ENVIRONMENTAL LABELLING AND CONSUMERS' CHOICE
– AN EMPIRICAL ANALYSIS OF THE EFFECT OF THE NORDIC SWAN

by

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Abstract:

Provision of information on the environmental effects of consumption is often put forward as an appealing alternative to traditional means of environmental regulation such as permits and environmental taxes. When consumers in opinion polls are asked if their purchasing decisions would be influenced by information on environmental or ethical aspects of products, the majority seem very ready to say yes. However, evidence for actual behavior along these lines is still limited.

The paper presents an empirical analysis of the effect of a certified environmental label (the Nordic Swan), using a large Danish consumer panel with detailed information on actual purchases from the beginning of 1997 to January 2001 (weekly observations).

In 1997, few products with the Nordic Swan label were available on the Danish market, as Denmark did not join the program of the other Nordic countries until April, 1997. Since then a considerable number of brands of different products in the Danish market have obtained the label, and the data includes information on purchases before and after a number of brands obtained the Swan label. In the paper we use a multinominal logit model to quantify the effect of the Swan label on consumers' choices among different brands of toilet paper, paper towels and detergents. It does appear that the Nordic Swan label has had a significant effect on Danish consumers' brand choices for toilet paper and detergents, corresponding to a willingness to pay for the certified environmental label of 10-17% of price of the labelled products. Results are less conclusive for paper towels, but the environmental label appears to have had less influence on the brand choice for the user of paper towels.

Key words: environmental labelling, information provision, consumer brand choice.

JEL: C25, D12 , D64 and Q28

1. Introduction

When political or administrative policy makers set out to directly influence private sector environmental behaviors via prohibitions, permits, or even »prices«, tensions and conflicts are explicit and long lasting. There will usually be conflicts about the terms of the prohibitions or permits and the size of the prices.

The provision of information appears less confrontational than traditional regulatory rule or price making and it seems that various programs that disseminate information about the environmental attributes of products or companies are becoming an increasingly popular tool of government agencies and organizations with the intent to improve the environmental performance of environmental actors. However, to better evaluate the claims for these programs and to allow the design of more effective programs, we need a better understanding of whether and how the provision of information can actually influence individual behaviour. For instance, although consumers in opinion surveys often maintain that they will reflect information on environmental or ethical aspects of goods or companies in their purchasing decisions (»green consumption«), there has been little empirical analysis of actual behavior along these lines.

An environmental label indicating that the labeled brand is more environmentally friendly than unlabeled brands of the given consumer product is often used as a simple way to present complex technical information to consumers. Examples includes the European Union's Ecoflower, the German Blue Angel and the Nordic Swan. The general idea of these programs is that the information will affect the choice of consumers and tend to increase the market shares of companies with relatively clean technologies or environment friendly products.

In this paper we present an analysis of the effect of the Scandinavian environmental label (Nordic Swan) on Danish consumers' choices among different brands of toilet paper paper towels[1] and detergents. The analysis is based on weekly purchase diary data for 1596 Danish households (on average) from 1997 to the beginning of 2001. During this period a number of brands of the consumer products being analysed were awarded the Swan label, so the data includes information on purchases both before and after the label information became available. From random utility theory we derive a multinominal logit model to describe the households' choices among different brands. In addition to the presence or absence of the Swan, other explanatory variables include the prices of the different brands and whether the brand was purchased on sale (as a special offer). In addition an index measuring the level of advertising of each brand on Danish television and in newspapers and magazines is included in the model. So, finally, are indicators of results from consumer test reports ranking different brands of detergents and paper towels.

It is found that the Swan label has had a significant effect on Danish consumers' choices of toilet paper. Willingness to pay for Swan labelled toilet paper ranges between

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[1] For clarification: 'Paper towels' (in US) are known as 'kitchen rolls' in UK (or 'Køkkenruller' in Danish).

10% to 17% of price for different chains of supermarkets. The Swan label appear to have had a similar effect on the choices of detergents, while the effect on choice of paper towels was lower (or, in many estimated models, even absent). Paper towels are not purchased frequently by all Danish households, as it is still common in Denmark to use dishcloth or other similar products, which can be washed out and reused. Hence, it seems likely that 'green' consumers prefers to rely mainly on dishcloths instead of purchasing paper towels.

In the following section we briefly describe the Nordic Swan label, review the literature on information provision and labelling, and describe previous empirical efforts to estimate the effect of such programme. The model is presented in section 3 and the data are described in section 4. Results are presented in section 5 and 6. Concluding remarks are offered in the last section.

2. Background

There are a number of dimensions on which to distinguish the myriad of existing information labels on environmental and other attributes of consumer goods. One important distinction concerns the motivation of the end user of the information. This distinction is between information that is directly applicable to the end user – such as hazard warning labels (like those on cigarette packages or domestically-used chemicals) that are intended to protect the user or those around him – and information that is applicable only to the extent that the user has some degree of concern for wider, more diffuse environmental effects on which the consumer's individual action can hardly make even a tiny impact. Apart from environmental labels like the Nordic Swan this could also include 'ethical' labels like the ones that are related to animal welfare (e.g. the US dolphin-safe tuna label) or 'fair trade' with developing countries (e.g. the Max Havelaar or TransFair labels used on coffee etc. in a number of European countries and in North America).

A number of labels capture characteristics with mixed private and public good dimension. This includes labels pointing out cost savings that flow from environment-friendly actions, such as energy usage programs (e.g. the energy labels on household appliances). It appears that organic food labels also must be included in this category, as organic products are often perceived as being healthier for the user or otherwise having higher quality (e.g. tasting better) as well as being less environmentally harmful. See e.g. a recent survey of the literature by Wier and Calverley (2001).

2.1 Theory related to provision of information and labelling

A priori, one may be skeptical of the whole idea that labels on attributes that do not yield the consumer significant direct benefits should have any effect on purchase decisions. However, early economic contributions, for example Sen (1973), attributed such behavior to what Sen called "sympathy" or "commitment" (and others refer to as "altruism") or to the fear of acting socially irresponsibly (non-instrumental or symbolic behav-

ior).[2]

Turning to more recent theoretical contributions, Kennedy et al.(1994) have investigated the case for public information provision about the environmental effects of product in a model with rational consumers. They show that there can be a market failure in the (private) provision of information on polluting products, which makes a case for government action as provider. The market failure arises because the individual consumer does not take full account of the benefit she bestows on other consumers if acquired information leads her to reduce consumption of the polluting product.

Kennedy et al. emphasize that the provision of information cannot substitute for environmental taxes. On the contrary, they conclude that when a corrective tax is available then the role for public information provision is (in some situations) to support the tax-corrected equilibrium. Their recommendation is that information provision is especially important in situations where corrective taxes are not available for attacking the externality (for technical or political reasons).

A slightly more positive view of the potential of provision of information is offered by Stern (1999), who presents a broader discussion of the interaction between provision of information and incentives (taxes/subsidies). Based on a review of a number of empirical studies, Stern finds that the effectiveness of fiscal incentives appears to improve greatly with improved information on the private and environmental effect of the program. Thus, information and fiscal incentive have synergistic effects on behavior.[3] Besides providing 'facts' to the consumers about the environmental consequences of their behavior, information may potentially have a positive effect on the environmental commitment of the individuals, while fiscal incentives run the risk of crowding out proenvironmental motivation as suggested in Frey and Oberholzer-Gee (1996).

A number of recent papers have modeled the impact of information where this takes the form of an environmental label. It appears from this literature that environmental label schemes in some special situations may have perverse effects on environment.

As an example Dosi and Moretto (2001) look on the effect of a label scheme on the incentives of companies to innovate and invest in green technology. They argue that a label scheme could increase investment in the conventional polluting technology even if green consumption is stimulated by the label scheme. This would be the case if there are image spill-overs in the sense that the eco-label projects a positive image not only on the

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[2]A number of more recent contributions have discussed the nature and implications of altruistic preferences in different areas of economic theory including environmental economics (see e.g. Johansson, 1997, McConnell, 1997 and Nyborg, 2000) and game theory (see e.g. Andreoni, 1988 and 1995).

[3]The analysis is based on a survey of a number of empirical studies, mainly on household energy conservation programs. An alternative interpretation of the studies surveyed by Stern (1999), which is less positive with respect to the potential of information as a broader environmental policy tool, is that only information on the private benefits associated with pro-environmental action (saving energy saves money) appear to have induced a change in behaviour. Thus, informing agents that they can help the environment, but without saving a dollar, would not be sufficient.

green product but also on the conventional product.[4]

Another line of concern is raised by Mattoo and Singh (1994) and Swallow and Sedjo (2000), who both find that an environmentally friendly label may increase the use of polluting products. In both papers a distinction is made between consumers who care about environment and other consumers who do not care. Awarding a label will increase demand from environmentally concerned consumers, but will have no effect on the demand of the unconcerned. However, awarding the label may also shift the supply of labeled products upwards because the label and/or the associated cleaner technology is costly.[5] This may reduce equilibrium quantity purchased by unconcerned consumers, and potentially do the same for the concerned consumers, which ultimately could lead to a decrease in equilibrium market quantity for environmentally friendly products.[6]

Finally, Kirchhoff (2000), Mason (2001) and Cason and Gangadharan (2001) more explicitly take into account the nature of environmental quality under asymmetric information. Environmental quality is often considered to be a credence good, one for which (environmental) quality cannot be observed by the consumers even after purchase (as opposed to an experience good for which quality is observed perfectly after purchase). This gives the firm an incentive to exaggerate the environmental performance of its products (»greenwash« brown products). Kirchoff (2000) finds, that a third-party environmental labeling system always will increase the likelihood that the firm will choose to produce the clean product (provided that there is some monitoring in the label scheme and consumers believe in the label). However, in a slightly different model Mason (2001) finds that the label may not increase the number of green products and that an environmental label in some situations may reduce welfare.[7] In an experimental study of asymmetric information about product quality between buyers and sellers, Cason and Gangadharan (2001) compare the effect of seller reputation, cheap talk (unverifiable) and third party certification (verifiable but costly for sellers). They find that third party certification is the only reliable way to improve product quality.

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[4]Note that the model of Dosi and Moretto (2001) has a number of short-run characteristics. That is, it is a two period model with irreversible investments. In addition the potential negative effect of the label scheme appear to be related strictly to the announcement of the label schemes (i.e. the introduction phase).

[5] The formal analysis in Swallow and Sedjo (2000) is based on a mandatory label, but the authors argue that the potential undesirable effects may also be found under a voluntary label scheme (though less likely under a voluntary program as compared to the mandatory).

[6]The mechanism yielding the potential adverse effect is a little different in the paper by Mattoo and Singh (1994) and Swallow and Sedjo (2000). The description of the mechanism mainly applies to the later paper.

[7]As one example Mason allows for a noisy test procedure, where dirty products have a positive probability of obtaining a label, but the likelihood of passing the test is lower for dirty products than for environmentally friendly products.

Despite the concerns raised about potential adverse effects on the environment, and the possibility of strategic behavior of companies in order to take advantage of green consumerism, it still appears to be a general view that the market pressure created by »green« consumers and investors provides reasons for optimism because it is a legitimate way for people to express their preferences and thus encourage socially beneficial outcomes (see e.g. Lyon and Maxwell (2001) and Nimon and Beghin (1999)). From an empirical point of view the main question seems to be how strong these effects are.

2.2. Empirical studies on the effect of environmental information

The different theoretical papers on environmental labeling described above generally assume that consumers are willing to pay a price premium for environmental friendly products. The proliferation of "green products" and "green advertising" suggest that at least some firms believe this to be the case as well. There are also examples of companies whose sales dropped precipitously as a result of being labeled environmentally unfriendly (Cairncross, 1992). Finally, there is a great deal of survey evidence that consumers will readily express a willingness to incorporate environmental information into consumption decisions (see Russell and Clark (1999)). Nevertheless, there are only few empirical analyses of whether consumers will actually do so. Indeed, according to EPA (1994) and OECD (1997) most evidence is anecdotal.[8]

Altogether we have identified five empirical studies published in academic journals or editions. These are summarized in table 2.1[9]. In three cases it appear that the presence of the label or the information about environmental attributes has increased willingness to pay for the good or increased sales. In the remaining two cases results are mixed. A variety of different methods/data are represented in the five cases and the markets focused on are all different.

Table 2.1. about here

Methodologically the work of Bennett et al. (2001) – see also Blamey and Bennett (2001)) – is the closest to the study presented in this article as they also use real market data in a discrete choice model. However, there are two important differences. First, Bennett et al.(2001) investigated the effect of two environmental attributes (based on claims by

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[8] Related research deals with the effect of information dealing with »private« characteristics of products like nutrition or warning labels or information on the energy performance of durables (mixed private and public characteristic). A number of studies indicate that information about nutrition effects influence consumer behaviour (resent examples include Kim et al. (2000), Variyam et al. (1998), Nayga et al. (1998), and Yen et al. (1996)). With respect to warning labels a survey by EPA (1994) notes that the effectiveness of warning labels appear to have been »moderate at best«. Finally, Stern (1999) discuss empirical evidence related to information on energy performance.

[9] As it appears from table 2.1 seven different studies have actually been found, but in two cases there are overlap whith data applied in another study.

producers), while we seek to identify the effect of a hybrid environmental label *certified* by a third party. Second, our study includes information on a number of brands both before and after they began to display the label. This may help to avoid confounding effects with other (observed or unobserved) brand characteristics.

In another study based on real market data Teisl et al (2001) used aggregate time series data to investigate the effect of the dolphin-safe label on the overall market share of canned tuna. The effect of the dolphin safe label is identified only though changes in aggregate consumption of tuna before and after the label (all brands of tuna labeled). As noted by the authors the lack of cross sectional variation in labeling is a limitation in the data. Thus, it is possible that the significant effect of the dolphin-save label could be caused by unaccounted-for market trends. In our study the different brands of toilet paper and paper towels were awarded the label at different time, so the risk that the estimated coefficient to the label just picks up some market trends is much reduced.

2.3 The Nordic Swan

The Nordic Council of Ministers decided to implement the Nordic Swan label in 1989 as an officially certified environmental label. The first licenses to use the Swan label were awarded at the end of 1991. It is the intention that only the most environmentally friendly brands within a given product category should be able to meet the gradually increasing requirements for obtaining the Swan label (without lowering the 'use' quality of the product).

For reasons not explored here, Denmark did not join the label program until 1997. At the beginning of 1997 a very limited number of products with the Swan were available for Danish consumers (brands with a permission to use the label in other Nordic Countries sometimes used the label also on the Danish market). Since 1997 an increasing number of brands in different product categories sold on the Danish market have obtained the label. Thus, at the end of 2000, the Swan had appeared on 13 different brands of toilet paper, 9 brands of paper towels and 3-4 brands of detergents available to Danish households.[10] In principle some brands were to lose the right to use the Swan label as requirements for obtaining the label gradually increased. However, this has not happened for any of the brands analysed here.

Three surveys have been carried out (in 1997, 1999 and 2000) investigating whether the Swan label is recognised and understood by Danish consumers, while comparative surveys were carried out in all Nordic countries in 1998 and 2000. There are quite large differences in the results between these two groups of surveys, which apparently are produced by different question designs. All surveys were carried out by direct interviews. In the Danish surveys respondents were shown the Swan label and asked if they recognised it. If she or he said yes, the respondent was asked to explain its meaning without

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[10]Note that a large number of product brands sold only to professionals or institutions also obtained the label (apparently induced by green public procurement policies).

having potential explanations suggested. In 1999 and 2000 more than half of the respondents recognised the Swan labels (table 2.2). Only part of the respondents claiming to recognize the label were able to correctly describe its meaning. However, altogether 18% (in 1997) to 29% (in 2000) of all respondents associated the label with environmental quality (i.e. gave the correct description of the meaning or otherwise positively associated the label with better environmental performance). A small share of respondents wrongly associated the label with positive private characteristics (quality or health), while a large share simple were unable to articulate the meaning of the label.

Table 2.2 about here

In 2000 most of the respondents who could explain the meaning of the Swan label expressed confidence to the label (63%), while only 5% did not trust it. In the 1997 survey 69% of the respondents found it important that labels are controlled by independent agency (in a Danish context this would include a government agency).[11]

The two comparative surveys carried out in the Nordic Countries in May/June 1998 and September 2000 by MMI for Nordisk Miljømærkningsnævn used a different design. In these surveys respondents were simply shown the Swan label and asked to explain its meaning. These studies suggest a considerably better understanding of the label. Thus, in Denmark the share of correct or partly correct explanations were at least 47% and 54% in 1998 and 2000.[12]

3. Model for brand choice

We take as a starting point the Lancaster consumer good model (Lancaster, 1966), in which a given consumer good is endowed with a vector of attributes (for toilet paper e.g. softness, strength, Swan label etc.) and brands of the good are distinguished by containing these attributes in different proportions. Mixing of different brands in consumption may be possible for some goods (e.g. spices, paint, etc) however, in the case of paper towels, toilet paper and compact detergents this does not seem a reasonable assumption. Rather consumers will typically have to choose to use one or the other brand so that only pure brands are members of the consumption possibility set. For such goods households will typically only consume one brand at a time[13].

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[11] More recent surveys suggests that the recognition/understanding of the label have increased during 2001 apparently as a results of a large promotion campaign for the Swan. However, this campaign began after the period covered by the applied data.

[12] The comparative Nordic surveys also showed that the understanding of the Swan label is considerably higher in Sweden and Norway (where the Swan label also have been utilised for a longer period of time).

[13] It is possible that different production processes using e.g. paper towels (e.g. in the kitchen and in the garage) may result in parallel consumption of two or more brands. However, purchases of more than one brand on a given shopping trip are uncommon

In this paper we use a multi-nominal model to estimate consumer brand choice with the aim of deriving household willingness to pay for (the utility value of) one specific good attribute; i.e. Swan label. The multi-nominal model is based on the assumption that the utility value of each attribute is constant across purchasing situations in the data period. This model is typically applied to the analyses of lumpy consumer goods (such as cars, houses, recreational sites etc) where the quantity of the consumed good is given and the consumer's problem therefore reduces to choosing which of the available brands to consume. The constant good quantity ensures that the consumed quantity of each attribute, and therefore its utility value, does not vary across purchasing situations.

For divisible goods it is not obvious that the multi-nominal model of brand choice is valid since the consumers not only decide which brand to consume but also the quantity to consume. If the quantity consumed varies across consumption periods in the data so will the consumed quantity of any given attribute and therefore also its marginal and total utility value[14]. However, when the divisible good in question is storable (as is the case here) a utility foundation that allows application of the multi-nominal set up can be developed.

3.1 Utility foundation for applying a model of brand choice to storable goods

Let U denote household utility per unit of time, which is assumed to depend on sub-utility derived from consuming the good in question (denoted V) and sub-utility of consuming other goods, which for simplicity is set equal to the part of income allocated to other goods i.e.

$$U = U(V, Y - q_j p_j) \qquad (1)$$

Where q_j is the quantity consumed of the good in question, p_j is the per unit price (the index j indicates that brand j of the good is consumed) and Y is total household income, so that income allocated to other goods becomes $Y - p_j q_j$. We further assume that good sub-utility is linear in the consumed good attributes i.e.:

$$V(q_j, X_j) = q_j b X_j$$

where X_j is the vector of per unit attributes of the consumed brand and b is the vector of parameters of the linear sub-utility of good attributes function.

Since V is linear in q_j we may normalize with respect to V-sub-utility which is an advantage in the following. Defining c_j as the per sub-utility unit cost of consuming brand

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in the data, which suggest that parallel consumption is uncommon.

[14] Under the standard assumption of decreasing marginal utility the utility derived from consuming any given attribute of the marginal unit will vary with the quantity consumed.

j (so that $c_j=p_j/(bX_j)$) equation (1) may be written:

$$U= U(V,Y- v_j c_j) \tag{1a}$$

The goods in question are not perishable and can easily be stored, so that consumers typically will buy goods for stock, taking advantage of sales and special offers while consuming from stock based on their expectation of the quality and price faced when stocks are replenished. Thus, the household is faced with two distinct (although linked) problems in the short run: the problem of *consuming* out of stocks and the problem of *purchasing* to replenish stocks. The fact that consumption and purchases may deviate substantially in the short run and that it is rational to base consumption decisions on the expected cost of replenishing stocks would make consumption modelling a challenge. As it turns out, developing a model of consumption from stocks is not necessary for our purposes – in fact it is sufficient to model household brand choice in the purchasing situation.

When the decision to consume out of stocks is made the actual purchasing costs are sunk. Taking outset in the normalized utility equation (1a) the consumption decision is based on the cost per sub-utility unit V expected when replenishing stocks. Letting c^e denote this expected cost, the optimal quantity of good sub-utility to consume (denoted V^*) is set according to the first order condition derived from (1a) i.e. so that:

$$U_V - U_Y c^e = 0$$

Thus, when optimal consumption is implemented we have that marginal utilities $U_V^* = U_V(V^*(c^e),Y- c^e V^*(c^e))$ and $U_Y^* = U_Y(V^*(c^e),Y- c^e V^*(c^e))$ only depend on the expected replenishing cost (trivially if brand j is consumed the optimal quantity to consume is $q_j^* = V^*(c^e)/(bX_j)$).

The key assumption we make here is that the *expected* replenishing cost per sub-utility unit (c^e) is constant over the estimation period[15]. If this assumption holds, then U_V^* and U_Y^* will be constant across different purchasing situations, which, as we shall see below, allows us to discover willingness to pay for attributes through a multi-nominal model of brand choice. Though restrictive, the assumption is consistent with the substantial week to week variation in prices (e.g. if households base their expectation of replenishing cost on some mean over experienced purchasing prices, this mean may be fairly stable even though week to week price variation is substantial).

When the household is faced with a purchasing opportunity it must choose which brand to purchase, if any, as well as the quantity (Q) to purchase. In the purchasing situation good attributes should be evaluated at their marginal utility value in consump-

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[15]The assumption implies that although the purchased brand and price may vary between purchasing situations the mean price per sub-utility unit that the consumer expects to pay in the future does not change over the data period.

tion, as should costs. The marginal effect on consumption utility of purchasing a unit of brand j is the marginal utility value in consumption of the purchased attributes of j net of the marginal utility of the reduction in consumption of other goods needed to finance the purchase. Taking outset in the original formulation of the utility equation (1) and letting MU_j denote marginal per good unit consumption utility of brand j we have:

$$MU_j = U_V^* \, bX_j - U_Y^* \, p_j \tag{2}$$

where U_V^* and U_Y^* will be constant across purchasing situations given the assumed constancy of expected replenishing costs. The optimal quantity to purchase in the given purchasing situation is restricted by the utility costs of transporting goods home, storing them, etc. Letting U_j denote the total utility effect of purchasing Q_j units of brand j we have:

$$U_j = MU_j Q_j - C(Q_j)$$

where $C(.)$ denotes the purchase specific utility costs which are assumed to be increasing and convex. Let Q_j^* denote the optimal purchase volume given that brand j is purchased. Q_j^* is set to satisfy the corresponding first order condition:

$$\frac{dU_j}{dQ_j} = MU_j - C_Q(Q_j) = 0$$

Although the $C(.)$ function typically varies from purchasing situation to purchasing situation[16] the utility cost function can reasonably be assumed identical across brands for the given purchasing situation.

   Let us now consider the choice of brand. In a given purchasing situation the household will prefer brand h over brand j when

$$MU_h Q_h^* - C(Q_h^*) > MU_j Q_j^* - C(Q_j^*)$$

i.e. when utility of buying the optimal quantity of brand h (given that brand h is chosen) is greater than utility of buying the optimal quantity of brand j (given that brand j is chosen).[17] By the first order condition this is satisfied if, and only if, marginal utility of

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[16]The purchase specific utility costs would typically depend on distance to the shop and on whether the buyer is transporting purchases on foot, with a bike, on a bus, or in a car.

[17]Note that purchasing more than one brand in a given shopping situation (for example brand h and brand j) can not be optimal when MU's differ across brands and the purchase specific utility costs $c(Q_h+Q_j)$ are a convex function of the purchased quantity. Thus, any mixed brand choices will alwais be dominated by a pure brand choice and can be disregarded.

consuming brand h is greater than marginal utility of consuming brand j i.e.:

$$MU_h > MU_j$$

This expression is independent of purchase specific costs $C(.)$ and given the assumption of constant expected replenishing price (ensuring that U_Y^* and U_Y^* are constant) MU-values do not vary between purchase situations. Adding random components e_h and e_j to capture the effect of unobservable variables the probability of choosing brand h over brand j in any given purchase situation is:

$$P_h = Prob(MU_h - MU_j > e_j - e_h) \quad for \ all \ j \neq h$$

This relationship is straightforward to estimate within the standard multi-nominal setup.

3.2 The statistical model

The statistical foundation of multi-nominal choice modelling derives from McFadden (1974). For a more detailed general description see Ben-Akiva and Lerman (1985) or Bennett and Blamey (2001).

Traditionally multi-nominal conditional choice models have been used in studies of travel demand and marketing research (examples of the latter includes Guadagni and Little (1983) and Fry and Longmire (1996)), but more recently they have also been increasingly used in environmental economics (e.g. Blamey et al. 2000 and Hanley et al, 1998).

The model to be estimated depends on the assumptions concerning the distribution of the e_j. An assumption of independent Extreme Value distributions leads to the multi-nominal logit model (MNLM), while an assumption of multivariate normality leads to a multinomial probit model (MNPM). A property of the MNLM is the assumption of independence of irrelevant alternatives (IIA). This property states that the ratio of the probability of choosing one brand rather than another does not depend upon the characteristics, or existence, of any other brands in the choice set. A direct consequence of this is that the cross-elasticities of price are constrained to be equal. The MNPM does not suffer from the restriction of the IIA property, but when there are many alternatives to choose between (and a large data set) the MNPM is computationally burdensome (and often infeasible). We therefore choose to use the MNLM.[18]

In the MNLM the probability that a household will choose brand h is given by[19]:

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[18] However, it is worth noting that Fry and Longmire (1996) found support for the IIA property using data similar to the ones used in this study.

[19] As it is usually done, the (suppressed) scale parameter is assumed to be equal to one.

$$P_h = \frac{exp[MU_h]}{\sum\limits_{j} exp[MU_j]} \tag{3}$$

As defined in equation (2) marginal consumption utility of brand j is a linear function of observed brand attributes X_j and price. In addition we also include a brand dummy and let MU_j be a linear function of household specific characteristics i.e.:

$$MU_j = \alpha_j ASC_j + \beta_1 X_{j1} + \beta_2 X_{j2} + \ldots\ldots\ldots + \beta_k p_j + \\ \gamma_{1j}(S_1 \times ASC_j) + \gamma_{2j}(S_2 \times ASC_j) + \ldots\ldots\ldots + \gamma_{mj}(S_m \times ASC_j) \tag{4}$$

where $_j = U_V^* b_j$ and $_k = -U_Y^*$ and the S_i are household specific characteristics, while ASC_j are alternative specific (brand) dummy variables. In this study the observed good attributes include a Swan variable (dummy), price, on sale (as a special offer) and advertising. The brand specific constants ($_j$) capture the effect of unobserved/unmeasurable factors on the utility of each brand (for identification one of these is restricted to be zero). Thus, the $_j$ control for differences in quality, brand reputation, special appealing packaging, etc. (to the extend that these are constant in the period analysed).

Household specific variables do not vary across the alternatives and would therefore not be identified if the individual variables were to enter in the same way as the brand attributes. A common way to include individual specific variables is to let them interact with the ASC dummies as shown in equation (4). Hence, to include a household specific variable like income, an income effect for each brand is estimated.[20]

The model's main advantage is that, even though the complex decision problems of household consumption and purchased quantity are not modelled, the parameters that are identified suffice for calculating willingness to pay for the Swan label attribute at the consumption margin - which is the focus of attention here. Since marginal WTP by definition is the income reduction needed to ensure constant utility, when an attribute is added to the marginal good, the WTP for attribute i is given by:

$$[U_V^* b_i] - [U_Y^*] WTP_i = 0 \\ \Leftrightarrow$$

so that $WTP_i = [U_V^* b_i]/[U_Y^*]$ which by (4) is estimated by $-\beta_i/\beta_k$ i.e. :

$$WTP_i = -\frac{\beta_i}{\beta_k} \tag{5}$$

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[20]Individual specific variables may also (or instead) be interacted with the attributes of the choice. E.g. one could investigate if the swan label have different effect depending on income, age, educational level etc.

4. Data

4.1 Data sources

Data on weekly purchase of toilet paper, paper towels and detergents were obtained from GfK Denmark for the period 1 January 1997 to 31 January 2001. These data are shopping diary data for wide sample of Danish households (an average of 1596 diaries are returned weekly). Socioeconomic information on the households are collected in a survey annually by GfK.

In order to simplify the modelling task we focus on the market for typical package sizes (in Denmark), which is respectively 6-10 rolls of toilet paper, and 3-4 rolls of paper towels. These package sizes cover about 85-90% of all observations and 70-80% of all rolls sold.[21] For detergents we focus on the highly concentrated powdered detergents, which are known as "compact" detergents on the Danish market. The compact detergents account for more than half of all the packages sold. Liquid detergents and powder with low concentration are omitted, but it is only compact brands of detergents that have obtained the Swan label.

Brands are recorded at a very detailed level by GfK (at bar code level). In a number of cases very small changes in the product may result in a change in brand code at the most detailed level. Thus, some types of decorated paper towels modify the decoration in special seasons (e.g. Christmas motifs in December). To reduce the number of choices we have 'aggregated' into a smaller, but still fairly detailed number of brands. Altogether, we obtain 32 different brands of toilet paper, 26 different brands of paper towels and 15 different brands of (compact) detergents[22] (the last brand numbers being 'other brands'). Note that some of these brands were not available over the whole time period as new brands have emerged while others have been removed from the market. Some brands are sold in a variety of stores, while others are only available in one chain of supermarkets ('house-brands'). A list of the brands along with some descriptive statistics can be found in appendix 1. Likewise, the different stores and supermarket chains in the data set have been aggregated into 12 different shop categories which have similar pricing policies and the same selection of brands. These "shops" are also listed in appendix 1. A number of the shops are discount chains, which tend to have fixed low prices and a smaller selection of different brands available. These are shop no. 5 (Fakta), shop no. 7 (Netto), shop no. 8 (Aldi) and shop no. 12 (other discount supermarkets). It should be noted that shop no. 11

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[21]Over time the market share of these package sizes have been fairly stable. In addition there are also Swan labels available on larger packages of toilet paper (e.g. 12-16 rolls) and paper towels. Therefore it seems unlikely that the omission of non-typical package sizes will bias the estimated effects of the Swan label.

[22] In the definition of brands we have not distinguished between 'color' (specially made for dyed clothes) and 'regular' (containing more bleach and mainly used for white clothes) varieties of the same brand.

('other non-discount stores') contains a large group of fairly heterogenous supermarkets.

In order to remove potential errors in the data we have deleted a small share of observations with unlikely and rare combinations of brands and shops. Finally, we have not included purchases of the households taking place at gasoline stations, small kiosks, etc.

Altogether this leaves 45,796 purchases of toilet paper, 28,198 purchases of paper towels and 16,738 purchases of detergents in the final data set covering a period of 213 weeks.

An index for the weekly marketing effort in Danish television, newspapers and a number of weekly magazines was kindly made available by the Danish Gallup Adfacts. Basically this index is based on the 'standard price' of placing commercials in a certain media (e.g. buy a time slot in prime time). No effort has been made to judge between the quality of the placed advertisements (or the cost of the advertising agency to produce the commercial).

Information about which brands have qualified to use the Swan label (and when they qualified) were obtained from Ecolabelling Denmark (i.e. the Danish labelling authority). As supporting evidence 'field trips' in shops were carried out. Producers and/or sales organisations were also contacted in order find what week each labelled brand actually was available on the shelves with the label. As it turned out there were some differences between the time the label was officially awarded and the date a brand was available to consumers with the label (for example because old stocks without the label were being cleared).[23]

Altogether 13 of the 32 different brands of toilet paper and 9 of the 26 brands of paper towels have obtained the label in the period analysed. For detergents only 3 of the defined brands have been labelled.[24] In most cases the labelled brands have also been available without the label, but in two cases (both for toilet paper and paper towels) the brand was introduced to the market with the Swan label on. In these cases the alternative specific constant is confounded with the label dummies, so these brands do not add to the identification of the effect of the Swan. For detergents all 3 brands were available on the market also before they were labelled, but for two of the brands there are a rather limited number of observations with the label, either because the brand has a very low overall

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[23] In 1997 some brands used the Swan label based on licenses obtained in other Nordic countries (as Ecolabelling Denmark was just being established and therefore did not award licenses). However, a list of all goods sold on the Danish market with the Swan label in 1997 was available from 'The Green Informationcenter' (Grøn Information). This information, combined with the responses of producers (or sales organisations), made it possible to obtain a thorough description of the availability of labelled brands in the beginning of the period being analysed.

[24] Another detergent brand (Naturligvis) was introduced to the market with the label in June 2000 (i.e. no observations before label), but there are only very few observations in the data of this brand, and it has therefore been included in the heterogeneous group of "other detergents". It should also be noted that an additional number of the detergent brands have obtained an environmental label since January 2001, but this is outside the period covered by the data.

share of the market (Tusindfryd) or because the brand was labelled very late in the period analysed (Neutral). Thus, these two brands will only give a limited contribution to the empirical identification of an effect of the label on the choice of detergents. The effect of the Swan label on detergents will therefore be tied closely to only one brand (Blue-care), which was labelled primo 1998 and has been sold as a house brand only in shops 1-3.

The number of observations and the share of observations with the Swan label are given in table 4.1. Evidently, there has been a large increase of the share of labelled observations, which largely reflects that an increasing number of the available brands having obtained the Swan label. Focus here is on choice of brand not of the number of packages or rolls sold in each choice situation. Hence, the shares of observations do not necessarily corresponds to the market share of the labelled goods, because each 'observation' describes the choice of brand, not the number of packages sold (nor package size). Thus, an observation could correspond to more than one package (when sold on sale this is often the case).[25]

Table 4.1 about here

4.2 Choices and variables in the model

Before estimating the model it is necessary to consider the choices relevant to the individual household. It seems unlikely that each household actually bases its choice of brand of the respective products on a careful inspection of the attributes of all the different brands available on the Danish market, because it would require a great deal of time to collect such information. In addition some brands will not be available to all individuals because of geographical restrictions in supply.

It appears to be closer to the actual choice situation to assume that consumers chose between the smaller number of brands available in the shop in which purchases were actually made. This can be done by estimating separate choice models for transactions taking place in different shops[26]. However, conditioning on each shop makes it impossible to reflect the fact that some individuals may change shops when a brand sold in another shop changes its attribute vector. In particular some (committed) respondents may choose to take their business to another shop if this allows them to obtain a Swan labelled brand. A choice model with all brands available to consumers may be able to capture such behaviour.[27] Therefore separate choice models will be estimated, where the consumers are

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[25]For some purposes the distinction between choice and number of rolls sold is important (e.g. with respect to understanding the effect of promotion activities on sales), but it seems unlikely that this would be the case for the effect of the Swan.

[26]The assumption that the (utility) cost of transportation and storing are equal across brands (see section 3.1) is also likely to be violated when all brands are included in the choice set (as different subset of brands are sold in different shops).

[27]In principle it would be preferable to capture this effect by estimating a joint model for choice of shop and choice of brand. However, we do not have detailed geographical information on the location of shops and individuals, so central information to

respectively allowed to choose between all available brands in the market and to choose only among the brands available in the shop where the purchases were actually made. The latter will be carried out by estimating separate models conditioning on each shop. For detergents conditional estimation will only be carried out for shop 1-3 as there are very few – and in many cases none – observations with labels in the other shops).

For any consumer the only price (P) recorded in the data is that of the purchased brand. To obtain the price for each of the other brands in the choice set we use average price for all purchases of each brand within the same week.[28] Prices are measured as price per roll or per standard wash for each brand. For some of the less frequently sold brands there are weeks with zero purchases. In these cases we rely on the monthly mean of the 'standard' price (i.e. not including on-sale prices). Inspections of average weekly prices in the same shop, suggest that these are fairly stable on a week to week basis (when the brand is not on sale). A variable for "on-sale" (ONS) was calculated in a similar way for each brand (If a brand was not purchased in a week it was assumed that it was not on sale.)

The marketing variable is denoted ADV[29], while the label (dummy) variable is called SWAN. In the estimations for paper towels a variable named CTEST is included. This variable is included to capture the effect of a consumer test reported in the danish consumer magazine *(Tænk + Test no 5. 2000)*. Most paper towels in this test obtained the same score. But one brand obtained a higher overall score than the majority, while another obtained a lower score. CTEST takes the value 1 and -1 for these two brands (respectively brand 3 and brand 5) after the consumer magazine was published. The base case is all other brands (including also brands not tested in the consumer report).

In 1999 a consumer test was also carried out on compact detergents *(Råd & Resultater no. 10. 1999)*. Results of what appeared to be a thorough washing test as well as the environmental performance of the different compact brands were described in the test. As expected the two brands that carried the Swan in 1999 (Bluecare and Tusindfryd) got a top score in environmental performance together with one other brand (Ren 2000).[30]

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choice of shop (like travel cost) are not available.

[28] In the choice model conditioning on the shops we use average price based on observations in the respective shops. In the choice model including all brands it is all observations in the week for the particular brand (across all shops).

[29] In the models presented we use marketing effort for the week in which purchase was actually taken place. We have experimented with other formulations of this variable, which allow for a gradual decrease over time in the effect of the marketing effort, but this did not (qualitatively) change the results.

[30] Actually a fourth brand also had a top score in environmental performance (Ecover), while it got the lowest score in the washing test. However, as there are only few observations with this brand it is included among the 'other compact detergents'. Likewise, one brand (Ren 2000), which is also included in the group of other compact detergents, also obtained a top score in the washing test. Finally, it should be noted that the test was only carried out for 'color' variants of the different brands of

Two of the largest brands on the market (Arial and Omo) were pointed out as having a 'bad' environmental performance. A variable denoted CTESTENV takes the value 1 and -1 for the brands that scored high and low on environmental performance. More surprisingly, the washing tests also gave a top score to the two Swan labelled brands (Bluecare and Tusindfryd), while one brand (Neutral) obtained a low score. The variable CTEST (for washing test) takes the value 1 and -1 for these 3 brands.

The consumer test report for compact detergents obtained a lot of press. Bluecare and Tusindfryd were pointed to as "winners". Besides emphasising that the most environmentally friendly brands on the market were the best at cleaning dirty clothes it was also noted that the price of these brands were relatively low. Ariel and Omo were described as the losers of the test. In addition to having the worst environmental performance it was emphasised that they were expensive without washing better than the most environmentally friendly brands (despite the fact that they actually were in the runner up group in the laundry test). As a way to control for the publicity effect of the consumer report a dummy variable for good publicity (CGODPUB) takes the value 1 for Bluecare and Tusindfryd), while another dummy variable (CBADPUB) takes the value 1 for Ariel and Omo. To control for the effects of the consumer report alternative regressions will be carried out including respectively CTESTENV and CTEST (to control for the *results* of the consumer test) and CGODPUB and CBADPUB (focussing on the *publicity* effect of the consumer report).

Basically we would like to control for all factors that over time influence the sale of different brands of the products analysed. Most supermarket chains distribute weekly sales flyers stressing the special offers in the week. It is a widely held view of actors on the Danish market that these sales flyers have a large influence on (at least some) consumers' behaviour. Systematic information on the exposure of the different brands in these sales flyers was not available, but the exposure of brands in the sales flyers is very likely to be correlated with the on-sale variable[31]

When conditioning on shops we also control for 'overall' changes in supply strategy of each shop, as we can observe when a certain shop chain no longer sells a particular brand (To be more precise we observe if none of the respondents purchases a brand from the shop.) However, a number of other supply decisions of the shop managers – such as the choice of more or less favourable locations in the stores – are not controlled for in the model.

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detergents (used mainly for dyed clothes). However, we are inclined to ques that consumers – in absence of similar information on non color variants – projected the results of the test on the color variants to the non-color variants of the respective brands. (A similar type of test focussing on non-color compact detergents was published in September 2001, but this was after the period covered by the data.)

[31] Part of the marketing literature has devoted attention to the empirical problems associated with assessing the effect of coupons. It is therefore worth noting that coupons are only very rarely used in the Danish market.

5. Estimation results

We start by presenting results when all brands are included in the choice set. Even though this formulation of the choice of the consumer can be criticised it allows us to present results based on all the data in a compact way.[32]

In all presented estimations alternative specific constants (ASC) are included in order to control for unobserved brand quality. Income and age are also included in the models (interacted with the ASC). The motivation for the inclusion of age is to control for generation effects in preferences for different brands.[33] For presentational ease the estimated parameters to these variables are not included in the tables.

5.1 All brands included in choice set

Consider first the estimates of the parameters in model 1 for toilet paper, paper towels and detergents as shown in table 5.1a. As expected, the estimated parameter capturing the effect of P is negative, while the corresponding parameter to the on sale variable (ONS) is positive. The estimated parameter on media marketing (ADV) is significant for all goods, but the sign is opposite to the expected one for toilet paper.

The estimate of the SWAN parameter is positive and significant for all goods (though for paper towels the parameter, at 0.082, is significant only at the 5 % level). For detergents the size of the estimated parameter on SWAN depends on the way the results of the consumer test is controlled for in the model. Thus, when results of the consumer test are not reflected in the model a high estimated parameter of 0.954 is obtained. When the results of the consumer test are controlled for by including the variables CTEST and CTESTENV the estimated parameter to SWAN is reduced to 0.581. If alternatively the two variables for the publicity effect of the consumer test are included in the model the estimated parameter is further reduced to 0.238 (though it is still significantly different from zero at the 1% level).[34] It is difficult to know whether the increases in the purchases of Bluecare and Tusindfryd after the release of the consumer report derived from the good results in the washing test, the emphasis of the relative low price of the two brands, or the

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[32] Estimation is carried out using LIMDEP

[33] Other socioeconomic variables such as education, children, household size and male buyer have also been experimented with. Income and age generally perform well (yield small but generally significant increases in the goodness of fit of the model), though other socioeconomic variables also could have been included. But as one parameter for each combination of brand and socioeconomic variable is estimated, it is not feasible to include all the available socioeconomic variables. However, inclusion of different individual specific variables has little effect on the estimates of the parameters to the attribute variables.

[34] As an additional way to control for the impact of the consumer test estimations for choice of detergent have only been carried out based only on observations before the release of the test. Also in this case a positive parameter to SWAN is estimated (though it is only significant at a 10% level).

emphasis on the two brands being Swan labelled (and testing as environmentally friendly). In the last presented model, were the publicity effect of the consumer test is controlled for, the increase in the sale of Bluecare and Tusindfryd after the consumer report was released is effectively 'dummied out' of the model. This suggest that the estimated effect of the Swan label in this model probably is a lower bound for the effect of the environmental label.

The significantly negative estimated parameter to CBADPUB confirms previous findings from Cairncross (1992) that sales drop for products earning a reputation as environmentally unfriendly. It is also worth noting that the variable for the effect of the consumer test report on paper towels was insignificant. However, this test was not given the same attention in the media as the test for detergents.[35]

Changes in P are highly correlated with the ONS variable. The variable ONS was intended to account for the promotional effects of a sale, beyond the price changes associated with a special offer. These include extra exposure in sales flyers and better location in the store during the week of promotion. In model 2 (for toiler paper, paper towels and detergents respectively) ONS have been excluded as an explanatory variable. This has a large impact on the estimated price parameter, which increases in absolute value by a factor of 4 (toilet paper), 3 (paper towels) and 2 (detergents). Thus, it appears that ONS also captures the effect of the price changes. As is normal with highly correlated variables, this is open for interpretation.

Table 5.1.a about here

For toilet paper and detergents the effect of the Swan label is very similar in model 1 (e.g. 0.312 for toilet paper) and model 2 (0.382 for toilet paper). Hence, the inclusion/omission of ONS does not seem to be important for an evaluation of the effect of the Swan label as its effect on utility is fairly stable. However, when we later use the equations to estimate willingness to pay (WTP) for the Swan attribute the change in the parameter on P by a factor 2 to 4 yields a similar change in WTP. So the inclusion/omission of ONS is by no means trivial. We will return to a description of the WTP after having looked at results from alternative model formulations and the results obtained when estimation is carried out conditioning on each shop.

5.1.1 Alternative specification of the effect of the Swan
Surveys to consumers carried out between 1997 and 2000 suggest that the proportion of Danish consumers recognising/understanding the Swan label has increased since Denmark joined the Swan label scheme. One would therefore expect the effect of the Swan label to

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[35] The results of the test of detergents was reported in all major Danish papers, while the results for the paper towels only appeared to be reported in a few local papers.

be lower in the beginning of the time period analysed.[36] In order to take this effect into account the SWAN dummy has been multiplied by the share of the general population understanding the label at a certain point in time (UND). UND is measured by the share of respondents that was able to give a correct (or partly correct) explanation of the meaning of the label. Point estimates of UND are 0.18 in Oct. 1997, 0.19 in Oct 1999 and 0.29 in Oct 2000 . See section 2.3. These point estimates was used to calculate UND using linear interpolation. Results when using SWAN×UND interaction are shown in table 5.1b.

Table 5.1.b about here

Comparing table 5.1.a and 5.1.b, it appears that the qualitative results in general are similar and that the pseudo R^2's are almost identical. This is also the case when estimation is carried out conditioning on shops (not shown). Therefore, we choose to continue with the simple formulation of the SWAN dummy, because this model is more straightforward to interpret.

In model 2 in table 5.1.b (without ONS) for paper towels the estimated parameter to SWAN×UND is significant, while the estimated parameter to SWAN was insignificant in the corresponding model in table 5.1.a. For detergents the opposite results are obtained (SWAN significant in table 5.1.a, while SWAN×UND is insignificant in the publicity effect versions of model 1 and 2). The results for detergents suggests that the effect of the Swan label is sensitive to model formulation, which probably reflects that there are relatively few brands of detergent that have obtained the label (and that the sales of these also have been influenced by other types of information provision).

In addition, it also appeared in section 2.3 that survey results for recognition/understanding of the Swan label are very sensitive to the formulation of the question. Other surveys using a different formulation of the questions indicate a considerable higher level of understanding.

5.2. Result when choice set is conditioned on shop
Results of choice models when conditioning on shop are presented in table 5.2 (toilet paper), table 5.3 (paper towels) and table 5.4 (detergents). There are large variations across shops in the number of brands sold. It ranges from just one brand of paper towels in shop 8 (since there is no brand choice no estimates are presented for shop 8 for paper towels) to 17 different brands of toilet paper in shop 11 (the heterogeneous group of 'other non discount shops'). Consequently there are also differences in the number of ASC included in the model and the interaction terms with income and age. The brands sold in each shop can be seen in table A1.4 in appendix 1.

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[36] See Teisl et al. (2001) for further discussion on this issue and for an example of an alternative way to include another indicator of the 'label information diffusion process' in an econometric model.

Table 5.2, 5.3 and 5.4 about here

It appears that the estimates of the parameters on P and ONS generally are significant and have the expected signs. In table 5.2, with ONS included, there are 3 cases of positive estimated coefficients on P (shops 2, 7 and 9), and in table 5.3 there are 2 cases (shops 5 and 7). In 3 of the 5 cases overall, the sign changes to negative when ONS is removed (bottom part of each table). In one of the two remaining cases, the size of the positive coefficient is reduced and becomes statistically insignificant. One refractory case remains – Shop 7 in table 5.2 (toilet paper). Both shops for which the price parameter sign does not go negative are discount stores with 'fixed low prices' and consequently small price variations over time.

The SWAN dummy parameters generally have the expected positive sign, but with a higher share of significant (positive) signs for toilet paper and detergents than for paper towels. Hence, when looking at toilet paper in models 1 (where ONS is included) there is a positive sign on the coefficient of the SWAN dummy in all of the 12 different shops. In 7 cases the estimated parameter to the SWAN dummy is also significant (5 % level). For detergents (model 1 with ONS included) there is a positive parameter in two of the 3 shops (conditional estimation only carried out in shop 1-3, where there is a reasonable number of observations with the label). In one of the two cases the estimated parameter to the SWAN was also significant. For paper towels (also in model 1) there is a positive sign in 8 of 11 shops, but the coefficient is only significant in 2 cases.

The estimated parameter on ADV is generally insignificant, with a mix of negative and positive sign for different shops. Thus, the counter intuitive results for ADV for toilet paper obtained in the model where all brands could be chosen (table 5.1.a) does not seem to hold when conditioning on shop. Nevertheless, it is a bit surprising that marketing effort does not seem to have a positive effect on choice probability. However, the marketing effort index is incomplete as it does not include marketing in weekly sales flyers of the different supermarket chains. These are used widely in the Danish market and goods like toilet paper, paper towels and detergents often feature in them. In addition there is anecdotal evidence that some of the larger television campaigns for toilet paper and paper towels have not been effective.

Finally, the estimated parameters to the indicators of results of the consumer reports confirm the results given in table 5.1.a. The consumer report on detergents had a significant impact on the choice of toilet paper in shop 1 and 3, resulting in drop of market shares for brands obtaining bad environmental results, while the likelihood of choosing brands doing well in the laundry tests increased. In shop 2 similar results were obtained, though the estimated parameters on the consumer report variables not always were significant. The consumer report on paper towels did not seem to have a significant effect (presumably because the result of the test were not given a lot of media attention and/or because most brands obtained the same score in the particular test)

Summarising, we generally obtain the expected effect of price and special offers on the choice of brand. In addition it appeared that the Swan label had a significant

influence on the choice of toilet paper, detergents and – to a lesser extent – on the choice of paper towels. The effect on the choice of detergents appear to be sensitive to formulation of the model. An interpretation of the parameters on the price and the label variables are offered below.

5.3 Interpretation of results: Price elasticity, WTP and model simulation
Based on the estimates of the parameter on P own- and cross elasticities of (probability of) brand choice can be calculated for each alternative in the choice set. Given the large number of different models estimated and the large number of brands analysed it is not feasible to present all own and cross elasticities. In table 5.5 the means of the own price elasticities are presented based on the estimated parameters presented in table 5.1.a, 5.2, 5.3 and 5.4. When ONS is included (model 1) choice of brand is price inelastic, as most of the mean own price elasticities are below unity. When ONS is omitted (model 2) choice is price elastic as most elasticities are around or above unity.

Table 5.5 around here

It is reasonable that different brands of toilet paper, paper towels or detergents (located next to each other in the same shop) should be close substitutes, and that the price elasticities of choice should be minus one or larger. Hence, model 2 seems to us to imply the most plausible results with respect to the price effects.

In the linear utility model applied here an 'implicit price' or marginal WTP for a certified environmentally friendly brand may be obtained by (equation 5) dividing the estimated parameter on SWAN by the parameter on P (see also. Hanley et al. (1998) and Bennett and Blamey (2001)). The WTP estimates for the Swan label is presented in table 5.6

Table 5.6 about here

Looking first at the WTP for toilet paper these are generally 2-3 times higher in model 1 than in model 2. This difference is largely related to the change in the estimated parameter on P between the two models. As price elasticities appear more reasonable in model 2 focus will be on WTP from this model. Seven of 13 of these WTP estimates are significant in the sense that underlying parameters are significant (at a 1 % level). The WTP ranges from 10.0% to 17.5% of price. The only exception is for shop 5 where a very high WTP of 82.4 % was obtained. Comparison of the estimated parameters in table 5.2. suggests that the high WTP for shop 5 derives from an 'out of bounds' estimated parameter on SWAN.[37]

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[37] It is not clear why the out of bounds parameter for shop 5 (Netto) was obtained. However, it should be noted that there were other examples of implausible parameter estimates for the low price 'discount' shops. E.g. positive price elasticities obtained

Note that the estimates of WTP are obtained for shops, which sell different brands of labelled toilet paper and that these brands started being labelled at different points in time. In this light the range of the estimated WTP from 10.0% to 17.5% reveals a high consistency in the effect of the Swan label on preferences for toilet paper.

It has already been noted that there are fewer significant estimated parameters to the SWAN dummy for paper towels and consequently the WTP results are not as clear. However, it seems that WTP is generally lower for paper towels than for toilet paper. Looking, finally, at the WTP for detergents the smaller number of results conditional on shops makes it difficult to make a strong comparison with the WTP obtained for the other product groups. A significant (5 % level) WTP is obtained for shop 1 (model 1 with ONS), while a significant negative WTP is obtained for shop 3 (model 2). However, in the model with all brands in the choice set (utilising all data) a significant WTP at 21.9% is obtained in model 1 (including ONS), while an also significant WTP at 11.9% is obtained in model 2 (without ONS). Focussing on results in the models including all brands in the choice set, it appears that the WTP for detergents are closer to the results obtained for toilet paper as compared to the lower WTP obtained for paper towels. As previously discussed the results of the Swan for detergents is sensitive to the way that the results of a consumer test is controlled for in the model. The WTP described here derives from the 'publicity effects' model, which gave the most conservative estimate for the effect of the Swan.

The estimated marginal WTP has a short run/partial adjustment interpretation since parameters assume unchanged household expectations of the sub-utility unit cost (c^e) and thus unchanged consumption propensity. If Swan labelling causes producer price increases that capture the entire utility value of the label the mean sub-utility unit cost experienced after the Swan labels does not change. In this case the estimated short run WTP may be equal to long run marginal WTP, as consumers do not have any reason to revise expectations.[38] However, if producers do not capture the entire utility value through price increases, mean cost per sub-utility unit will fall after label introduction. If consumers revise expectations accordingly, marginal WTP (after expectation adjustment) will be smaller than the value estimated here.

The interpretation of the estimated parameter on the Swan variable may also be illustrated by model simulation showing the impact of the Swan on the choices probabilities of one or several brands. Results of such a simulation is shown in table 5.7, where the

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in shop 5 (Netto) and shop 7 (Fakta). These two shops typically have only one or two (no name) brands of toilet paper/kitchen rolls, which are always supplied. For limited time periods the core (house) brands are supplemented with different 'name' brands, presumably when the discount shops are able to obtain a large quantity of these goods at a low price. Potentially, the choice models (and/or the data generation of choices) were not able to capture the fluctuations in supply of brands for some of the discount shops.

[38]Formally, the rise in bX_j is neutralised by the rise in mean p_j (ensuring that $c_j = p_j/bX_j$ does not change), and so rationalizing unchanged expected costs c^e.

overall effect of the Swan label on the choice of Swan labelled brands is illustrated for the second part of 2000.

Table 5.7 about here

The first row in table 5.7 shows the actual share of observations of labelled brands[39], while the second shows the share predicted by the model. The third row shows the predicted share of the labelled brands without the label effect. This has been calculated by setting the SWAN variable to value 0 also for the labelled brands (while holding the level of all other attributes constant). The share of observations in this row can be interpreted as the share of the environmentally friendly brands (in the sense that they qualify for the Swan label) in the absence of a certified label that signal this attribute to the consumer. Results show that the share of the environmentally friendly brands of toilet paper would drop by 6-7%, while the share of environmentally friendly brands of detergents would drop by 4%. The predicted reduction in the share of environmentally friendly paper towels is lower (1-2% reduction), primary explained by the substantial lower WTP for labelling here.

5.5 Summary of results

It appears that there is a significant positive willingness to pay for the certified environmental label for toilet paper and detergents ranging from 10-17% of price. Results for toilet paper appear very solid as rather similar estimates of willingness to pay can be found when estimation is carried out on different labelled brands (being labelled at different points in time) purchased in different shops. Results for detergents derive from only a few labelled brands and results are therefore more sensitive to the formulation of the model – specifically the way the results of a high profile consumer report is controlled for in the model. In some cases it also appeared that the Swan label had a significant effect on consumers' choice of paper towel brand, but in most cases no significant effect could be found for this products.

Initially, the differences in the results for toilet paper and paper towels may appear surprising as these two paper products in many aspects are very similar. But, closer examination reveals that toilet paper and detergents are purchased by practically all households, whereas paper towels are purchased frequently by a smaller fraction of households. The smaller number of observations for paper towels, combined with the lower number of labelled brands, does also (other things equal) suggest that it will be more difficult to identify an effect of the Swan on choice of paper towels. However beyond that, it seems likely that households frequently using paper towels are likely to be on average less environmentally concerned than households not using paper towels. That is, there are reusable substitutes for them in most applications such as the dishcloth still

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[39]Note the share of observations may deviate from the actual market share of the labelled goods , because each 'observation' describes the choice of brand, not the number of packages sold (nor package size).

24

used widely in Denmark. The need to wipe up spills is probably constant across households, but the choice set for method is broader than just brands of paper towels. The "green" consumers may well be choosing to use a reusable alternative rather than *any* brand of paper towels.

6. Socioeconomic characteristics and effect of the Swan

In the MNLM estimated so far, socioeconomic variables have been included in the model as interaction terms with the ASC dummy variables. Socioeconomic variables may also be included in the model by interacting them with the other brand attributes like the SWAN. This makes it possible to see whether the labelling has a stronger effect on households with certain characteristics. Since we are trying to identify effects of the Swan for sub-groups of the households these estimations will be carried out for models where all choices are included in the choice set (i.e. where all observations are included). In addition the ONS variable will be included as we focus on the qualitative differences between households with different characteristics.

Socioeconomic variables were selected based on results from simple logit regressions (not shown) where the endogenous binary variable was choice of a labelled versus unlabelled brand.

To ease interpretation, simple dummy variables of the socioeconomic characteristics have been used. Hence, INCH indicate high income, EDUH high level of education and AGEH high age (dividing the sample in two groups of roughly similar size for each characteristics). The presence of children in the household is indicated with the variable KIDS while MANB indicate that the person on the recorded shopping trip was a male as opposed to a female or both adults shopping together (only 8-10% of the observations). Regressions, where these socioeconomic variables are interacted with the SWAN variable, are reported in table 6.1 (carried out for all observations).

Table 6.1 about here

The SWAN variable is included in the regression as the 'base' case, which corresponds to the effect of the Swan for a low income, low education, low age household without children, where a female was participating in the shopping trip. For other types of households the relevant estimated parameters of the socioeconomic interaction terms need to be added. As an example the estimated parameter on the SWAN (relating to the base household) for toilet paper is 0.335. If the household instead has a high income (other characteristics being the same) the effect of the Swan is higher (0.335 + 0.330 = 0.665).

It is interesting to note that there is no consistency in the effect of the Swan for respondents with high income and high education. Hence, for toilet paper high income tends to increase the effect of the swan, but the opposite result is found for detergents, while the parameter on SWAN×INCH is insignificant for paper towels. Results are most consistent for children and male buyers. Thus, in all 3 cases it appears that households

with children were *less* likely to be influenced by the Swan (though the negative parameter is only significant in two of the three cases). Results also suggest that males shopping (on their own) are less likely to be influenced by the Swan (significant negative parameter obtained in two of the three cases, while an insignificant positive parameter is found in the third case).

One might have expected that households with children would be more likely to be influenced by the Swan, as parents might consider an environmentally friendly brand also to be heathier for their children. It seems likely that this effect will be stronger for detergents than for the paper products. It is therefore worth noting that the parameter to SWAN×KIDS is significantly negative for toilet paper and paper towels, but insignificant for detergents. It should also be noted that surveys carried out on the recognition and understanding of the Swan (see section 2.3) show that very few respondents wrongly associated the label with more healthy products. Another label indicating low asthma and allergy risk can also be found on a large number of products (including different brands of detergents), so parents concerned with health effects were likely to respond to this label instead[40].

The opposite results obtained for the effect of income on the effect of the Swan appear to correspond with results by Teisl et al. (1999). Based on a hypothetical study of choice of electricity supplier the level of income did not significantly influence the effect of the label (green electricity).

Summarising, it appeared that the effect of the certified label was lower for males and households with children in choice of toilet paper and paper towels. In a number of cases the effect of the label also varied with levels of income and education, but the directions were not consistent across different products groups.

A number of surveys describe the characteristics of consumers (frequently) purchasing labelled goods (environmental or other) as opposed to consumers newer or rarely purchasing labelled goods. It is worthwhile to emphasise that results from such studies should be interpreted carefully, as the label in question may be correlated with other attributes of the labelled brands. To give an example result from simple binary logit models (not shown) focussing on the choice of Swan labelled versus unlabelled brands of paper towels resulted in a highly significant positive parameter on income, which one might be tempted to interpret as a causal relationship. However, the brands of paper towels carrying the Swan label are (on average) more expensive then the unlabelled (suggesting they have higher quality). When brand quality is controlled for (as it is done with the ASC in table 5.7) the parameter on high income is insignificant (for paper towels). This suggest that households with high income purchased the Swan labelled products because they had higher quality, not because they were carrying the Swan label.

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[40] The effect of the asthma and allergy label is not identified in the study. However, most brand with this label have carried it for the whole time period analysed (or as long as they have been in the market). Therefore the effect of the asthma and allergi label is controlled for in the study by the brand constants (ASC).

A similar results apply with respect to the age profile of the households. The share of labelled brands of paper towels and toilet paper tend to increase with the age of the household. However, results in table 5.7 show that after controlling for brand quality, the Swan label did not have a significant additional effect on the choice of brand. Hence, high age households DO tend to choose brands that are labelled, but this can NOT be attributed to the label.

7. Conclusion

Product labelling has become a popular tool of government agencies as a way to allow consumers to express their environmental preferences through the market. But there is still limited empirical evidence on whether consumers actually use the labels in their purchase decisions. In this paper we have estimated models for consumers' choices among different brands of toilet paper, paper towels and detergents in order to trace effects of the Nordic certified environmental label on consumers preferences. In the period covered by the data a number brands obtained the label at different points in time and the data includes information of purchases before and after the brands were labelled, which allows us to control for (unobserved) differences in the qualities of the different brands. In addition this same fact (that brands have obtained labels at different points in time) makes it unlikely that the identified effect of the label is confounded with unaccounted trends over time in the respective markets. Models with different numbers of brands in the choice set have been estimated as a rough way to describe alternative decision structures of the individual.

It appears that the environmental label has had a significant effect on the choice of toilet paper and detergents. Results are strongest for toilet paper, where willingness to pay for certified environmental friendly brands ranges from 10% to 17% of price for a number of different shops, which sell different labelled brands (being labelled at different time periods). A willingness to pay of similar size was obtained for detergents, but results are more sensitive to model specification, as fewer brands of detergents have obtained the Swan label in the time period analysed. In addition the effect of the Swan is partly confounded with a consumer report, which had a large impact on the Danish market. The model for detergents also confirms that a bad environmental reputation (obtained from the consumer report) can result in a substantial drop in sale.

For paper towels a significant effect of the Swan label could not generally be identified, but when identified the effect was lower as compared with toilet paper and detergents. The most reasonable interpretation of this discrepancy is that green consumers in Denmark choose to avoid using paper towels and instead rely more on a dishcloth to wipe up spills etc.

As (Danish) consumers are willing to act on an environmental label even though this does not yield any direct benefit to the users it also indicates the presence of altruistic motives of some kind. It seems that a number of conditions conductive to the success of environmental labels are to be found in Denmark. Most prominently, there is a great confidence in the government (which certify the label), environmental issues receive

substantial attention in the media, and there appears to be wide acceptance of a policy of pursuing relatively ambitious environmental goals. So it is an important but unanswered question whether the positive effect of the environmental Swan label found in the Danish market will also be found in other countries, especially those outside the Nordic group.

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Tables and appendix to:

Title: Environmental labelling and consumers' choice - An empirical analysis of the effect of the Nordic Swan.
By Thomas Bue Bjørner, Clifford S. Russell and Lars Gårn Hansen

Table 2.1 Empirical studies on the effect of environmental labels and product characteristics

Reference	Method/data	Market	Type of label or environmental characteristic	Did label have an effect ?
Henion (1972)	Real market experiment in 4 stores	Detergents	Content of phosphate	Yes
Teisl et al. (2001)	Real market behavior using aggregate monthly time series data (using an 'almost ideal demand system' specification).	Canned seafood and substitute meat products	Dolphin safe label	Yes
Blamey and Bennett (2001) Bennett et al (2001)	Real market behavior in discrete choice models (also combined with stated preference data)	Toilet paper	Unbleached Recycled	No Yes
Nimon and Beghin (1999)	Hedonic regression using catalog prices	Apparels	Environmental friendly dyes Organic cotton[1]	No Yes
Roe et al (2001) Teisl et al (1999)	Hypothetical market (validated with hedonic regression based on electricity prices)	Electricity	Certified green electricity	Yes

1) See earlier discussion on the interpretation of the organic label.

Table 2.2 Recognition and understanding of the Swan label in Denmark

	Oct. 1997 (AC Niel-sen AIM)	Oct. 1999 (Gallup)	Oct.2000 (Gallup)	Maj 1998 MMI (Den-mark only)	Sept. 2000 MMI (Denmark only).
Recognising the Swan-label	29%	52%	56%	na	na
Explanation of the Swan-label as share of respondents recognising the label and *share of the whole sample*					
Correct explanation	33% *10%*	30% *16%*	45% *26%*	47% **38%**[4]	66% **46%**[4]
Partly correct (Other environmental issue[1])	26% *8%*	6% *3%*	6% *3%*	11% **9%**[4]	11% **8%**[4]
Product quality or health	3% *1%*	11% *6%*	4% *2%*	1% *1%*[4]	3% *3%*[4]
'Other' explanations[2]	30% *7%*	17% *9%*	11% *6%*	8% *8%*[4]	6% *6%*[4]
Don't know	31% *9%*	35% *19%*	34% *19%*	44% *44%*[4]	37% *37%*[4]
SUM	123%[3] 35%	100% 52%	100% 56%	112%[3] 100%[4]	123%[3] 100%[4]

Notes: 1) E.g. respondents indicating 'recyclable/recycled', 'Organic' or 'Private' environmental label. 2) In 1997 'other' explanations mainly consist of respondents indicating that the Swan was a general Nordic sign of approval. In 1999 and 2000 'other' is a category for 'other explanation' the interviewer has ticked. 3) Responses aggregates to more than 100%, which reflect that the respondents was allowed to give more than one explanation. 4) To ease comparison with results from Gallup, it is assumed that all multiple explanations was related to correct or partly correct explanation of the Swan label (thus it is a lower bound for the share of the population that were able to explain the meaning of the Swan label.)

Table 4.1 Share of observations with label

	1997	1998	1999	2000	Jan 2001	All
Toiletpaper						
- N Observations	10756	11330	11593	11045	1072	45796
- % with label	**4%**	**13%**	**23%**	**29%**	**35%**	18%
Kitchen tissue						
- N Observations	6854	7141	6921	6620	662	28198
- % with label	**15%**	**21%**	**25%**	**26%**	**28%**	22%
Detergents						
- N Observations	3918	4508	4050	3802	460	16738
- % with label	**0%**	**4%**	**9%**	**24%**	**25%**	**9%**

Table 5.1.a MNLM for Toilet paper, Paper towels and Detergents (all brands in choice set)

Using SWAN dummy as explanotory variable for Swan effect

	Toilet paper						Paper towels					
	Model 1			Model 2			Model 1			Model 2		
	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value
P	-0.250	-10.41	0.00	-0.911	-48.79	0.00	-0.186	-10.45	0.00	-0.544	-38.87	0.00
ONS	1.035	41.39	0.00				0.957	30.74	0.00			
SWAN	0.312	12.98	0.00	0.382	15.90	0.00	0.082	1.99	0.04	0.032	0.78	0.42
ADV	-0.969	-4.19	0.00	-0.898	-3.89	0.00	0.414	2.49	0.01	0.226	1.34	0.18
CTEST							-0.009	-0.14	0.88	-0.032	-0.48	0.63
N	45796			45796			28198			28198		
Log L	-137879			-138705			-77467			-77933		
Pseudo R^2	0.1313			0.1261			0.1568			0.1517		

	Detergents (without results of consumer report)						Detergents (with consumer report)						Detergents (Publicity effect of consumer report)					
	Model 1			Model 2			Model 1			Model 2			Model 1			Model 2		
	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value
P	-0.626	-12.507	0.000	-1.277	-33.635	0.000	-0.731	-14.118	0.000	-1.326	-34.284	0.000	-0.682	-13.171	0.000	-1.288	-33.197	0.000
ONS	0.784	20.045	0.000				0.701	17.342	0.000				0.720	17.754	0.000			
SWAN	0.954	13.894	0.000	0.974	14.267	0.000	0.581	6.917	0.000	0.575	6.858	0.000	0.238	2.797	0.005	0.245	2.884	0.004
ADV	0.230	3.990	0.000	0.248	4.294	0.000	0.205	3.491	0.000	0.217	3.697	0.000	0.143	2.424	0.015	0.154	2.614	0.009
CTEST							0.752	13.936	0.000	0.749	13.963	0.000						
CTESTENV							0.403	14.164	0.000	0.450	15.887	0.000						
CGODPUB													1.469	23.201	0.000	1.484	23.476	0.000
CBADPUB													-0.590	-13.970	0.000	-0.645	-15.286	0.000
N	16738			16738			16738			16738			16738			16738		
Log L	-38429.0			-38628.1			-38045.3			-38194.5			-37912.9			-38069.4		
Pseudo R^2	0.15219			0.14780			0.16065			0.15736			0.16358			0.16012		

Note: Parameters to ASC, ASC* income and ASC*age estimated but not shown in table

Table 5.1.b MNLM for Toilet paper, Paper towels and Detergents (all brands in choice set)

Using SWAN×UND as explanatory variable for effect of Swan label

	Toilet paper						Paper towels					
	Model 1			Model 2			Model 1			Model 2		
	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value
P	-0.257	-10.74	0.00	-0.919	-49.12	0.00	-0.189	-10.64	0.00	-0.546	-40.11	0.00
ONS	1.032	41.26	0.00				0.954	30.70	0.00			
SWAN*UND	1.460	14.32	0.00	1.764	17.39	0.00	0.485	2.81	0.01	0.508	2.96	0.00
ADV	-0.912	-3.95	0.00	-0.832	3.61	0.00	0.442	2.65	0.01	0.268	1.59	0.11
CTEST							-0.014	-0.22	0.88	-0.039	-0.59	0.56
N	45796			45796			28198			28198		
Log L	-137855			-138682			-77465			-77930		
Pseudo R^2	0.1314			0.1262			0.1568			0.1518		

	Detergents (without results of consumer report)						Detergents (with consumer report)						Detergents (Publicity effect of consumer report)					
	Model 1			Model 2			Model 1			Model 2			Model 1			Model 2		
	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value
P	-0.608	-12.108	0.000	-1.245	-32.697	0.000	-0.717	-13.833	0.000	-1.312	-33.813	0.000	-0.681	-13.149	0.000	-1.287	-33.151	0.000
ONS	0.772	19.623	0.000				0.701	17.334	0.000				0.721	17.749	0.000			
SWAN	5.334	20.111	0.000	5.495	20.778	0.000	2.556	7.622	0.000	2.535	7.579	0.000	0.370	0.986	0.324	0.476	1.281	0.200
ADV	0.191	3.307	0.001	0.207	3.592	0.000	0.200	3.421	0.001	0.213	3.636	0.000	0.149	2.526	0.012	0.159	2.706	0.007
CTEST							0.664	11.847	0.000	0.663	11.923	0.000						
CTESTENV							0.389	13.557	0.000	0.436	15.241	0.000						
CGODPUB													1.496	20.042	0.000	1.500	20.244	0.000
CBADPUB													-0.592	-14.009	0.000	-0.646	-15.315	0.000
N	16738			16738			16738			16738			16738			16738		
Log L	-38326.6			-38517.4			-38042.2			-38191.1			-37916.4			-38072.8		
Pseudo R^2	0.15445			0.15024			0.16072			0.15744			0.16350			0.16005		

Note: Parameters to ASC, ASC* income and ASC*age estimated but not shown in table

Table 5.2 MNLM for Toilet paper when conditioning on brands in shop (table continued on next page)

Including ONS in Models (model 1)

	Shop 1		Shop 2		Shop 3		Shop 4		Shop 5		Shop 6		Shop 7		Shop 8	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
P	-0.306	0.000	0.211	0.203	-0.328	0.000	-0.292	0.078	-1.006	0.002	-0.462	0.000	1.008	0.000	-0.746	0.001
ONS	1.280	0.000	1.454	0.000	1.250	0.000	1.265	0.000	0.729	0.003	1.278	0.000	0.908	0.000	0.295	0.548
SWAN	0.118	0.2089	0.532	0.031	0.280	0.006	0.238	0.329	2.805	0.000	0.375	0.000	1.398	0.178	0.065	0.465
ADV	-1.721	0.139	-0.650	0.826	-1.509	0.110	1.041	0.795	5.443	0.000	1.333	0.004	-9.451	0.000		
N	4747		1236		3352		666		2556		6784		7603		2565	
log L	-6488.1		-1198.7		-4925.4		-508.5		-1171.2		-13358.9		-6821.0		-1730.0	
Pseudo R2	0.37795		0.53363		0.3313		0.57388		0.66946		0.20754		0.59169		0.02694	

Not including ONS in Models (model 2)

	Shop 1		Shop 2		Shop 3		Shop 4		Shop 5		Shop 6		Shop 7		Shop 8	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
P	-1.102	0.000	-0.838	0.000	-1.203	0.000	-1.033	0.000	-1.234	0.001	-1.249	0.000	0.886	0.000	-0.740	0.003
ONS																
SWAN	0.002	0.979	0.328	0.184	0.332	0.001	0.297	0.213	2.795	0.000	0.574	0.000	0.879	0.396	0.066	0.448
ADV	-2.079	-0.059	0.222	0.984	-2.537	0.006	2.271	0.562	6.084	0.000	1.233	0.007	-9.524	0.000		
N	4747		1236		3352		666		2556		6784		7603		2565	
log L	-6653.3		-1234.8		-5064.2		-523.2		-1175.4		-13701.8		-6840.7		-1730.2	
Pseudo R2	0.36211		0.51958		0.31232		0.56152		0.66827		0.18720		0.59051		0.02684	

Note: Parameters to ASC, ASC* income and ASC*age estimated but not shown in table.

Table 5.2 (continued)

Including ONS in Models (model 1)

	Shop 9		Shop 10		Shop 11		Shop 12	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
P	0.056	0.649	-0.359	0.011	-0.253	0.000	-0.392	0.000
ONS	1.831	0.000	2.093	0.000	0.784	0.000	0.550	0.000
SWAN	0.345	0.036	0.491	0.004	0.236	0.000	0.166	0.399
ADV	-1.653	0.114	-0.337	0.797	-0.621	0.120	0.235	0.819
N	2071		1546		9681		2262	
log L	-1450.0		-1422.4		-21493.0		-3448.2	
Pseudo R2	0.64019		0.61630		0.21639		0.36428	

Not including ONS in Models (model 2)

	Shop 9		Shop 10		Shop 11		Shop 12	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
P	-1.245	0.000	-1.827	0.000	-0.755	0.000	-0.634	0.000
ONS								
SWAN	0.599	0.000	0.758	0.000	0.335	0.000	0.255	0.195
ADV	-4.111	0.383	0.994	0.450	-0.503	0.209	-0.027	0.979
N	2071		1546		9681		2262	
log L	-1552.9		-1574.4		-21647.3		-3463.6	
Pseudo R2	0.61466		0.57531		0.21077		0.36144	

Table 5.3 MNLM for Paper towels when conditioning on brands in shop (table continued on next page)

Including ONS in models (model 1)

	Shop 1		Shop 2		Shop 3		Shop 4		Shop 5		Shop 6		Shop 7	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
P	-0.268	0.000	-0.208	0.095	-0.086	0.149	-0.104	0.537	0.228	0.062	-0.350	0.000	0.192	0.001
ONS	1.253	0.000	1.122	0.000	1.364	0.00	1.659	0.000	1.599	0.000	1.324	0.000	1.945	0.000
SWAN	0.142	0.329	0.528	0.221	0.234	0.097	-0.374	0.396	0.777	0.340	-0.202	0.083	2.321	0.025
ADV	-1.105	0.160	5.892	0.179	-1.873	0.021	-59.950	0.635	12.588	0.000	0.578	0.099	2.540	0.000
CTEST	-0.124	0.291	-0.211	0.602	0.049	0.720			1.858	0.078	-2.000	0.052		
N	3192		789		1949		172		1257		4130		4318	
Log L	-3591.1		-617.6		-2638.6		-134.9		-445.4		-7724.4		-2562.8	
Pseudo R^2	0.51140		0.62358		0.38384		0.51265		0.77986		0.24733		0.66875	

Not including ONS in models (model 2)

	Shop 1		Shop 2		Shop 3		Shop 4		Shop 5		Shop 6		Shop 7	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
P	-0.818	0.00	-0.700	0.000	-0.636	0.000	-0.526	0.000	0.115	0.367	-0.838	0.000	-0.082	0.107
ONS														
SWAN	0.030	0.829	0.342	0.426	0.285	0.041	-0.786	0.848	0.817	0.138	-0.191	0.099	0.925	0.368
ADV	-1.534	0.055	5.841	0.175	-1.297	0.110	-43.667	0.679	14.043	0.000	0.519	0.135	2.731	0.000
CTEST	-0.203	0.088	-0.596	0.129	0.052	0.707			2.036	0.053	-1.743	0.090		
N	3192		789		1949		172		1257		4130		4318	
Log L	-3676.7		-629.7		-2711.4		-145.5		-461.8		-8043.4		-2618.8	
Pseudo R^2	0.49976		0.61622		0.36686		0.47400		0.77175		0.21625		0.66152	

Note: Parameters to ASC, ASC* income and ASC*age estimated but not shown in table. Shop 8 not included as there is only one brand of paper towels recorded in the trimmed data set. For shop 5 a large proportion of the purchase observations (47%) are not included for the same reasons.

Table 5.3 (continued)

Including ONS in models (model 1)

	Shop 9		Shop 10		Shop 11		Shop 12	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
P	-0.196	0.046	-0.218	0.009	-0.131	0.000	-0.114	0.092
ONS	1.402	0.000	1.820	0.000	0.811	0.000	0.975	0.000
SWAN	0.111	0.639	-0.127	0.635	0.177	0.010	0.005	0.988
ADV	-1.206	0.188	0.400	0.729	-0.260	0.412	0.143	0.852
CTEST	0.359	0.407			0.131	0.444	-0.510	0.123
N	939		994		6084		1539	
Log L	-632.2		-915.5		-1256 6.6		-2261 .5	
Pseudo R2	0.58167		0.58085		0.19471		0.33122	

Not including ONS in models (model 2)

	Shop 9		Shop 10		Shop 11		Shop 12	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
P	-0.763	0.000	-0.979	0.000	-0.405	0.00	-0.372	0.000
ONS								
SWAN	0.175	0.453	-0.167	0.542	0.079	0.26	0.060	0.863
ADV	-2.381	0.085	0.354	0.748	-0.436	0.18	-0.270	0.727
CTEST	0.784	0.057			0.115	0.53	-0.491	0.137
N	939		994		6084		1539	
Log L	-664.8		-998.3		-1269 2.9		-2293 .8	
Pseudo R2	0.56013		0.54292		0.18662		0.32168	

Table 5.4 MNLM for Detergents when conditioning on brands in shop[1]

CONSUMER REPORTS RESULTS						PUBLICITY EFFECT OF CONSUMER REPORT					
Including ONS in Models (model 1)						Including ONS in Models (model 1)					
	Shop 1		Shop 2		Shop 3			Shop 1		Shop 2		Shop 3	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value		Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
P	-0.890	0.000	-0.266	0.307	-0.321	0.003	P	-0.918	0.000	-0.263	0.314	-0.347	0.001
ONS	1.366	0.000	1.346	0.000	1.595	0.000	ONS	1.363	0.000	1.347	0.000	1.576	0.000
SWAN	0.400	0.014	0.129	0.719	-0.203	0.265	SWAN	0.389	0.016	0.129	0.720	-0.213	0.242
ADV	-0.234	0.903	0.634	0.104	0.290	0.091	ADV	-0.063	0.743	0.617	0.117	0.261	0.129
CTEST	0.362	0.038	0.719	0.087	1.527	0.000	CGODPUB	1.034	0.000	0.813	0.011	1.782	0.000
CTESTENV	0.761	0.000	0.114	0.651	0.331	0.004	CBADPUB	-0.983	0.000	-0.185	0.567	-0.503	0.000
N	2934		616		2405		N	2934		616		2405	
log L	-4286.9		-792.0		-3691.3		log L	-4280.5		-792.0		-3688.0	
Pseudo R2	0.33503		0.41481		0.33342		Pseudo R2	0.33603		0.41486		0.33402	
Not including ONS in Models (model 2)						Not including ONS in Models (model 2)					
	Shop 1		Shop 2		Shop 3			Shop 1		Shop 2		Shop 3	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value		Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
P	-2.454	0.000	-1.731	0.000	-1.853	0.000	P	-2.490	0.000	-1.731	0.000	-1.870	0.000
ONS							ONS						
SWAN	0.288	0.064	-0.185	0.958	-0.339	0.053	SWAN	0.276	0.077	-0.019	0.956	-0.357	0.042
ADV	-0.502	0.790	0.606	0.958	0.544	0.002	ADV	-0.097	0.615	0.593	0.125	0.489	0.005
CTEST	0.356	0.038	0.859	0.114	0.961	0.000	CGODPUB	1.159	0.000	0.940	0.003	1.493	0.000
CTESTENV	0.894	0.000	0.097	0.039	0.672	0.000	CBADPUB	-1.136	0.000	-0.152	0.637	-0.975	0.000
N	2934		616		2405		N	2934		616		2405	
log L	-4452.4		-816.4		-3889.9		log L	-4445.1		-816.4		-3879.5	
Pseudo R2	0.30935		0.39682		0.29757		Pseudo R2	0.31048		0.39685		0.29944	

Note: Parameters to ASC, ASC* income and ASC*age estimated but not shown in table. 1) Only for shop 1-3 (very few observation with label for shop 5-12 and relatively few observations overall for shop 4).

Table 5.5 Mean Own Price Choice Elasticities

Shop	Toilet Paper		Paper Towels		Detergents[1]	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
1	**-0.57**	**-2.13**	**-0.62**	**-1.81**	**-1.11**	**-3.02**
2	0.29	**-1.06**	-0.41	**-1.39**	-0.20	**-1.39**
3	**-0.65**	**-2.16**	-0.22	**-1.62**	**-0.33**	**-1.71**
4	-0.43	**-1.45**	-0.21	**-1.07**		
5	**-0.79**	**-0.96**	0.37	0.18		
6	**-0.72**	**-1.94**	**-1.18**	**-2.80**		
7	0.80	0.69	0.42	-0.18		
8	**-0.69**	**-0.68**				
9	0.07	**-1.61**	**-0.41**	**-1.52**		
10	**-0.33**	**-1.89**	**-0.42**	**-1.93**		
11	**-0.28**	**-0.84**	**-0.28**	**-0.86**		
12	**-0.48**	**-0.78**	**-0.29**	**-0.95**		
Not conditioning on shop	**-0.49**	**-1.79**	**-0.65**	**-1.89**	**-0.90**	**-2.56**

Derived from parameters presented in table 5.2 and 5.3 (elasticities by shop) and table 5.1.a (not conditioning on shop). **Bold** indicate that the elasticity is calculated based on a parameter to P significant at a 5 % level. 1) For detergents the elasticities derives from the model with the 'publicity effects' of the consumer test (elasticities very similar in model with consumer test variables instead)

Table 5.6 Willingness to pay for label

Shop	TOILET PAPER Model 1 (incl. on-sale) WTP (DK per roll)	% of Price	Model 2 (excl. on-sale) WTP (DK per roll)	% of Price	PAPER TOWELS Model 1 (incl. on-sale) WTP (DK per roll)	% of Price	Model 2 (excl. on-sale) WTP (DK per roll)	% of Price	DETERGENTS[2] Model 1 (incl. on-sale) WTP (DK per wash)	% of Price	Model 2 (excl. on-sale) WTP (DK per roll)	% of Price
1	0.39	14.0 %	0.00	0.1%	0.53	10.7%	0.04	0.7%	**0.42**	**26.3%**	0.11	6.9%
2	-2.52[1]	-91.7%[1]	0.39	14.2%	2.54	51.4%	0.49	9.9%	0.49	30.6%	-0.01	-0.7%
3	**0.85**	**31.0%**	**0.28***	**10.0***%	2.77	55.1%	**0.45**	**9.1%**	-0.61	-38.1%	**-0.19**	**-11.9%**
4	0.82	29.6%	0.29	10.5%	-3.60	-72.8%	-1.49	-30.2%				
5	**2.79***	**101.4***%	**2.26***	**82.4***%	-3.41[1]	-69.0%[1]	-7.10[1]	-143.8%[1]				
6	**0.81***	**29.5***%	**0.46***	**16.7***%	-0.58	-11.7%	-0.23	-4.6%				
7	-1.39[1]	-50.4%[1]	-0.99[1]	-36.1%[1]	-12.09[1]	-244.7%[1]	11.28	228.3%				
8	0.09	3.2%	0.09	3.3%								
9	-6.16[1]	-224.0%[1]	**0.48***	**17.5***%	0.57	11.5%	0.23	4.6%				
10	**1.37***	**49.7***%	**0.41***	**15.1***%	-0.58	-11.8%	-0.17	-3.5%				
11	**0.93***	**33.9***%	**0.44***	**16.1***%	**1.35**	**27.4%**	0.20	3.9%				
12	0.42	15.4%	0.40	14.6%	0.04	0.9%	0.16	3.3%				
Not conditionining on shop (all N)	**1.25***	**45.4***%	**0.42***	**15.2***%	**0.44**	**8.9%**	0.05	1.2%	**0.35***	**21.9***%	**0.19***	**11.9***%

Derived from parameters presented in table 5.2, 5.3, 5.4 (by shop) and table 5.1.a (not conditioning on shop). **Bold** indicate that calculated WTP is based on parameters significant at a 5 % level. A star (*) indicate that the WTP is also significant at a 1 % level (significance levels for WTP were calculated using the Delta Method).

1: the high negative WTP derives from a positive parameter on price.

2: from regression with CGODPUB and CBADPUB included as explanatory variables.

Table 5.7 The overall effect of the Swan label on brand choice

Prediction/simulation of share of observations of labelled brands in July-Dec 2000.

	Toilet paper		Paper towels		Detergents[1]	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Actual share of observations with label in July-Dec 2000	31.3%		27.4%		25.4%	
Predicted share of labelled brands	29.6%	29.3%	26.5%	25.5%	28.4%	28.0%
Predicted share of labelled brands without label	23.7%	22.2%	24.9%	24.8%	24.2%	23.6%
Predicted effect of labelling on share of currently labelled brands	5.9%	7.1%	1.6%	0.6%	4.2%	4.4%

Derived from parameters presented in table 5.1.a (all brands in choice set)

1) For detergents from the model with the 'publicity effects' of the consumer test.

Table 6.1 Socioeconomic characteristics and effect of Swan

	Toiletpapir			Paper towels			Detergents		
	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value	Coeff.	t-ratio	P-value
P	-0.247	-10.296	0.000	-0.188	-10.539	0.000	-0.683	-13.193	0.000
ONS	1.037	41.507	0.000	0.957	30.724	0.000	0.719	17.725	0.000
SWAN	0.335	8.109	0.000	0.232	3.577	0.000	0.341	2.691	0.007
SWAN×INCH	0.330	11.326	0.000	-0.009	-0.183	0.855	-0.299	-2.904	0.004
SWAN×EDUH	-0.081	-2.886	0.004	0.036	1.103	0.270	0.548	9.271	0.000
SWAN×AGEH	-0.004	-0.111	0.911	-0.044	-0.852	0.394	-0.269	-2.812	0.005
SWAN×KIDS	-0.298	-9.511	0.000	-0.294	-8.043	0.000	-0.035	-0.521	0.603
SWAN×MANB	-0.294	-5.978	0.000	-0.325	-6.128	0.000	0.159	1.531	0.126
ADV	-0.989	-4.282	0.000	0.409	2.464	0.014	0.144	2.437	0.015
CTEST				-0.012	-0.186	0.853			
CGODPUB							1.458	22.893	0.000
CBADPUB							-0.591	-13.983	0.000
N	45796			28198			16738		
LogL	-138098			-77416			-37859		
Peudo R2	0.12991			0.15735			0.16477		

Note: Parameters to ASC, ASC* income and ASC*age estimated but not shown in table (for toilet paper ASC*income are not included in the above regression due to a limit of 100 estimated parameters in LIMDEP).

Appendix 1.

Table A1.1 Brands of toilet paper and descriptive statistics

Brand No.	Brand Name (definition)	N	Price[1]		Onsale	
		Obs	Mean	Std	Mean	Std
1	Lambi	2697	3.20	0.32	0.49	0.21
2	Edet	2169	2.71	0.33	0.47	0.24
3	Lotus (soft/royal)	2093	2.63	0.38	0.59	0.24
4	Artex (Aldi)	1338	1.45	0.17	0.02	0.07
5	Solo (Aldi)	1227	2.43	0.11	0.01	0.05
6	Bluecare	946	3.13	0.35	0.31	0.36
7	Spar (Dagrofa)	633	1.73	0.19	0.40	0.35
8	Nemli (Dagrofa)	444	1.74	0.11	0.18	0.24
9	Edet Natur	454	1.54	0.33	0.74	0.32
10	Vivette	351	1.62	0.28	0.56	0.42
11	Lotus comfort plus	305	2.98	0.11	0.06	0.12
12	Serla Maximeter	221	2.88	0.41	0.33	0.30
13	Tusindfryd	100	3.10	0.42	0.29	0.44
14	8 No name (Dansk Supermarked)	4801	1.51	0.12	0.03	0.04
15	8 ruller (FDB)	4536	1.60	0.19	0.35	0.30
16	Dinky soft	2826	1.67	0.06	0.03	0.05
17	Ny	2574	1.62	0.07	0.16	0.12
18	Elegance	2201	2.54	0.15	0.10	0.13
19	Hvid tapir	2198	1.41	0.21	0.79	0.24
20	Kleenex (Premium/Quiltet/Servus)	1711	3.23	0.29	0.38	0.24
21	Super (Vibclean)	1470	1.49	0.24	0.57	0.41
22	Luksus (Dansk Supermarked)	1127	1.75	0.23	0.10	0.15
23	Maxi toilet (FDB)	1052	3.09	0.30	0.20	0.30
24	Ida	909	1.27	0.19	0.82	0.29
25	Daily soft	912	3.33	0.48	0.39	0.36
26	Svane soft	710	1.32	0.20	0.54	0.34
27	Uniline	744	1.49	0.05	0.15	0.10
28	Luxus compact (Dansk Superm.)	760	3.22	0.33	0.19	0.30
29	Grøn Linie	649	1.98	0.19	0.27	0.33
30	Lotus silkeblød	463	2.60	0.35	0.62	0.26
31	Med Striber (Irma)	439	3.97	0.75	0.54	0.44
32	Other brands	2736	1.95	0.46	0.38	0.22
	All obs	**45796**	**2.10**	**0.74**	**0.31**	**0.33**
	Without Swan	37751	1.96	0.69	0.29	0.33
	With Swan	8045	2.75	0.57	0.43	0.30

Note: Brand 1 to 13 labeled in (part of) 1997 to January 2001

1) Price per roll.

Table A1.2 Brands of paper towels and descriptive statistics

Brand No.	Brand Name/Definition	N	Price[1]		Onsale	
		(obs)	Mean	Std	Mean	Std
1	Lotus	2756	5.19	0.69	0.43	0.23
2	Lambi	2071	4.75	0.53	0.52	0.22
3	Edet (Ultra/Whip&Clean)	1030	4.46	0.54	0.48	0.24
4	Nemli	732	3.43	0.28	0.40	0.28
5	Bluecare	477	6.21	0.75	0.32	0.40
6	Vivette	221	3.13	0.61	0.57	0.41
7	Edet Natur Kitchen	146	2.92	0.64	0.88	0.27
8	Serla Maximeter	119	5.59	0.85	0.44	0.34
9	Tusindfryd	62	5.90	0.97	0.35	0.46
10	4 No name (Dansk Supermarked)	3800	3.16	0.11	0.02	0.03
11	4 ruller (FDB)	3305	3.13	0.31	0.31	0.29
12	Super	2294	3.17	0.22	0.24	0.22
13	Dinky	2201	3.17	0.10	0.03	0.05
14	Hvid tapir	1429	2.83	0.46	0.80	0.25
15	4 No name (Aldi)	1288	3.17	0.13	0.04	0.07
16	Kleenex (Premium/Quiltet)	812	4.74	0.62	0.52	0.32
17	Daily	787	5.10	0.62	0.33	0.33
18	Ida	683	2.58	0.37	0.82	0.28
19	Bamse	622	3.21	0.17	0.17	0.23
20	Uniline	456	3.10	0.12	0.21	0.14
21	Svane soft	415	2.76	0.42	0.49	0.36
22	Grøn Linie	406	3.73	0.37	0.31	0.37
23	Maxi Køkken (FDB)	331	6.14	0.82	0.29	0.37
24	3 Compact (Dansk Supermarked)	290	6.24	0.71	0.29	0.36
25	Dash	234	2.60	0.38	0.84	0.28
26	Other brands	1231	3.64	0.62	0.37	0.25
	All obs	**28198**	**3.75**	**1.05**	**0.32**	**0.33**
	Without Swan	21920	3.41	0.84	0.28	0.33
	With Swan	6278	4.94	0.84	0.47	0.26

Note: Brand 1 to 9 labeled in (part of) 1997 to January 2001

1) Price per roll.

Table A1.3 Brands of detergents[1] and descriptive statistics

Brand No.	Brand Name/Definition[2]	N	Price[3]		Onsale	
		(Obs)	Mean	Std	Mean	Std
1	Bluecare	1575	1.60	0.15	0.51	0.34
2	Neutral	637	2.09	0.38	0.52	0.36
3	Tusindfryd	110	1.31	0.27	0.65	0.45
4	Ariel	3175	1.66	0.19	0.60	0.19
5	Biotex	2668	1.45	0.14	0.60	0.20
6	Omo	2132	2.22	0.28	0.54	0.22
7	Dynamo	1644	1.42	0.21	0.53	0.25
8	Jelp	1265	0.81	0.16	0.31	0.28
9	Cleani	671	1.09	0.22	0.25	0.37
10	Netop	516	1.21	0.08	0.05	0.17
11	Cyclon	498	0.92	0.34	0.86	0.27
12	Mini-risk	421	1.77	0.33	0.54	0.40
13	Proff	266	1.00	0.07	0.02	0.12
14	Una	263	1.12	0.11	0.15	0.30
15	Other compact brands	897	1.25	0.22	0.36	0.27
	All obs	**16738**	**1.52**	**0.45**	**0.50**	**0.30**
	Without Swan	15166	1.52	0.46	0.49	0.30
	With Swan	1572	1.59	0.21	0.53	0.34

Note: Brand 1 to 3 labeled in (part of) 1997 to January 2001

1) Includes highly concentrated ('compact) detergents (not low concentration or liquid detergents)

2) In the definition of brands no distinction has been made between 'color' (for dyed clothes) and non-color (for white clothes) variants of the same brand.

3) Price of detergents per standard wash (defined as wash of 3-4 kg 'normally' dirty cloth using water with a 10-20 degree of hardness without using a pre-wash).

Table A1.4 Definition of shops and descriptive statistics by shop (table continued on next page)

Shop no.	Shop name/Definition	Toilet paper Brands[1] (brand no. sold in store)	N (Obs)	Price Mean	Ons Mean	Paper towels Brands[1] (brand no. sold in store)	N (Obs)	Price Mean	Ons Mean
1	Superbrugsen	1,2,3,6,15,20,23,25,32	4746	2.30	0.36	1,2,3,5,11,14,16,17,23,26	3192	3.98	0.36
2	Dagligbrugsen	3,6,15,19,20,23,25,32	1236	2.19	0.29	1,5,11,14,16,17,23,26	801	3.89	0.30
3	Kvikly/Obs	1,2,3,6,15,20,23,25,32	3350	2.45	0.36	1,2,3,5,11,16,17,23,26	1948	4.33	0.33
4	Irma	13,15,20,23,31,32	669	3.58	0.45	9,11,16,23,26	183	4.99	0.30
5	Fakta (discount)	1,2,16,32	3295	1.81	0.08	1,2,3,13,26	2346	3.24	0.06
6	Føtex/Bilka	1,2,3,18,19,20,22,24,28,29,30,32	6780	2.30	0.44	1,2,3,14,16,18,19,21,22,24,25,26	4129	3.96	0.50
7	Netto (discount)	1,11,14,18,20,22,24,26,32	7599	1.91	0.06	1,2,10,16,21,26	4739	3.54	0.09
8	Aldi (discount)	4,5	2565	1.92	0.02	15	1288	3.17	0.04
9	Prima	1,2,3,9,17,21,32	2070	1.92	0.53	1,2,3,12,26	954	3.61	0.41
10	Favør	1,2,3,8,11,12,19,20,27,30,32	1546	1.92	0.64	1,2,3,4,8,14,16,20,26	998	3.65	0.64
11	Other non discount (Spar/Superbest/Iso etc)	1,2,3,7,8,9,10,11,12,17,19,20,21,26,27,30,32	9677	2.03	0.44	1,2,3,4,6,7,8,12,14,16,20,21,26	6081	3.79	0.46
12	Other discount (Suma/ Rema/Coma/ABC etc)	1,2,3,12,17,19,20,26,27,30,32	2263	1.92	0.29	1,2,3,8,12,16,20,21,26	1539	3.68	0.29
	All shops	1-32	45796	2.10	0.31	1-26	28198	3.75	0.32

Note: 1) Brands recorded sold in the 'trimmed' data set during 1997 to January 2001 (not necessarily sold in the whole time period). Corresponds to the data set used when not conditioning on shops. When conditioning on shops there are observations not included e.g. because only one brand was recorded in a certain time period (implying there is no choice is available in the shop). This is always the case for paper towels in shop 8 and for half the observations for paper towels in shop 5 and shop 4 for detergents. In a few cases the number of observations used in the choice models conditioning on shops (table 5.2 and 5.3)are higher than given in table A1.3 (due to small differences in the generation/trimming of data).

Table A1.4 (continued)

Shop no.	Shop name/Definition	Detergents Brands[1] (brand no. sold in store)	N (Obs)	Price Mean	Ons Mean
1	Superbrugsen	1, 4, 5, 6, 7, 9, 11, 12, 15	2931	1.51	0.56
2	Dagligbrugsen	1, 4, 5, 6, 7, 9, 11, 12, 15	619	1.54	0.47
3	Kvikly/Obs	1, 4, 5, 6, 7, 8, 9, 11, 12, 15	2404	1.52	0.53
4	Irma	3, 4, 5, 6, 15	198	1.46	0.60
5	Fakta (discount)	2, 4, 5, 6, 13	686	1.45	0.33
6	Føtex/Bilka	2, 4, 5, 6, 7, 8, 15	2962	1.59	0.56
7	Netto (discount)	2, 4, 5, 6 ,7, 8, 10, 15	1929	1.53	0.40
8	Aldi (discount)	6, 14, 15	312	1.25	0.19
9	Prima	2, 4, 5, 6, 7, 8, 15	539	1.48	0.50
10	Favør	2, 4, 5, 6, 7, 8, 15	472	1.42	0.54
11	Other non discount (Spar/Superbest/Iso etc)	2, 4, 5, 6, 7, 8, 15	2924	1.52	0.48
12	Other discount (Suma/ Rema/Coma/ABC etc)	2, 4, 5, 6, 7, 8 ,15	762	1.53	0.47
	All shops	1-15	16738	1.52	0.50