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**Working Paper**

# Disentangling Purchasing Motives from Socio-demographic Differences: The case of Organic Milk

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FOI Working Paper

# Disentangling Purchasing Motives from Socio-demographic Differences: The Case of Organic Milk

*Laura Mørch Andersen*

**2010 / 5**

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Disentangling purchasing motives from socio-demographic differences:
The case of organic milk

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# Disentangling Purchasing Motives from Socio-demographic Differences: The case of Organic Milk*

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**Abstract**

*Using a unique data set where an unbalanced panel of more than 1,000 households have reported their purchases of groceries in great detail over a period of six months it is shown that consumption of organic milk increases significantly with level of education, urbanisation and income. Age and presence of children in the household have no significant effects.*

*Combining the purchase data with a questionnaire about attitudes towards organic production issued to the same panel shows that 51 per cent believes that organic production has a positive effect on the environment and 41 per cent believes in a positive effect on their own health. The level of trust in organic products generally increases with level of education, urbanisation and income. Including perception of organic goods in the estimation therefore reduces the effects of these socio-demographics, and thereby demonstrates the strength of this type of data combination.*

* I thank GfK Denmark for providing the purchase and background data, and for issuing the questionnaire.
I thank Kenneth Train, David Revelt and Paul Ruud for making their MMNL software available at Train's MMNL homepage: elsa.berkeley.edu/Software/abstracts/train0296.html (verified 11 June 2008), and I especially thank Kenneth Train for fast and clarifying answers to my questions.
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*It turns out that both trusts in effect on environment and on health increases the probability of choosing organic milk significantly. The effect of trust in health is more than twice as big as the effect of trust in environment.*

Key words: Panel mixed multinomial logit; labelling, characteristics model; health; environment; organic

JEL codes: Q51, Q13, D12, C25

### 1.1. Introduction

The growing interest in organic agriculture has inspired numerous scientists to investigate the motives for purchasing organic goods. Most studies are based on relatively few respondents (Makatouni, 2002; McEachern and McClean, 2002; Thompson and Kidwell, 1998; Wolf, 2002) and/or stated consumption of organic goods (Fotopoulos and Krystallis, 2002; Magnusson et al., 2001 and 2003; Makatouni, 2002; McEachern and McClean, 2002; Wandel and Bugge, 1997). Stated consumption has several disadvantages. First of all it is stated and is therefore to some extent also a measure of intention to buy, and secondly – and perhaps more importantly – it provides no information about the prices facing the respondents in the actual purchase situation. It is therefore impossible to separate the effect of prices and budget restrictions from the effect of socio-demographics and attitudes. This paper distinguishes itself by using information about actual purchases (including prices of the purchased goods), socio-demographics and answers to a questionnaire about perception of organic goods for each of the 1,022 households in the sample.

The data on prices available for the present study means that it is possible to investigate whether the lack of income effect in stated behaviour studies (e.g. Wolf, 2002) might be due to the absence of budget restriction in the hypothetical settings. The data used for this analysis also make it possible to entangle the effects of attitudes from the effects of socio-

demographics. It is therefore possible to investigate whether attitudes are correlated with socio-demographics and to what extent the effect of socio-demographics observed in studies without information about perception of organic products could be ascribed to attitudes rather than socio-demographics.

*Methodology*: Data on actual purchases of milk during a six-month period from 1,022 households are combined with information about the perception of environmental and health effects of organic goods for each individual household along with information about income, urbanisation, education, age and presence of children in the household. A Lancaster characteristics model (Gorman, 1980; Lancaster, 1966) is estimated as a discrete choice model, using mixed multinomial logit (McFadden and Train, 2000). A model including only purchases and socio-demographics is compared to a model which also includes questionnaire responses. The result is that socio-demographics and attitudes are correlated, and that the effects of soci-demographics may be exaggerated in estimations where individual perceptions of the organic label are not available. Using a discrete model means that the data is investigated as close as possible to the actual purchase situation, which involves discrete choices between alternatives.

The purpose of this paper is twofold: To separate the effects of different motives for purchasing organic milk and to give an introduction to the mixed logit model. Readers who are not interested in estimation technique may skip section 1.6 and 1.7.

The structure of the paper is as follows: Section 1.2 presents the data which combine information about actual purchases with information about not only conventional socio-demographics, but also attitudes towards the organic label. Section 1.3 presents the different types of milk. Section 1.4 motivates the choice of purchase motives and socio-demographics used in the paper. Section 1.5 explains how the model is related to Lancaster's characteristics model and section 1.6 introduces the Mixed Multinomial Logit model (MMNL). Section 1.7

presents the empirical specification of the utility function. Section 1.8 provides the main results of estimations and section 1.9 concludes.[1]

### 1.2. Data

The data are collected by GfK ConsumerScan Denmark (GfK). Each week households in the panel report the values and volumes of their actual purchases to the GfK in a 'diary'. Among other attributes, the households report whether the goods are organic or conventional, and for milk the *type* of milk is reported which means that the approximate fat content and taste are known. All data are self-reported by the households. GfK recommends that the diaries are filled in immediately after each shopping trip to avoid problems with forgotten purchases. Once a year the households answer a questionnaire about household attributes such as e.g. level of education for father and mother, and household income.

The data on milk used in this paper cover the period from 1 July 2000 to 31 December 2000 and are combined with results from a questionnaire about attitudes towards organic production issued to the panel in the summer of 2002. 1,771 households reported purchases of milk during the six months in the data period, and 1,022 of these also answered the questions used in this paper. The background data allows us to identify the individuals in the household by date of birth, and thereby to establish that less than three per cent of the households changed their composition of adults between the time of purchase and the questionnaire. The number of observed purchases from these households was between 1,033 and 1,596 per week, with a median of 1,321. 10 per cent of the households reported less than 6 purchases, but half of the households reported more than 28 purchases of milk and 25 per cent reported more than 46 purchases (for more on the GfK purchase data see Andersen, 2006).

[1] Appendix A gives a more thorough definition of the socio-demographics. For more information about socio-demographics, prices and market shares see Andersen (2008), paper 1.

As mentioned above, the data include answers to a questionnaire on attitudes towards organic production. The questionnaire makes it possible to combine stated preferences with observed purchasing behaviour. This means that it is possible to entangle the effects of trust in an organic effect on environment and on health from each other, and to estimate the impact of these different types of trust on the propensity to buy organic milk. The relationship between the questionnaire and the purchase data is based on the assumption that the perception of organic goods has been unchanged from 2000 to 2002, something which might not be entirely true. In 2007 another questionnaire was issued to the same panel, and more than half of the 1,022 households used in this paper also answered this new questionnaire. In general they had increased their level of trust in positive effects on both environment and health related to organic farming in general. If this increasing trend was also present between 2000 and 2002, some of the households which are categorized as positive in this paper may have been less positive at the time of purchase. If the perception of organic good has changed it means that distinction between the group of households perceiving no effect and the ones expecting environmental or health improvements will be less precise, and that the effects of trust may be slightly underestimated.

The degree of trust in the organic label is determined from the question: 'To what extent do you agree with the following statements: I think that the rules regarding organic production are good enough to create improvements for:'

- Nature, e.g. wild animals and plants
- My and my family's health

The respondents were allowed to answer on a five-point scale ranging from 'Totally disagree' to 'Totally agree'.

In Table 1, the 'totally disagree' category is merged with the 'disagree' category and the 'agree' category with the 'totally agree' category. This leads to nine possible combinations of the attitudes towards environment and health. Trust in positive effects on environment seems to be a precondition for trust in positive effects on health, as only 46 households (8+38=46) have trust in health but not the environment. On the other hand, trust in health effects is not a precondition for trust in environmental effects, as 152 households (20+132=152) trust in environmental effects, but not in health effects. This indicates that many people believe that their own health is related to the 'health' of the surrounding environment, and thereby supports the results found by Makatouni (2002). Makatouni reported results from qualitative interviews with 40 British parents, and found that health (personal or for their families) was the most important factor when trying to explain stated organic consumption. Environment and animal welfare were also important, but mainly through their impact on the health factor.

**Table 1 Relationship between trust in positive organic effect on environment and health**

| Number of households/ Number of purchases/ | | Health | | | |
|---|---|---|---|---|---|
| | | **Disagree** | **Uncertain** | **Agree** | ***Total*** |
| **Environment** | **Disagree** | 106<br>3,043 | 18<br>656 | 8<br>146 | *132*<br>*3,845* |
| | **Uncertain** | 15<br>537 | 313<br>10,679 | 38<br>1,202 | *366*<br>*12,418* |
| | **Agree** | 20<br>545 | 132<br>4,437 | 372<br>12,748 | *524*<br>*17,730* |
| | ***Total*** | *141*<br>*4125* | *463*<br>*15,772* | *418*<br>*14,096* | *1,022*<br>*33,993* |

Source: GfK questionnaire data from 2002.

Table 2 shows the relationship between the organic purchase share[2] and the different combinations of the answers to questions on environment and health. Households who believe in none of the effects still purchase organic milk in 8 per cent of the cases, so environment and health are not the only attributes of organic products that matter. They are, however, very

[2] The discrete choice model used in this paper disregards the volumes and focuses on the probability of choosing the different types of milk in a given purchase.

important. Trust in just one of the two practically doubles the purchase share, and trust in both health and environment leads to a purchase share of 43 per cent.

**Table 2 Organic purchase shares by perception of organic goods**

| Organic purchase share | | Health | | | |
|---|---|---|---|---|---|
| | | **Disagree** | **Uncertain** | **Agree** | ***Total*** |
| **Environ-ment** | **Disagree** | 7.8% | 17.8% | 20.6% | *10.0%* |
| | **Uncertain** | 12.1% | 13.0% | 28.7% | *14.5%* |
| | **Agree** | 27.2% | 21.1% | 43.4% | *37.3%* |
| | ***Total*** | *10.9%* | *15.5%* | *41.9%* | *25.9%* |

Source: GfK purchase data for milk June to December 2000 combined with questionnaire data from 2002. Only whole, semi-skimmed and skimmed milk.

### 1.3. Milk

During the last six months of 2000 three[3] main types of milk were available with different content of fat:

- Whole milk (‘sødmælk’ in Danish): 3.5 per cent fat
- Semi-skimmed milk (‘Letmælk’ in Danish): 1.5 per cent fat
- Skimmed milk (‘Skummetmælk’ in Danish): Between 0.1 per cent and 0.5 per cent fat (typically 0.1)

The conventional versions of these types were always homogenised and the organic versions were un-homogenised. Note that the effect of homogenisation is perfectly correlated with the organic label in these types of milk and therefore not separable from the effect of the organic label.

The nature of the data means that only the price of the chosen alternative is recorded. The prices and availability of the different types of milk in each choice situation are imputed from purchases made by other panel members (in the same chain of stores, within the same week).

[3] Buttermilk and chocolate milk are excluded from the analysis because they taste very different compared to the other types, and are used for different purposes.

If nobody purchased a given type of milk in a given chain of stores in a given week it is perceived as rationed, and not included as an alternative in the specific purchase situation. Figure 1 and Figure 2 show the absolute imputed prices and price differences. To avoid systematic differences in the measurement errors of the price all prices are imputed in the estimations, including the one for the type that was actually chosen.

**Figure 1**

**Absolute prices of different types of milk over time**

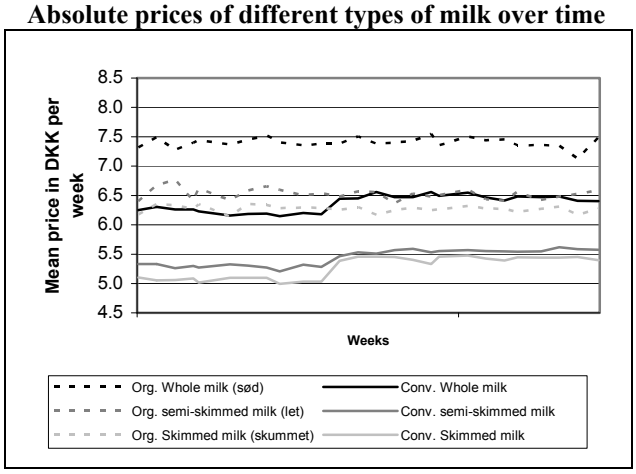
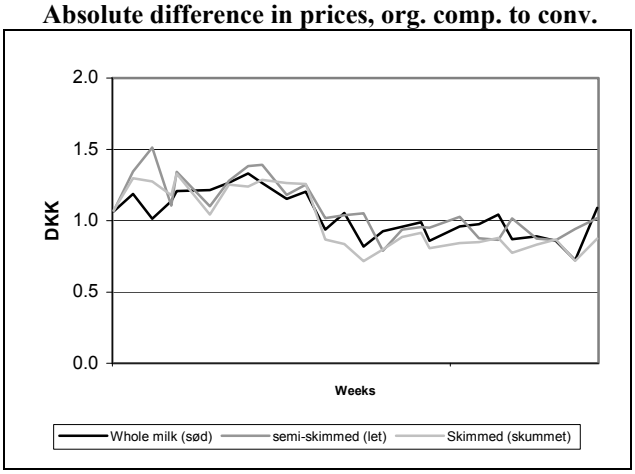



**Figure 2**

**Absolute difference in prices, org. comp. to conv.**




Source: GfK purchase data for milk June to December 2000, only whole, semi-skimmed and skimmed milk.

The consumption of different types of milk has remained practically unchanged during the data period, and the propensity to buy the three different types of milk is therefore assumed to be constant. As can be seen in Table 3, the propensity to buy the organic version varies between the different types of milk. The organic share of skimmed milk is much higher than the share of semi-skimmed and whole milk.

**Table 3 Market share and organic share for the different types of milk**

| | ***Market purchase share*** | ***Organic purchase share*** |
|---|---|---|
| *Whole (3.5% fat)* | 18.4% | 19.9% |
| *Semi-skimmed (1.5% fat)* | 52.6% | 21.0% |
| *Skimmed (0.1-0.5% fat)* | 29.0% | 38.6% |
| *Total* | *100%* | *25.9%* |

Source: GfK purchase data for milk June to December 2000, only whole, semi-skimmed and skimmed milk.

Skimmed milk has a low fat content and might appeal more to people who are very health conscious. People who are more health conscious may also be more interested in organic

products because these are often regarded as healthier. Furthermore, the low fat content of skimmed milk makes the effect of homogenisation smaller compared to semi-skimmed or whole milk. Many people dislike the 'lumpiness' of un-homogenised milk, and this negative effect is likely to be smaller for skimmed milk. None of these correlations can be tested using the data at hand, so this is mere hypothesis.

As for the propensity to purchase milk with different levels of fat, the propensity to buy the organic version is invariant during the data period. It is therefore assumed to vary between milk types, but to be constant over time.

### 1.4. Motives and socio-demographics

Many studies have investigated the motives for purchasing organic goods (e.g. Fotopoulos and Krystallis, 2002, Makatouni, 2002, Magnusson et al., 2003, McEachern and McClean, 2002), and some of the most important motives appear to be environmental and health improvements (Makatouni, 2002, Magnusson et al., 2003). As mentioned before the data used in this paper includes household perception of environmental and health benefits from purchasing organic products. The relationship between the perception of environmental and health effects was presented in Table 1, and it is evident that distrust in effect on environment and health is almost perfectly correlated. This means that the effect of distrust in health effects and distrust in environmental effects cannot be identified separably. It is therefore chosen to compare the utility of the organic characteristic for households which agree in a positive effect with the utility for those who either disagree or are uncertain about the effect. The organic purchase shares for these groups are reported in Table 4 at the end of this section.

When it comes to socio-demographics, this paper focuses on the effect of income, urbanisation, education, age and presence of children in the household.[4] These characteristics

[4] See Appendix A for a detailed definition of these.

do not vary over the period used in the estimations, so in that sense the data are treated as cross-sectional. However, the utility function is assumed to be constant for each household during the estimation period, but to vary between households, thereby utilising the panel dimension of the data.

A quick look at the highest level of education within the household shows that it has a vast effect on the propensity to buy organic milk. The effect ranges from an organic purchase share of 20 per cent for households with no further education to 42 per cent for households with a long further education (Table 4). The question is whether the effect of education is an expression of something else. It is clear from the data that there is a relationship between education, urbanisation and income. A high level of education seems to be associated with having a relatively high income and living in the capital area. It is therefore important to include these explanatory variables in the estimation. For more details see Andersen (2008), paper 1.

Children (especially young children) are expected to have a positive effect on the propensity to choose organic products because the health of young children may be more important for parents than their own health. Even if the parents are not convinced that organic products are healthier, they may buy them as insurance just in case. However, looking at data, it seems that children most likely result in a negative effect (the organic purchase share is 27 per cent for households with no young children and 16 per cent for households with young children where the effect was expected to be the largest, see Table 4). Data indicate that the effect of children may vary with level of education, but the number of families with children is too small to estimate the cross effects. The presence of children in the household is strongly correlated with age, and it is therefore important to control for this effect too.

The perceptions of environmental and health effects of organic goods mentioned above are related to the socio-demographics. Trust in positive effects of organic products is more likely

to be present when either income or level of education is high, and when the household is living in the capital area. In many studies information about attitudes is not available for the estimation, and the effect of these socio-demographics may therefore be overestimated. The question is by how much.

Table 4 sums up the information about perception of organic goods and socio-demographic characteristics used in the estimations and provides the organic purchase share for each group. Table 4 also indicates which sub-groups constitute the control group in the estimations. The utility of the organic characteristic in the other groups is measured relative to this group. The estimated utility in the capital area is e.g. the difference between the mean utility for households in the capital area and those in the rural municipalities. If the parameter for capital area is significant, it means that the difference between the utility in the capital area and in the rural municipalities is significantly different from zero.

**Table 4 Perceptions and socio-demographic data used in estimations**

| Variable | Sub-groups | Number of households | Share of households | Control group[a] | Organic purchase share |
|---|---|---|---|---|---|
| Environment[b] | Disagree or not sure | 498 | 49 | X | 13 |
| | Positive effect on environment | 524 | 51 | | 37 |
| Health[c] | Disagree or not sure | 604 | 59 | X | 15 |
| | Pos. effect on own or family's health | 418 | 41 | | 42 |
| Income[d] | Lowest 25 % | 283 | 28 | X | 22 |
| | Middle 50 % | 462 | 45 | | 23 |
| | Highest 25 % | 277 | 27 | | 36 |
| Degree of urbanisation[e] | Rural municipality | 338 | 33 | X | 19 |
| | Urban municipality | 468 | 46 | | 25 |
| | Capital area (Copenhagen) | 216 | 21 | | 42 |
| Level of education[f] | No further education stated | 277 | 27 | X | 20 |
| | Vocationally oriented high-school | 347 | 34 | | 21 |
| | Short further education | 172 | 17 | | 34 |
| | Medium further education | 176 | 17 | | 32 |
| | Long further education | 50 | 5 | | 42 |
| Age[g] | 18-29 years | 44 | 4 | | 17 |
| | 30-44 years | 218 | 21 | | 24 |
| | 45-59 years | 363 | 36 | | 27 |
| | 60 years or more | 397 | 39 | X | 27 |
| Children 0-6 years[h] | No | 937 | 92 | X | 27 |
| | Yes | 85 | 8 | | 16 |
| Children 7-14 years[h] | No | 902 | 88 | X | 27 |
| | Yes | 120 | 12 | | 23 |

Data source: GfK purchase data for milk June to December 2000 combined with background data covering 2000 and questionnaire data from 2002. Only whole, semi-skimmed and skimmed milk. The total number of households is 1,022 and the organic purchase share for all households is 26 per cent.

a: Utility of the organic characteristics in the other groups is measured relative to this group.
b: To what extent do you agree with the following statement: "I think that the rules regarding organic production are good enough to create improvements for nature, e.g. wild animals and plants".
c: To what extent do you agree with the following statement: "I think that the rules regarding organic production are good enough to create improvements for my and my family's health".
d: Income is recorded in brackets of DKK 50,000 (~€6,700). These brackets are divided by the number of persons in the household, weighted by the OECD-modified scale i.e. 1 for the first adult, 0.5 for the next adults and 0.3 for children (OECD). Income is split into three categories indicating relative levels of income.
e: GfK divides the 275 Danish municipalities (2002) into categories depending on how urbanised they are and on their geographical location. The geographical location is ignored here, and the sample is split into rural, urban and capital area municipalities.
f: Highest level of education within the household.
g: Age is defined by the age of the oldest person in the household.
h: Indicates whether children in a specific age group are present in the household.

### 1.5. Characteristics of milk

As in Gorman (1980 and Lancaster (1966) it is assumed that goods are bundles of characteristics and that consumers derive utility from these characteristics (sometimes referred to as 'attributes') rather than from the goods themselves. The goods are linear combinations of characteristics and the connection between goods $q$ and characteristics $z$ can therefore be can be written as $z = \mathrm{A}'q$, where A is the technology matrix, describing the composition of characteristics in the different goods.

In the case of milk the consumer can choose between an organic and a conventional version of three different types of milk, leading to six goods $j \in \{1,...,6\}$, each constituting a different combination of characteristics. The goods are presented in Table 5:

**Table 5 Definition of choice set**

| | *Organic* | *Conventional* |
|---|---|---|
| *Whole (3.5% fat)* | $j = 1$ | $j = 2$ |
| *Semi-skimmed (1.5% fat)* | $j = 3$ | $j = 4$ |
| *Skimmed (0.1-0.5% fat)* | $j = 5$ | $j = 6$ |

The three types of milk (whole, semi-skimmed and skimmed) all share a set of 'milkiness' characteristics which differentiate the product from other goods which also consists of fat, protein, calcium etc. Milk can be used for drinking, coffee and other things where e.g. butter would be inapplicable. The fat percentages of different types of milk leads to differences in taste and other sensory characteristics of the milk, but not necessarily as a linear function of the fat percentage. It is therefore also necessary to include 'whole-milkiness', 'semi-skimmed-milkiness' and 'skimmed-milkiness' as characteristics of the goods. The organic attribute is also assumed to consist of a general part, and a part which is allowed to depend on the type of milk, mainly because the effect of the non-homogenisation is likely to vary a great deal depending on the fat percentage.

The general organic attribute is a credence good (Giannakas, 2002), which means that consumers cannot observe the organic characteristic neither in the purchase situation, nor at the point of consumption. Consumers must therefore rely on the organic labelling. It is therefore possible to have different perceptions of the organic attribute, and the data used in this paper show that some consumers expect to get a positive effect on the environment when purchasing organic goods, whereas others do not, just as some expect to get a positive health effect (Table 1). This leads to an individual specific technology matrix $A_i$ indicating that the households receive different sets of characteristics when consuming organic goods.

Household who neither believes in environmental nor health effects receive only the characteristics of the common technology matrix A, whereas those who trust in environmental or health effects also benefits from these when they purchase organic products. The characteristics *z* obtained by individual *i* from a bundle of goods *q* can therefore be described as:

$$z_i(q) = \mathrm{A}'q + \mathrm{A}_i'q \tag{1.1}$$

The definition of the technology matrix above means that if a household with no trust in environmental or health effects purchases a litre of organic whole milk it gets one unit of whole-organic-ness, one unit of whole-milkiness, one unit of general-organic-ness and one unit of milkiness. A household who believes in positive effects on both the environment and own or family's health gets the same, but also one unit of environmental improvements and one unit of improved health.[5]

Variation in utility of goods may thus originate from at least two different sources: Different perceptions of the characteristics of the goods or different preferences for the characteristics of the goods. In this example, the perception of environmental and health effects of organic goods varies between households, and thus results in different *perceptions* of the characteristics related to organic goods, whereas the difference in utility of the general organic attribute between socio-demographic groups is interpreted as differences in *preferences*. The preferences for environment and health are assumed to be the same for all households.[6]

[5] The value of these units is likely to vary between different food categories, so this is actually one unit of e.g. organic-milk-healthiness.

[6] The utility of environment and health is assumed to be independent of socio-demographics (a simplifying assumption which could be relaxed in further research).

### 1.6. Mixed logit

When dealing with discrete choices, the parameters of the utility function are often estimated using a conventional multinomial logit model (e.g. Greene 1997) which means that the household likelihood function is

$$L_i^{conv}(\beta) = \prod_{t=1}^{T_i} \left( \frac{\exp(U_{it}(j))}{\sum_{k=1}^{J} \exp(U_{it}(k))} \right) \tag{1.2}$$

where $\beta$ is a vector containing all of the parameters of the utility function,[7] $J$ is the number of alternatives in the choice set (in this case six) and $U_{it}(k)$ is the utility for household *i* from choosing alternative *k* from the choice set in period *t*.

However, the conventional multinomial logit model suffers from the assumption of Independence of Irrelevant Alternatives (IIA). Imagine that organic skimmed milk leaves the market. Then the IIA in the multinomial logit model would imply that the people who used to buy organic skimmed milk would distribute themselves between the rest of the five combinations of organic/conventional and milk type according to the *market* share of these other combinations. But people who buy organic skimmed milk may very well have a higher propensity to buy either organic semi-skimmed milk or conventional skimmed milk than the population in general and, in particular, have a lower propensity to buy conventional whole milk. IIA is therefore not reasonable in this case.

Investigating data shows that some households buy e.g. organic milk more frequently than others, which contradicts the theory that all households have the same utility of the organic attribute. As in e.g. McFadden and Train (2000), Revelt and Train (1998), Train (1998) or Train (1999) it is therefore assumed that (part of) the household utility is drawn from a distribution (i.e. the household utility is known to the household, but only the distribution is

[7] The details of the empirical specification of the utility function is given in section 1.7.

observable to the econometrician). The household likelihood function then becomes the likelihood function in the conventional multinomial logit model integrated over all possible values of $\beta$:

$$L_i(\theta) = \int L_i^{conv}(\beta) f(\beta|\theta) d\beta \tag{1.3}$$

where $\theta$ are the parameters determining the distribution of the utility $\beta$, and $f(\beta|\theta)$ is the density of $\beta$ given $\theta$. The likelihood function is maximised over $\theta$ instead of $\beta$. This is known as the Mixed MultiNomial Logit (MMNL or MXL) model (McFadden and Train 2000). As will be seen in the following the MMNL model does not suffer from IIA (as long as at least one parameter is assumed to be drawn from a common distribution (i.e. to be '*mixed'*)):

Under the conventional multinomial logit the utility function is assumed to be

$$U_{it}(j) = \beta' x_{ijt} + \varepsilon_{ijt} \tag{1.4}$$

with identical $\beta$'s for all households and i.i.d. extreme value error terms $\varepsilon_{ijt}$. The fact that the error terms are independent over households *i*, milk types *j* and time *t* creates IIA. As in Train (1998) the utility function in the Random Utility Model underlying the MMNL model can be written as

$$U_{it}(j) = \beta_i' x_{ijt} + \varepsilon_{ijt} = (b' + \eta_i') x_{ijt} + \varepsilon_{ijt} = b' x_{ijt} + \eta_i' x_{ijt} + \varepsilon_{ijt} \tag{1.5}$$

where the household-specific $\beta_i$ is decomposed into a part, *b*, that is common for all households (the mean of the distribution of household $\beta_i$'s) and an individual part, $\eta_i$, that differs between households and has mean zero in order to separate the effect of *b* from the effect of $\eta_i$.

The common part, *b*, can be estimated by the econometrician, but the individual part $\eta_i$ remains unobserved by everyone except the household itself. The econometrician will, therefore, observe the error terms

$$\xi_{ijt} = \eta_i x_{ijt} + \varepsilon_{ijt} \tag{1.6}$$

which are correlated over alternatives (*j*) and time (*t*) for household *i* because of the common influence of $\eta_i$. This means that the differences in taste make the probability of choosing different types of milk correlated for household *i*. The households that have tastes different from the mean of the population ($\eta_i \neq 0$) will therefore not distribute their consumption according to the average distribution and thus not substitute according to this average distribution, but according to their own conventional multinomial logit model, i.e. the market shares of their own personal consumption. The fact the errors are correlated over possible alternatives therefore eliminates IIA, and means that a mixed multinomial logit is more flexible than the conventional multinomial logit model.

### 1.7. Empirical specification of the model

The utility of the characteristics is assumed to follow a Random Utility Model (RUM) in which the household utility is not perfectly observed by the econometrician. The utility function is assumed to have a simple linear form, depending on the prices of the different alternatives of milk and the characteristics of the alternatives. The linear form of the utility function means that the marginal willingness to pay is simply the utility of the attribute divided by the utility of money, just as in Hanemann (1984).[8] The relationship between goods and characteristics ($z = \mathrm{A}'q + \mathrm{A}_i'q$) means that the expected utility of the characteristics inherent in the goods is

$$U_i(q) = U_i(z_i) = \beta_i' z_i = \beta_i'(\mathrm{A}'q + \mathrm{A}_i'q) \tag{1.7}$$

where A and $\mathrm{A}_i$ are the technology matrixes used in (1.1) and $\beta_i$ measures the household specific utility of the characteristics. The utility of the characteristics is defined in Table 6:

[8] Marginal willingness to pay is the amount of money a person is willing to pay in order to receive an extra unit of the good in question. It implies that the person is assumed to be at a given level of utility when he is offered an extra unit of the good. If the consumer is faced with a unit price for the good, he will only accept the purchase if it leaves him with at least the initial level of utility. The point of interest is the unit price that will lead to the same level of utility regardless of whether the person chooses to buy the good or not, since this is the maximum amount the person will be willing to pay. Actually, this is 'marginal *maximum* willingness to pay', but it is often simply referred to as 'marginal willingness to pay' or 'wtp'.

**Table 6 Utility of characteristics of organic and conventional milk**

| Utility | Description |
|---|---|
| | *Common characteristics of milk:* |
| $\beta_{ow}$ | Organic, whole |
| $\beta_{w}$ | Whole-milkiness |
| $\beta_{oss}$ | Organic, semi-skimmed (:= 0 for identification) |
| $\beta_{ss}$ | Semi-skimmed-milkiness (:= 0 for identification) |
| $\beta_{os}$ | Organic, skimmed |
| $\beta_{s}$ | Skimmed-milkiness |
| $\beta_{o}$ | Mean utility of the General organic attribute |
| $\beta_{oi}$ | Household specific utility of the general organic attribute, mixed with the normal distribution, $E(\beta_o + \beta_{oi}) = \beta_o$ |
| $\beta_{m}$ | General Milkiness (:= 0 for identification) |
| | *Household specific characteristics of organic milk:* |
| $\beta_{oEnv}$ | Positive environmen0 tal effects of organic goods |
| $\beta_{oHealth}$ | Positive health effects of organic goods |

In a discrete choice model the absolute utility of a given alternative is never observed, only which alternative yields the highest utility. This limits the identification in two dimensions. First of all, only the *difference* between the utility of two alternatives can be estimated, and secondly all parameters are only defined up to a *scale*. If the utility of all alternatives is multiplied with the same number it will have no effect on the choices observed. This is usually solved by normalising the variance of the utility in the RUM model, but it is crucial to remember that the absolute values of estimated parameters cannot be compared with results from other estimations. Only ratios such as the willingness to pay are identified. It is, however, possible to use the estimated parameters to tell whether the utility of one attribute is higher than the utility of another attribute, *within the same estimation.*

It is not possible to identify the utility of all eight characteristics in Table 6 and it is therefore chosen to restrict the utility of milkiness, semi-skimmed-milkiness and organic semi-skimmed to zero and measure the utility of the other characteristics relative to this. This means that the utility of the conventional version of the two other milk types is compared to semi-skimmed milk, and that the utility of the organic version is compared to the conventional version for each of the three types of milk, whole, semi-skimmed and skimmed. The utility of the part of

the organic characteristic which depends on the type of milk is assumed to be the same for all households, whereas the utility of the part that is common for all types of milk is assumed to vary between households (drawn from a normal distribution). The mean utility is allowed to vary between different groups of the population, depending on relative income, degree of urbanisation, the highest level of education, age and presence of children in the household. This means that we allow for systematic differences between the groups, but not that all members of a group have e.g. higher utility than all members of another group. They just have a higher *expected* utility due to the difference in the mean. The utility of environmental and health improvements related to organic milk is also assumed to be the same for all households.

The utility of choosing alternative *j* therefore becomes:

$$U_{it}(j) = \underbrace{\beta_p p_{jt}}_{\text{price}} + \underbrace{\mathrm{A}'U\left(z\left(q_j\right)\right)}_{\substack{\text{characteristics of}\\ \text{goods common}\\ \text{for all consumers}}} + 1_{\{j=organic\}}\left( \underbrace{\beta_{oi}}_{\substack{\text{individual specific part}\\ \text{of utility of common}\\ \text{organic characteristic}}} + \underbrace{U_{soc}^{org}\left(x_i\right)}_{\substack{\text{Variation in preferences for}\\ \text{the organic characteristic}\\ \text{beween socio-demogr. groups}}} + \underbrace{\mathrm{A}_i'U\left(z_{env}, z_{health}\right)}_{\substack{\text{individual specific}\\ \text{characteristics of}\\ \text{organic goods}}} \right) \quad (1.8)$$

where $(-\beta_p)$ is the utility of money, $p_{jt}$ is the imputed price of alternative *j* at time *t*, $1_{\{j=organic\}}$ is a dummy/indicator function indicating whether *j* is an organic good, $\beta_{oi}$ is the individual specific deviation from the average utility of the organic attribute (mixed with the normal distribution), $U_{soc}^{org}$ is the part of the utility of the organic attribute which varies with socio-demographics. A is the technology matrix for common characteristics, describing the general characteristics of the six different types of milk, $\mathrm{A}_i$ is the individual specific technology matrix, indicating whether households trust in positive environmental or health effects.

The utility of the common characteristics of milk of type *j* is given by the $j^{th}$ column of the common technology matrix and the common parameters defined in Table 6,

$\mathrm{A}'U\left(z\left(q_j\right)\right) = \mathrm{A}_j'\beta$. The utility of the individual specific characteristics (environment and health) is given by the $j^{\text{th}}$ column of the individual technology matrix and the parameters for the household specific characteristics in Table 6:

$$\mathrm{A}_i'U\left(z_{env}, z_{health}\right) = \left( \underbrace{\underbrace{1_{\{Env,trust\}}}_{trust} \underbrace{\beta_{oEnv}}_{utility}}_{environment} + \underbrace{\underbrace{1_{\{Health,trust\}}}_{trust} \underbrace{\beta_{oHealth}}_{utility}}_{health} \right) \underbrace{1_{\{j=organic\}}}_{\substack{only\ for \\ organic \\ goods}} \tag{1.9}$$

where $1_{\{Env,trust\}}$ indicates trust in positive environmental effects of organic goods and $\beta_{oEnv}$ is the level of utility obtained from the environmental effects. This means that $\beta_{oEnv}$ measures the difference in utility between believers and non-believers. Trust in positive health effects is treated the same way. $1_{\{j=organic\}}$ indicates that the utility is only obtained by purchasing organic types of milk.

The socio-demographic differences in the utility of the organic characteristic depend on the level of income, degree of urbanisation, level of education, age and presence of children 0-6 years or 7-14 years. The control groups and the levels of the socio-demographics are defined in Table 4. Neither the socio-demographics, nor the perception of organic goods varies within the estimation period, and all parameters are assumed to be constant. The price of milk is therefore the only variable which varies from observation to observation.

For a household in the control group (i.e. trusting neither of the positive effects of organic production, with relatively low income, living in a rural municipality, no further education, aged 60 or more with no children younger than 15 years), the utility of e.g. organic whole milk ($j$=1) compared to conventional semi-skimmed milk is:

$$U_{it}\left(j=1\right) = \beta_p p_{1t} + \beta_o + \beta_{ow} + \beta_w + \beta_{oi} \tag{1.10}$$

The interpretation of this utility function is that the utility is composed of disutility of paying money for the milk ($\beta_p p_{it}$), plus the average utility of the general organic attribute ($\beta_o$), plus the utility of the fact that the organic attribute comes from whole milk ($\beta_{ow}$), plus the utility of the whole-milkiness compared to the semi-skimmedness ($\beta_w - \beta_{ss} := \beta_w$), plus the individual specific utility of the general organic attribute ($\beta_{o,i}$). Note that semi-skimmed milk is used as base for both the conventional and the organic attribute which means that the utility of the general organic attribute is actually the utility of organic semi-skimmed milk. The utility of conventional semi-skimmed milk is therefore just $\beta_p p_{4t}$, whereas the utility of organic semi-skimmed milk is $\beta_p p_{3t} + \beta_o + \beta_{oi}$.

The interpretation of $U_{soc}^{org}$ is that households with different levels of education, income, urbanity, age and children have different levels of utility of organic milk in general, independent of milk type. The difference between the utility of organic whole or skimmed milk and the utility of organic semi-skimmed milk is therefore assumed to be the same for all types of households, just as the difference in utility of different fat levels of conventional milk is assumed to be independent of socio-demographics.

This specification of the utility function means that it is assumed, that the utility of the organic attribute depends on the type of milk, that it varies between households and that it follows a normal distribution. As a further restriction, it is also assumed that the variance is identical for all three types of organic milk, i.e. the level of heterogeneity is the same.[9] The utility of the organic attribute is assumed to be a combination of a general utility of the organic attribute and a part which is allowed to vary with the type of milk and with various socio-demographics and perception of the organic good. By mixing only the general utility of

[9] Estimations allowing the three types of organic milk to have different levels of variance proved to be highly unstable (lots of local maxima, even with Antithetic draws), thus the restriction of one common level of heterogeneity.

the organic attribute it is therefore possible to achieve a multitude of mixed distributions with different means of the utility of the organic attribute.

### 1.8. Estimation results

Table 7 presents the results of estimations using only socio-demographics (model 1 in Table 7) and including both socio-demographics and perception of organic goods (model 2 in Table 7). As mentioned in section 1.6, the scaling of a discrete choice model depends on the magnitude of the variance of the utility, and the results of two different estimations are therefore not directly comparable. In this specific case, however, the utility of money (the parameter for price) is the same in both estimations which means that the sign of the difference in willingness to pay (which is a ratio and therefore can be compared between estimations) can be elicited directly from the differences in the non-price parameters.

The definition of the utility function in (1.8) means that if perception of organic goods matters, the difference between the two estimated models should affect only the mean of the mixed organic attribute (because the control group becomes even more restrictive in the model including perception of organic goods) and the parameters of the socio-demographics (if socio-demographics are correlated with perceptions as indicated in Andersen 2008, paper 1). It turns out that this is exactly the case. The parameters for price, type of milk, standard deviation of the utility of the general organic characteristic and the differences between the different types of organic milk are identical in the two models.

*Distribution of utility:*

In the model without perceptions of the organic attribute (model 1) the mean utility of the general organic characteristic is -5.29 and the parameter has a standard *error* of 0.486, which means that it is significantly different from zero at the 1 per cent level. The standard *deviation* of the mixing distribution of the utility of the general organic characteristic is 4.68. This

parameter has a standard error of 0.167 which means that it is also significantly different from zero at the 1 per cent level. Together the two parameters show that in the control group (low income, rural municipality, no further education, 60 years old or more and no children) 13 per cent have a positive utility of the general organic characteristic as long as it is provided in organic semi-skimmed milk. This probability can be calculated from the estimated normal distribution: $P\left(x>0\middle|x\sim N\left(-5.29,4.68\right)\right)=12.9\%$. If the organic characteristic is provided in skimmed milk instead the share with positive utility changes to 17 per cent because the mean utility is increased by 0.81: $P\left(x>0\middle|x\sim N\left(-5.29+0.81,4.68\right)\right)=16.9\%$. Note that the negative mean of a mixed parameter is thus not synonymous with negative utility as it would have been in a conventional logit which assumes that everyone has the same utility. In a mixed logit a negative mean merely indicates that less than 50 per cent have a positive utility. This is an important difference between conventional and mixed logit.

**Table 7 Estimation results**

| | | Model 1: Without perceptions | | | Model 2: With perceptions | | | LR test, only model with perceptions |
|---|---|---|---|---|---|---|---|---|
| | | Estimate | St. err. | | Estimate | St. err. | | |
| $\beta_p$ ¤ | Price | -0.24 | (0.068) | *** | -0.24 | (0.068) | *** | |
| | **Type of milk** | | | | | | | |
| $\beta_w$ | Whole | -0.82 | (0.101) | *** | -0.82 | (0.101) | *** | |
| $\beta_{ss} := 0$ | *Semi-skimmed* | | | | | | | |
| $\beta_s$ | Skimmed | -0.86 | (0.079) | *** | -0.86 | (0.079) | *** | |
| | **Mixed organic attribute** | | | | | | | |
| $\beta_o$ | Mean | -5.29 | (0.486) | *** | -6.39 | (0.489) | *** | |
| $\sigma_o$ | Standard deviation | 4.68 | (0.178) | *** | 4.36 | (0.172) | *** | |
| | **Type of organic milk** | | | | | | | |
| $\beta_{ow}$ | Organic whole milk | -0.02 | (0.167) | | -0.02 | (0.167) | | |
| $\beta_{oss} := 0$ | *Org. semi-skimmed milk* | | | | | | | |
| $\beta_{os}$ | Organic skimmed milk | 0.81 | (0.141) | *** | 0.80 | (0.141) | *** | |
| | **Positive effect on environment** | | | | | | | |
| $\beta_{oEnvNoTr} := 0$ | *Disagree or not sure* | | | | | | | |
| $\beta_{oEnv}$ | Agree | | | | 1.00 | (0.400) | ** | $\chi^2_1(5.94) = 0.015$ |
| | **Positive effect on own or family's health** | | | | | | | |
| $\beta_{oHlthNoTr} := 0$ | *Disagree or not sure* | | | | | | | |
| $\beta_{oHealth}$ | Agree | | | | 2.45 | (0.401) | *** | $\chi^2_1(35.96) = 0.000$ |
| | **Income** | | | | | | | |
| $\beta_{o_L_inc} := 0$ | *Lowest 25%* | | | | | | | |
| $\beta_{o_M_inc}$ | Mid 50% | 0.19 | (0.441) | | 0.28 | (0.411) | | $\chi^2_2(9.40) = 0.009$ |
| $\beta_{o_H_inc}$ | Highest 25% | 1.57 | (0.574) | ** | 1.48 | (0.551) | ** | |
| | **Urbanisation** | | | | | | | |
| $\beta_{o_Rural} := 0$ | *Rural municipality* | | | | | | | |
| $\beta_{o_City}$ | Urban municipality | 1.36 | (0.411) | *** | 0.98 | (0.417) | ** | $\chi^2_2(33.51) = 0.000$ |
| $\beta_{o_Capital}$ | Capital area | 3.09 | (0.509) | *** | 2.57 | (0.461) | *** | |
| | **Education** | | | | | | | |
| $\beta_{o_No} := 0$ | *No further educ. stated* | | | | | | | |
| $\beta_{o_Vocal}$ | Voc.-oriented high-school | -0.06 | (0.500) | | -0.25 | (0.439) | | |
| $\beta_{o_Short}$ | Short further education | 1.66 | (0.601) | ** | 1.33 | (0.541) | ** | $\chi^2_4(16.68) = 0.002$ |
| $\beta_{o_Medium}$ | Medium further education | 1.15 | (0.574) | ** | 0.85 | (0.529) | | |
| $\beta_{o_Long}$ | Long further education | 2.34 | (0.859) | ** | 1.74 | (0.775) | ** | |
| | **Age** | | | | | | | |
| $\beta_{o_60} := 0$ | *60+* | | | | | | | |
| $\beta_{o_4559}$ | 45-59 years | -1.31 | (0.463) | ** | -1.13 | (0.440) | ** | $\chi^2_3(7.48) = 0.058$ |
| $\beta_{o_3044}$ | 30-44 years | -0.53 | (0.637) | | -0.39 | (0.575) | | |
| $\beta_{o_29}$ | 18-29 years | -1.01 | (0.886) | | -0.76 | (0.794) | | |
| | **Children** | | | | | | | |
| $\beta_{o_NoCh} := 0$ | *No children* | | | | | | | |
| $\beta_{o_Ch06}$ | Children 0-6 years | -0.91 | (0.681) | | -0.95 | (0.621) | | $\chi^2_2(2.42) = 0.298$ |
| $\beta_{o_Ch714}$ | Children 7-14 years | 0.49 | (0.655) | | 0.36 | (0.639) | | |
| | ***Number of observations*** | | *33,993* | | | *33,993* | | |
| | ***Number of households*** | | *1,022* | | | *1,022* | | |
| | ***Number of parameters*** | | *20* | | | *22* | | |
| | ***Log-likelihood value*** | | *-39,930.4* | | | *-39,882.8* | | |

¤: Parameter labels for general characteristics of milk are defined in Table 6, the parameters for environment and health are defined in equation (1.9). The names of the parameters for socio-demographic differences in utility should be self-explanatory.

*Italics* means that the parameter is restricted to zero (control group).

Mixed logit with one normally distributed parameter using 2,500 Antithetic Halton draws based in the prime 2, and a convergence criterion of $10^{-4}$. Data source: GfK purchase data for milk June to December 2000 combined with background data covering 2000 and questionnaire data from 2002. Only whole, semi-skimmed and skimmed milk. '***' is significant at the 1% level, '**' at the 5% level and '*' at the 10% level. The LR tests show the results of comparing the complete model with a model excluding variables group by group.

When perception of organic goods is included in the estimation (Model 2), it means that the control group is restricted to households who expect no positive effects on either environment or health and are part of the control group in Model 1. The result is that the share with positive utility drops from 13 per cent to 7 per cent because the new mean and standard deviation lead to $P\left(x > 0 \middle| x \sim N\left(-6.39, 4.36\right)\right) = 7.1\%$. The standard deviation of the utility of the organic attribute decreases a bit when perceptions are introduced into the model, again a natural effect since the difference in perceptions explain part of the variation in utility.

*Comparing the two models:*

The data used for this analysis make it possible to entangle the effects of attitudes from socio-demographics. When comparing the results of the two estimations it becomes clear that the utility of the organic characteristic which could easily be seen as a result of living in the capital area or having a long education, partly arises from the fact that these groups generally are more positive towards organic products than the rest of the population. The remaining extra utility of the organic characteristic for households in the capital area must either come from other attitudes not included in the estimation or from structural differences such as easier access to organic goods. This supports the hypothesis that attitudes are correlated with socio-demographics and indicates that part of the effect of socio-demographics observed in studies without information about perception of organic products ought to be ascribed to attitudes rather than socio-demographics.

*Likelihood ratio tests on the most sophisticated model:*

The likelihood ratio (LR) tests presented in the last column of Table 7 show the results of comparing the full model 2 with models where sets of parameters are restricted to zero. As an example, looking at the parameters for age shows that the difference in utility of the general organic characteristic is not significant between the groups 18-29 and 30-44 compared to those who are 60 years old or more. However, the difference between the group of 45-59 and

the 60+ is significant at the 5 per cent level. The LR test shows that the effect of the dummies for the different age groups can be ignored without significant loss of explanatory power (the probability that the model without dummies for age is just as good as the model including age is 5.8 per cent). The effect of children is even less important as the probability of the LR test is 29.8 per cent, which clearly accepts the restricted model without children. The effect of trust in environment is close to being tested out of the model at the 1 per cent level, but the effects of health, income, urbanisation and education are all significant.

*Comparing with other studies:*

As mentioned in the introduction, several studies have investigated the motives for purchasing organic goods. Bonti-Ankomah and Yiridoe (2006) provide an excellent review of the literature including more theoretical contributions about the nature of organic goods. Most studies are based on relatively few respondents and/or stated consumption of organic goods. This paper distinguishes itself by using information about actual purchases (including prices of the purchased goods), socio-demographics and perception of organic goods for each of the 1,022 households in the sample. The results therefore yield information about the final effect of the attitudes and purchase intentions reported in many other studies – namely the actual money put on the counter at the end of the day.

In the present study, the effect of trust in positive effects on *health* is bigger and more significant than the effect of trust in positive *environmental* effects. This corresponds with findings in Makatouni (2002)[10] and Magnusson et al. (2003).[11] As mentioned above, Makatouni (2002) found that health (personal or for their families) was the most important factor when trying to explain stated organic consumption. Environment and animal welfare were also important, but mainly through their impact on the health factor. Magnusson et al.

[10] Makatouni (2002): Results of qualitative interviews with 40 British parents, stated motives for purchasing organic foods.

[11] Magnusson et al. 2001 & 2003: Mail survey, 1,154 Norwegian respondents, stated consumption.

(2003) found that health was the most important predictor of both attitudes towards organic products and purchase intention of these, and that the health factor also was an important predictor of the stated purchase frequency of four types of foods (organic milk, meat, potatoes, and bread). Magnusson et al. also found that perception of the environmental effects of organic foods contributed to the prediction of attitude towards the specific foods, but not to the prediction of stated purchase. The actual purchases under actual budget constraints and prices in the present study therefore confirm the findings in studies using stated motives for purchase of organic goods. Health seems to be more important than the environment, but environmental improvements are likely to be perceived as related to better human health, and therefore influence the purchase decision positively in a more indirect way than health.

The results on *income* vary. Some studies find a positive correlation between income and propensity to purchase organic products (e.g. Fotopoulos and Krystallis, 2002)[12] others find no significant differences (e.g. Wolf, 2002).[13] The present study finds a strong positive and significant effect of income, indicating that the lack of effect in stated behaviour studies might be due to the lack of budget restriction in the hypothetical settings.

The effect of *urbanisation* is rarely investigated, perhaps because many studies focus on specific geographical locations, without much variation in urbanity. However, this study proves that urbanisation is a crucial factor in explaining consumption of organic goods. Part of the effect of urbanisation can be ascribed to a positive correlation between trust in positive environmental and health effects of the organic attribute and degree of urbanisation, but even when controlling for the perception of organic goods, the effect of urbanisation is still very strong. The positive effect of urbanisation may partly be caused by structural differences

[12] Fotopoulos and Krystallis, 2002: Face to face interviews, 1,612 Greek respondents, stated purchasing behaviour.

[13] Wolf, 2002: Personal interview of 342 randomly selected respondents at food stores in May 2001 in San Luis Obispo County, California, stated willingness to pay.

between rural and urban municipalities, leading to a better supply of organic goods in urbanised municipalities. Another possible explanation is a "neighbouring" effect. The trust in positive effects of organic goods is more common in urbanised municipalities and may lead people to purchase organic goods simply because everybody else do so, independent of their own faith in organic products.

The effect of *education* also varies from study to study, but most studies find either an insignificant or a positive effect. One example is Magnusson et al. (2003) who find a positive and significant effect on stated purchase of organic milk, but not on meat, potatoes and bread. Some studies, however, find a negative effect of education on willingness to pay (e.g. Thompson and Kidwell 1998).[14] In the present study, the effect of education is positive, but not as significant as the effect of urbanisation. The observed organic purchase share is 20 per cent for households with no further education (control group) and between 34 and 42 per cent for households with short, medium or long further education (see Table 4). The difference between the control group and the non-control groups is therefore just as big as for the degree of urbanisation (20 per cent in the control group, 42 per cent in the capital area, see Table 4), but the likelihood ratio test of urbanisation (0.000) is stronger than the test for education (0.002). This might be because income seems to be more closely associated with education than with urbanisation.[15] Part of the difference in organic purchase share between educational levels which is observed in simple one-way tables like Table 4 may therefore be caused by differences in income.

In the present study, *age* has no significant effect on the utility of the organic attribute, however, there is a significant difference between households aged 45-49 and households aged 60 years or more, in favour of the oldest households. This is surprising, because the

[14] Thompson and Kidwell 1998: Actual purchases and actual prices, 340 consumers, one shopping trip each, Tucson, Arizona, April 1994.

[15] Andersen (2008), paper 1.

organic purchase share is the same for the two groups (27 per cent, see Table 4). Again, the relationship between income and other socio-demographics becomes important. The probability of belonging to the high income group is 48 per cent for the households aged 45-59, but only 10 per cent for the ones aged 60 or more (Andersen 2008, paper 1). This means that the elderly households purchase organic goods to the same extent as the somewhat younger households in spite of the fact that they have considerably less money. Their utility of the organic attribute is therefore higher. The higher utility of elderly households might be explained by the findings in Wandel and Bugge (1997).[16] Based on stated purchasing motives Wandel and Bugge (1997) find that the importance of environmental effects was decreasing with age whereas the importance of health was increasing. In the present study the effect of trust in positive effects on environment and health is assumed to be the same for all households, and differences will therefore turn up as differences between socio-demographic groups e.g. depending on age. This could be worth exploring further in future research.

Most studies find a positive or insignificant effect of *children* in the household. McEachern and McClean (2002)[17] find that committed consumers who claim that they always buy organic products are more likely to have children, and Thompson and Kidwell (1998) find that children below 18 years old in the household increase the probability of choosing the organic version of certain vegetables. Magnusson et al. (2001) find no significant differences between respondents with and without children. In the present study both the observed difference in organic purchase shares (Table 4) and the estimated effect of children indicate that especially young children between 0 and 6 years have a *negative* effect on the propensity to purchase organic milk. The estimated effect on utility is not significantly different from zero, but the probability that the utility of the organic characteristic is higher for households

[16] Wandel and Bugge (1997): Personal interviews, 1,103 Norwegian respondents, stated willingness to pay and stated purchasing motives.

[17] McEachern and McClean (2002): Questionnaires answered by 200 Scottish consumers, stated consumption.

with young children is only 6 per cent. The positive results of children in other studies can therefore not be confirmed here.

### 1.9. Conclusion

It appears that higher income, further education and especially living in an urban area has a significant positive effect on the probability of choosing organic milk over conventional. Age and presence of children do not have a significant effect. Compared to other studies it is interesting that the effect of young children is highly unlikely to be positive (6 per cent).

Believing that organic production has an effect on the environment increases the utility of the organic characteristic of organic milk, but not as much as believing in an effect on health. This corresponds with findings in other studies which indicate that the positive environmental effects of organic goods are perceived as an indicator of possible improvements in human health.

The effect of organic production on the environment and especially on human health is still being debated. This study shows that a considerable share of the population derives utility from environmentally friendly and especially healthy production. Proving these effects scientifically and thus making more people trust in them could be a fertile way of increasing the sale of organic goods.

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## Appendix A: Data definitions

The variables used in the estimations are:

**Trust in effect on environment and health:** Defined in the paper. See Table 1 and Table 2 for details.

**Income, Urbanisation, Age and Children:** See footnote for Table 4.

**Education:**

Highest level of further education after primary and lower secondary school (for 7- to 16-year-olds) for the father or the mother. Separated into:

- *None stated* (27 per cent of the households)
- *Vocationally oriented high school* (34 per cent of the households)
    - Examples: Basic vocational courses, trainee, apprentice, laboratory technician, nursing aide, 'social- og health assistant'
- *Short further education* (17 per cent of the households)
    - Examples: Policeman, kindergarten teacher, technical school
- *Medium further education* (17 per cent of the households)
    - Examples: Teacher in the primary and lower secondary school, nurse (both of these are not university educations, but requires upper-secondary school), Bachelor
- *Long further education* (5 per cent of the households)
    - Examples: Various Master degrees (at least 5 years at the university after upper-secondary school)