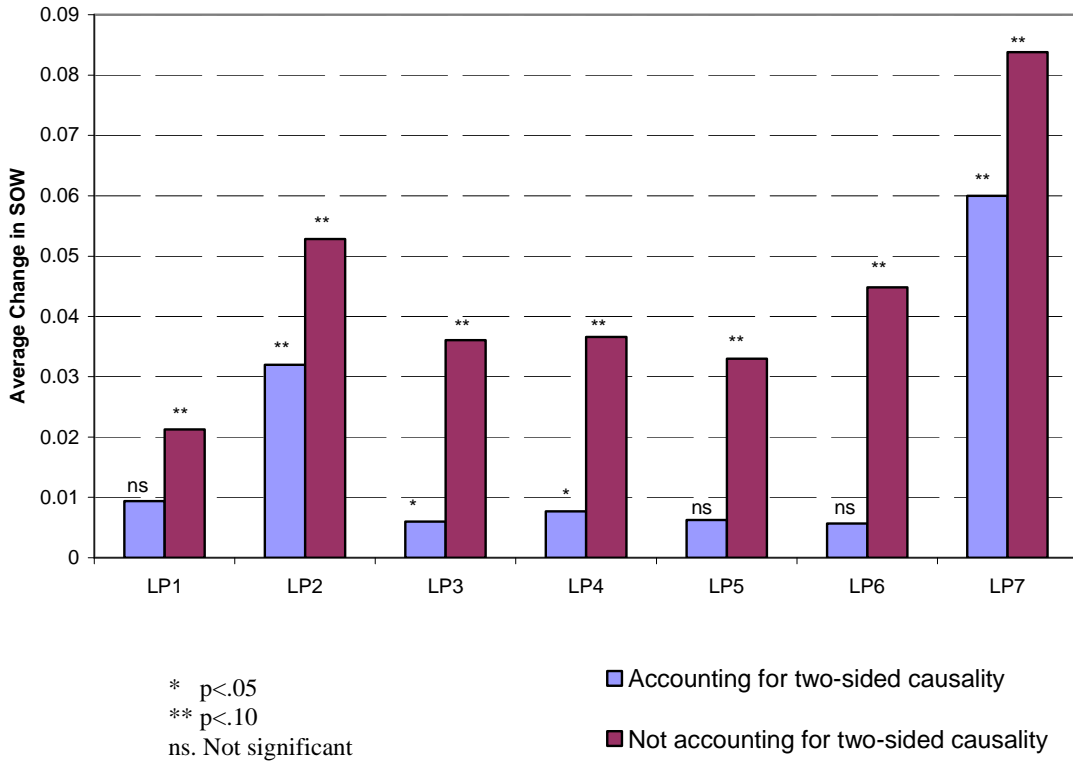


TABLE 1
Information on Supermarket Chains with a Loyalty program

| Supermarket Chain | Loyalty Program | | | Market Share (in 2000) | | # Stores visited | Customer Base Characteristics (Based on Panel Households) | |
|-------------------|-----------------|-------------|---------------|---------------------------|-------------------|------------------|--|---|
| | Loyalty Program | Saving Rate | Discount Rate | Market Share % | Market Share Rank | | % Loyalty Program Members | # Competitive Cards held by Loyalty Program Members |
| Albert Heijn | LP1 | 1.0% | 4% | 24% | 1 | 4.56 | 83% | 1.02 |
| Super de Boer | LP2 | .5% | 0% | 9% | 3 | 5.04 | 60% | 1.38 |
| Edah | LP3 | 2.0% | 5% | 8% | 4 | 5.07 | 76% | 1.48 |
| Integro | LP4 | .6% | 2% | 7% | 6 | 5.18 | 52% | 1.54 |
| Konmar | LP5 | .8% | 5% | 3% | 9 | 5.53 | 52% | 1.89 |
| Jan Linders | LP6 | .5% | 9% | 1% | 17 | 4.95 | 74% | 1.67 |
| COOP | LP7 | 4.0% | 3% | 1% | 18 | 5.08 | 68% | 1.61 |

TABLE 2
Explaining Loyalty Program Membership by Instrumental Variables

| Explanatory variable | | Parameter Estimate | <i>t</i> -Value |
|-----------------------------|----------------|--------------------|-----------------|
| Constant | α_1 | -.208 | 9.36*** |
| SOWI | α_2 | .483 | 33.70*** |
| ENJOY | α_3 | .097 | 8.88*** |
| PRIV | α_4 | -.021 | -2.45** |
| Distribution Density (DENS) | φ_{51} | .776 | 10.90*** |
| Price High (PH) | φ_{61} | .018 | 1.41 |
| Price Low (PL) | φ_{71} | -.082 | -3.08*** |
| DENS*HHSIZE | φ_{52} | .018 | .36 |
| DENS*HHINC | φ_{53} | .069 | 1.38 |
| PH* HHSIZE | φ_{62} | .043 | 4.37*** |
| PH*HHINC | φ_{63} | -.015 | -1.55 |
| PL*HHSIZE | φ_{72} | .021 | 2.41** |
| PL*HHINC | φ_{73} | -.018 | -.95 |
| | R^2 | .20 | |

*** $p < .01$ ** $p < .05$ * $p < .10$ (one-sided tests)

TABLE 3
Results of the Tobit-II model

| Explanatory Variable: | ATTRACTION (Share-of-wallet) | | | CHOICE | |
|-----------------------------|------------------------------|--------------------|-----------|--------------------|-----------|
| | | Parameter Estimate | t-Value | Parameter Estimate | t-Value |
| Constant | β_1 | .271 | 22.21*** | -1.946 | -61.68** |
| LP1 | β_{21} | .064 | 1.15 | | |
| LP2 | β_{22} | .511 | 8.03*** | | |
| LP3 | β_{23} | .099 | 1.74** | | |
| LP4 | β_{24} | .153 | 2.00** | | |
| LP5 | β_{25} | .096 | .87 | | |
| LP6 | β_{26} | .114 | .61 | | |
| LP7 | β_{27} | .944 | 5.80*** | | |
| Distribution Density (DENS) | Γ_{31} | .312 | 1.56* | 7.378 | 54.38*** |
| Price High (PH) | γ_{41} | -.083 | -2.44*** | -.1511 | -7.74*** |
| Price Low (PL) | γ_{51} | .172 | 5.72*** | .124 | 7.72*** |
| DENS*HHSIZE | γ_{32} | .114 | .87 | .130 | 1.39* |
| DENS*HHINC | γ_{33} | .097 | .73 | .274 | 2.79*** |
| PH* HHSIZE | γ_{42} | -.014 | -.62 | -.010 | -.72 |
| PH*HHINC | γ_{43} | .015 | .75 | .002 | .14 |
| PL*HHSIZE | γ_{52} | .047 | 1.79** | .018 | 1.73** |
| PL*HHINC | γ_{53} | -.014 | -.86 | -.012 | -1.14 |
| SOWI | β_6 | 4.615 | 126.40*** | | |
| CHOICEI | | | | 2.446 | 139.25*** |
| ENJOY | | | | .032 | 1.94** |
| PRIV | | | | -.018 | -1.40* |
| | σ_{12} | -.390 | | | |
| | σ_1 | 1.191 | | | |

*** $p < .01$ ** $p < .05$ * $p < .10$ (one-sided tests).

TABLE 4
Changes in Share-of-Wallet and (Net) Revenues of the Customer Base
Due to Loyalty Program

| | Δ SOW* | | Δ Revenues ** | Δ Costs ** | Δ Net Revenues ** |
|----------------|---------------------------|-----------------------------|----------------------|-------------------|--------------------------|
| | Change in Share-of-Wallet | % Change in Share-of-Wallet | | | |
| LP1 | .009 | 3.0% | € 55.05 | € 93.99 | € -38.94 |
| LP2 | .032 | 16.5% | € 188.24 | € 5.81 | € 182.43 |
| LP3 | .006 | 2.6% | € 37.21 | € 93.06 | € -55.85 |
| LP4 | .008 | 3.3% | € 51.41 | € 36.72 | € 14.69 |
| LP5 | .006 | 3.6% | € 35.72 | € 65.38 | € -29.66 |
| LP6 | .005 | 2.4% | € 34.77 | € 101.86 | € -67.09 |
| LP7 | .060 | 26.6% | € 391.09 | € 178.40 | € 212.69 |
| Average | .018 | 8.3% | € 113.36 | € 82.17 | € 31.18 |

* Average predicted change for a customer of the supermarket chain in Euros

** Average predicted change for a customer of the supermarket chain in Euros per year

APPENDIX A

DATA SOURCES

| Source | Obtained data |
|------------------------------------|---|
| GfK Panel Services 1998-2000 | Purchasing behavior of Dutch households in supermarkets, loyalty program memberships, privacy concerns, loyalty program enjoyment, and socio-demographics of the households |
| Dutch Consumer Reports 2000 | Discount Rate of Dutch Supermarket Loyalty Programs |
| Dutch Consumer Reports 1998-2000 | Price Level Dutch Supermarket Chains |
| Elsevier Business Information 2000 | Outlet Locations of Dutch Supermarket Chains |
| ACNielsen Consumer Insight 2002 | Loyalty Program Membership rate of American and Canadian households in supermarkets. |

APPENDIX B

INSTRUMENTAL VARIABLES MEASUREMENT

Enjoyment of program membership

Measured by the following items on five-point Likert scale

(1 = strongly disagree; 5 = strongly agree):

- I enjoy participating in loyalty or saving programs.
- Loyalty and saving programs offer attractive benefits.
- I appreciate being selected for loyalty programs and special offers.

Cronbach's alpha = 0.79

Average value = 3.14, standard deviation = .82

Privacy concerns of registration

Measured by the following item, on five-point Likert scale

(1 = strongly disagree; 5 = strongly agree):

- The registration systems of loyalty programs infringe on my privacy.

Average value = 2.90, standard deviation = .96

APPENDIX C

MODEL SPECIFICATION

$$(C1) \quad \log \frac{SOW_{ist}}{(\prod_s SOW_{ist})^{1/S}} = (X_{1ist} - \bar{X}_{1i,t})' \beta_{ist} + u_{ist} \text{ if } CHOICE_{ist}^* > 0,$$

$$\text{with } X'_{1ist} = (1, \hat{L}P_{ist}, DENS_{ist}, PH_{st}, PL_{st}, SOWI_{is})$$

$$(C2) \quad SOW_{ist} = 0 \text{ if } CHOICE_{ist}^* \leq 0,$$

$$(C3) \quad CHOICE_{ist}^* = X'_{2ist} \gamma_{ist} + \varepsilon_{ist},$$

$$\text{with } X'_{2ist} = (1, PRIV_i, ENJOY_i, DENS_{ist}, PH_{st}, PL_{st}, CHOICEI_{is})$$

$$(C4) \quad \begin{pmatrix} \varepsilon_{ist} \\ u_{ist} \end{pmatrix} = NID \left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_1^2, \sigma_{12} \\ \sigma_{12}, 1 \end{pmatrix} \right).$$

We set the constraint $\sigma_2 = 1$ to avoid identification problems (Verbeek 2000, p.208).

The likelihood of the model is (Verbeek 2000, p.211):

$$(C5) \quad \begin{aligned} L &= \prod_0 p(CHOICE_{ist}^* \leq 0) \prod_1 f(SOW_{ist} | CHOICE_{ist}^* > 0) P(CHOICE_{ist}^* > 0) \\ &= \prod_0 p(CHOICE_{ist}^* \leq 0) \prod_1 f(SOW_{ist}) P(CHOICE_{ist}^* > 0 | SOW_{ist}) \end{aligned}$$

Equations C6-C8 show the expressions for the components of the likelihood function.

$$(C6) \quad p(CHOICE_{ist}^* \leq 0) = 1 - \Phi(X'_{2ist} \gamma_{ist}),$$

$$(C7) \quad f(SOW_{ist}) = \frac{1}{\sqrt{2\pi\sigma_1^2}} \exp \left\{ \left[-\frac{1}{2} \left(\frac{\log SOW_{ist}}{\log(\prod_s SOW_{ist})^{1/S}} - (X_{1ist} - \bar{X}_{1i,t})' \beta_{ist} \right)^2 / \sigma_1^2 \right] \right\},$$

$$(C8) \quad \begin{aligned} &P(CHOICE_{ist}^* > 0 | SOW_{ist}) = \\ &\Phi \left(\frac{X'_{2ist} \gamma_{ist} + (\sigma_{12} / \sigma_1^2) (\log SOW_{ist} - \log(\prod_s SOW_{ist}))^{1/S} - (X_{1ist} - \bar{X}_{1i,t})' \beta_{ist}}{\sqrt{1 - \sigma_{12} / \sigma_1^2}} \right). \end{aligned}$$

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