Fairness to dairy cows or fairness to farmers: What counts more in the preferences of conventional milk buyers for ethical attributes of milk?

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Abstract:

We investigate the willingness-to-pay (WTP) of German conventional milk buyers for ethical attributes of milk production through a choice experiment. Respondents have the highest WTP for animal welfare – free-stall plus summer pasture – followed by biodiversity conservation, support for small, below-average income farms, and regional milk production. Respondents also have a positive WTP to support all farms but only in combination with regional production. We further find a positive WTP to support small farms in combination with tethering. This implies animal-welfare concerns are somewhat counterbalanced by fairness aspects. Our insights may support developing labels for ethical aspects of milk production.

Keywords:

dairy production, ethical attributes, fairness, choice modelling, latent class model, biodiversity, grassland

1. Introduction

During the recent EU milk price crisis, producer prices dropped from around 0.38 €/kg in 2014 to less than 0.27 €/kg in 2016 for conventional milk in Germany (Bioland, 2017). These low milk prices led to the closure of many small farms and contributed to the trend of conversion to more intensive, large-scale milk production (Ilchmann, 2017; Sauer, 2016). Similar milk price developments took place in other European countries (see BLE, 2017 for Germany, France, and Austria). As a response, the EU conducted public intervention (buying up and storage of skimmed milk powder) and provided financial support for dairy farms, including a voluntary production reduction scheme, where farmers received 14 Cent for each kilogramme of reduced milk production (compared to their deliveries in the same 3-month period in the previous year). As a response milk prices again reached the levels prior to the milk price crisis at the end of 2016 (EU Milk Market Observatory, 2017).

From an economic perspective, market interventions are inefficient, due to the deadweight losses they create. The market interventions in the milk price crisis cost the EU taxpayer €1 billion for only those support measures financed by the EU (European Commission, 2016). Public intervention also led to the piling up of stored skimmed milk powder between 2015 and 2017 (AHDB Dairy, 2017). Moreover, the voluntary production reduction scheme has been criticized to have 'compensated farmers for production decisions they had already made' (Dairy Australia, 2017: 27).

Dairy farming has also been under pressure for other reasons. From an animal welfare point of view, it has been criticized that cows are kept in tie-stalls (where they are tethered and cannot move freely) and that they often lack access to pastures (Algers et al., 2009; Kikou, 2015). Moreover, an important part of European biodiversity depends on the existence of grassland and its management and, consequently, on how the production system of dairy farming is organised (Klimek, Hofmann and Isselstein, 2007). A diverse and extensive grassland management is highly beneficial for endangered biodiversity (Klimek, Hofmann and Isselstein, 2007; Wätzold et al., 2016). However, today such a production system, with low economic yield, is not economically viable (Hodgson et al., 2005). Even intensively managed grassland is increasingly under pressure to be transformed to arable land due to the rising replacement of grazed-herbage by maize silage and concentrated feed, resulting in adverse effects on biodiversity (IEEP, 2007).

Interestingly, during the milk-price crisis, producer prices for organic milk remained rather stable in Germany at around 0.48 €/kg, (Bioland, 2017). This is unusual as previously the price of organic milk typically followed the fluctuations of conventional milk prices. However, a similar widening of the gap between organic and conventional milk prices could be observed in France during the milk price crisis (CLAL, 2017). This, together with an increasing share of organically produced agricultural goods, including milk, over the past 10 years (Meredith and Willer, 2016), suggests that consumers are increasingly willing to pay more for what they perceive are higher-value agricultural products.

However, organic milk does not offer much product and price differentiation, which suggests that the product and price segment between conventional and organic milk has not yet been fully utilized (note that the market share of organic milk is still low with about 2.6% of the of total EU milk production in 2014: Meredith and Willer, 2016). Thus, besides organic farming, another marketing strategy for more stable milk prices, which may also address the above mentioned challenges of dairy farming, could be value-creation and product differentiation through introducing and marketing different ethical attributes of production. Ethical attributes are associated with social and environmental issues (Luchs, 2010). Ethical issues in milk production for which some industry labels and initiatives already exist include regional/local production, fair prices to farmers, and pasture milk, which refers to milk produced from cows with regular access to pasture.

Several economic studies on preferences for ethical milk attributes have been conducted in Europe applying either choice experiments (CE) or other willingness-to-pay (WTP) approaches. Previous CE studies have focused on preferences for organic and local milk (Illichmann and Abdulai 2013), partly in combination with other attributes (Hasselbach and

Roosen, 2015 with brand names; Klein, 2011 with fair prices for producers; Wägeli, Janssen and Hamm, 2016 with exclusion of GMO production). Some studies analysed preferences for ethical milk attributes on a more general level but have not involved a monetary valuation of specific attributes (e.g. Stolz et al., 2011; Zander and Hamm, 2010). Others have directly asked respondents about their WTP for certain ethical attributes (Hellberg-Bahr, Steffen and Spiller, 2012 and Weinrich et al., 2014 for pasture milk; Ellis et al., 2009 for animal welfare; Emberger-Klein, Menrad and Heider, 2016 for regional milk).

In contrast to previous studies on milk preferences, we focus on conventional milk buyers and include a comprehensive list of ethical milk attributes in a monetary valuation study using a CE. These ethical attributes are animal welfare (statement of the type of housing system and pasture access for dairy cows), the support of biodiversity through milk production, the financial support of small farms with below-average income or of all farms and production in the own region. Furthermore, the ethical attributes in our experiment are not linked to explicitly using labels, certifications or brands, as it has been in previous valuation studies (Hasselbach and Roosen, 2015; Illichmann and Abdulai, 2013; Klein, 2011; Wägeli, Janssen and Hamm, 2016). The reason is that there is no existing label for the ethical attributes (except for regional origin) in Germany and they have not been covered in valuation studies. Our study also provides novel insights in other respects. Previous valuation studies focused on fair prices to all farmers (Klein, 2011). We introduce another dimension of farmers' equity by including fairness to small, below-average-income farms. Moreover, to our knowledge we conduct the first study to provide a monetary valuation for biodiversity conservation in the context of milk production.

The afore-mentioned studies on milk preferences focused on values, attitudes, socio-demographic variables and norms to explain variation in preferences for ethical milk attributes (e.g. Emberger-Klein, Menrad and Heider, 2016). In addition to socio-demographic factors, we use actual buying behaviour towards milk to explain heterogeneity in consumers' preferences for ethical milk attributes. The explanatory variables we use are gender, frequency of organic milk purchase, currently paid milk price, having donated for animal protection and having a farmer as friend or family member. We are especially interested in the preferences of milk buyers who usually buy the cheapest milk. We identify them by including a question on the currently paid price for milk in the questionnaire and use lowest currently paid price as one determinant of preferences. Thereby, respondents' currently paid milk price acts as an indicator for price consciousness, which we expect to have an influence on the WTP for ethical milk attributes.

Moreover, we investigate the preferences for some combinations of ethical attributes (four interaction effects) which to our knowledge have not been addressed in the literature.

(1) *Fairness for dairy cows vs. equity for small, poor farms.* How do milk buyers value support for small, below-average income farms who use tethering of dairy cows (1a) with pasture and (1b) without pasture?

(2) *Influence of product origin on preferences for fairness to milk producers.* Do buyers prefer to support (2a) only small, below-average-income farms or (2b) all farms in their region?

In terms of policy development our results can inform the development of labels for milk products which reflect the preferences of customers. Although we did not explicitly address agri-environmental support measures in our survey, the results might be relevant for their design. From an economic perspective, the design of agri-environmental support should be based on the preferences of the population on public goods provided by agriculture (Hall, McVittie and Moran, 2004). Our study provides information of the preferences of a substantial part of the population – conventional milk buyers – on selected public goods related to milk production.

2. Choice modelling

To investigate the trade-offs in milk preferences we use the stated-preference method CEs, which is based on Lancaster's (1966) characteristics theory of value and on random utility theory (McFadden and Train, 2000). According to the former, consumers' preferences relate to different characteristics of a good and not directly to the good as a whole. According to the random utility theory, the utility U_{nsi} an individual n gets from an alternative i in a choice situation s involves an observable component V_{nsi} and a stochastic element ε_{nsi}, which is not observable to the researcher.

$$U_{nsi} = V_{nsi} + \varepsilon_{nsi} \quad (1)$$

The observable part of utility depends on the characteristics x_{nsi} of the alternative and/or of the respondent and the corresponding marginal utilities or weights β_n that respondents assign to them.

$$V_{nsi} = \beta_0 + \beta'_n x_{nsi} \quad (2)$$

where β_0 represents an alternative-specific constant.

The general form of choice models is represented by equations 3 and 4, where the probability of choosing an alternative i equals the probability that this alternative's utility is higher than the utility of any of the other (J-1) alternatives in a choice set (Hensher, Rose and Greene, 2015).

$$P_{nsi} = Prob\left(U_{nsi} \geq U_{nsj}, \forall i \neq j\right) = Prob\left(V_{nsi} + \varepsilon_{nsi} \geq V_{nsj} + \varepsilon_{nsj}, \forall i \neq j\right),\ j = 1, \dots, J \quad (3)$$

$$P_{nsi} = \frac{\exp(V_{nsi})}{\sum_{j=1}^{J} \exp(V_{nsj})} \quad (4)$$

Different choice models can be employed depending on the assumptions made on the distribution of the stochastic component ε_{nsi}. In a mixed logit model (MLM) the marginal utility parameter estimates are assumed to vary over all respondents with a predefined distribution (cf. Train, 2009). The probability of observing a sequence of choices under the assumption of a certain parameter distribution $f(\beta)$, e.g. normal distribution, in an MLM is specified as (e.g. Kuhfuss et al., 2016):

$$P_{ns} = \int \prod_s \left(\frac{\exp(\beta\prime x_{nsi})}{\sum_{j=1}^{J} \exp\left(\beta\prime x_{nsj}\right)} \right) f(\beta) d(\beta) \quad (5)$$

We employ an MLM with a panel specification for calculating overall mean willingness-to-pay (WTP) values over the whole sample. For ensuring meaningful WTP estimates with correct signs, the utility parameter for price is assumed to be fixed, whereas the other parameters are normally distributed. Alternative-specific constants are included for the A-alternative, the lowest-price fixed alternative and the ‘no-buy’ option and are assumed to be fixed.

In the latent class model (LCM) employed here the utility parameter estimates are assumed to vary between classes of respondents and are fixed within the classes (Boxall and Adamowicz, 2002). The panel specification for the LCM used is shown in equations 5, 6 and 7 (based on Hensher, Rose and Greene, 2015), where c is the index for the estimated latent classes and y is the index of the observed choices. $P_{nsi|c}$ is the probability of individual n choosing alternative i in choice situation s conditional on membership to class c.

$$P_{nsi|c} = \frac{\exp(V_{nsi|c})}{\sum_{j=1}^{J} \exp(V_{nsj|c})} \qquad (6)$$

The probability of membership to class c (P_{nc}) is estimated based on the observed utility component δ_c from the class assignment model and on predefined respondents' characteristics h_n which determine class membership.

$$P_{nc} = \frac{\exp(V_{nc})}{\sum_{c=1}^{C} \exp(V_{nc})}\text{, where } V_{nc} = \delta_c h_n \qquad (7)$$

Using equations 5 and 6 $P_{ns|c}$, the choice probabilities conditioned on the observed choices are calculated based both on the class assignment probabilities P_{nc} and the choice situation probabilities $P_{nsi|c}$.

$$P_{ns|c} = \frac{\prod_s y_{nsj} P_{nsi|c} P_{nc}}{\sum_{c=1}^{C} \prod_s y_{nsj} P_{nsj|c} P_{nc}} \quad , \forall c \in C \qquad (8)$$

WTP values are calculated as the negative ratio of the marginal utility estimates for the attributes ($\beta_{attribute}$) and the marginal utility estimate for price (β_{price}). The confidence intervals of the WTP are computed based on the delta method (Bliemer and Rose, 2013).

$$WTP = -\frac{\beta_{attribute}}{\beta_{price}} \qquad (9)$$

Since we are interested in the preferences of milk buyers who usually buy the cheapest milk, using an LCM is more appropriate than using MLM with heterogeneity. The use of LCM with class membership function enables us to analyse the preferences of different milk consumer groups and allows for separate estimation of WTP values for each estimated latent class of consumers.

In an LCM the number of classes is specified by the analyst and is usually determined after estimation of models with all possible and plausible number of classes based on the resulting values of information criteria, such as Bayesian Information Criteria (BIC) or Akaike Information Criteria (AIC) (Swait, 2007). In our analysis the Bayesian Information Criterion (BIC) and the Consistent Akaike Information Criterion (CAIC) were employed.

3. Survey

We conducted an online CE survey among 1040 conventional milk buyers (individuals who buy occasionally or frequently conventional milk for themselves or their families) in Germany with the help of the survey company Respondi in February 2017. Respondents who only rarely or never buy conventional milk (as opposed to organic milk) were excluded from the survey. Individuals, who frequently or occasionally buy conventional milk and in addition to this frequently or occasionally buy organic milk were allowed to participate. Respondents were screened on representativeness for gender, education, age and size of their place of residence. The quotas for the sampling were based on data for German milk buyers between 18-95 years in the past 12 months from the German marketing study best4planning 2016. Table A. 1 provides an overview of sample statistics based on the quota sampling procedure. The proportion of females in the sample is greater than that of males, as more often women are responsible for shopping.

Respondents faced choices among four hypothetical milk alternatives – two alternatives with changing attributes (‘milk A’ and ‘milk B’), one fixed lowest-price milk alternative with all ethical attributes at their lowest levels (‘milk C’), and one ‘no-buy’ alternative. We decided to include a ‘no-buy’ alternative instead of a real opt-out ‘none-of-these’ option, because we were particularly interested, if, how often, and why customers would choose the lowest-price milk, even though it involved the lowest levels for all ethical attributes. The definition of the opt-out as a ‘no-buy’ alternative also reduces the attractiveness of the opt-out alternative and therefore is likely to amplify the trade-off between price and the ethical attributes of milk. An example of a choice card used in the experiment is provided below.

Please choose one of the three products below. In all eight decision situations you also have the option not to buy milk. Please be honest in your choices and always take into account your financial situation.

	Milk A	**Milk B**	**Milk C**
Animal welfare/ Housing system of dairy cows	free-stall	free-stall + summer pasture	tie-stall
Biodiversity conservation	good for biodiversity conservation	no special biodiversity conservation	no special biodiversity conservation
Support for milk farms	small milk farms with below-average income	no support	no support
Origin of the milk	from your region	from your region	from Germany
Price per litre	1.32 €	0.78 €	0.60 €

○ **I buy milk A** ○ **I buy milk B** ○ **I buy milk C** ○ ***I buy no milk***

Figure 1 Example of choice card used in the survey

The attributes and levels for the experiment were chosen based on the research aims, literature review and focus group discussion. For the animal welfare attribute we focus on particular aspects of animal welfare, namely housing system and the provision of pasture access. We distinguish between four different types of housing systems: tie-stall, tie-stall with summer pasture, free-stall and free-stall with summer pasture. There are other existing housing systems, e.g. having a free-stall and outdoor exercise area. However, we included only the main housing systems to keep the complexity of the trade-offs at an acceptable level.

We considered fairness to farmers as support for dairy farms by providing “fair prices”, whereby a specific part of the consumer milk price can go to a special fund for the support of either all milk farms or only small milk farms with below-average income. This leads to three options: no support, support to all farms, and support to small, below-average-income farms. Support to small, below-average-income farms is related to Rawls' (1971) maximin principle, which postulates that inequalities (in our case in financial support) should be 'to the benefit of the least advantaged', and the needs principle (Miller ,1976; Dobson, 1998), which postulates that those in need should get higher support.

In Germany small dairy farms predominantly use tie-stalls, often in combination with pasture, whereas large farms rarely use tie-stalls, but also rarely provide pasture access (Federal Statistical Office Germany, 2010; see Table A. 2). Therefore, it becomes an interesting question, whether milk buyers gain utility from supporting small farms despite cow tethering[1]. To analyse this trade-off between animal welfare and fairness to small, below-average income farms we estimate two interaction effects: support for small, below-average-income farms with tethering and summer pasture; and support for small, below-average-income farms with tethering.

We are also concerned with the preferences of milk buyers for biodiversity conservation through milk production practices. Traditional extensive dairy farming supports biodiversity, whereas the intensification of milk production leads to a decline in grassland species diversity (CEAS Consultants, 2000). Thus, depending on the type of production, dairy farming can have a negative or a positive effect on grassland biodiversity. In the CE the biodiversity-conservation attribute takes two levels – good for biodiversity conservation with the conservation of many endangered species, and no special biodiversity conservation whereby due to intensification the loss of grassland biodiversity is not mitigated. We explicitly stated that especially meadow birds and butterflies can profit from extensive grassland management by dairy farmers. As Lienhoop and Brouwer (2015) conclude, in stated-preference studies information on the type of species protected is instrumental for valuing biodiversity by respondents.

[1] For small farms tethering is allowed in organic milk production, provided that summer pasture is used and the cows have access to open air at least twice a week in winter (Article 39 of Commission Regulation (EC) No 889/2008).

For the origin of milk we set two levels – regional and national origin - to keep the complexity of trade-offs in acceptable limits. In Germany consumer milk is rarely imported, in the last years imports account for only about 7% of the total milk production (MIV, 2016). To analyse preferences for fairness to farmers when buying regional milk, we estimate two interaction effects: between regional origin and support for either small, below-average income farms or all farms.

Table 1 provides an overview of the attributes and levels included in the CE and Table A. 3 in the appendix a complete description of attributes and levels from the survey questionnaire.

Table 1 Attributes and levels included in the CE

Attributes	Levels
Animal welfare/ Housing system of dairy cows	- Tie-stall - Tie-stall with summer pasture - Free-stall - Free-stall with summer pasture
Biodiversity conservation	- Good for biodiversity conservation – many endangered species protected - No special biodiversity conservation – loss of biodiversity not mitigated
Support for milk farms – fair prices to producers	- Support for all milk farms - Support for small milk farms with below-average income - No support
Origin of the milk	- From your region (within a radius of max. 40 km) - From Germany
Price per litre[2]	0.60 €; 0.78 €; 0.96 €; 1.14 €; 1.32€

The survey questionnaire included questions on milk purchases of respondents, importance of/ attitude towards different ethical aspects in buying decisions in general, and information on the CE, the different milk attributes, and the choice cards. Debriefing questions on the choice of the fixed and 'no-buy' alternatives and on the importance of cows' welfare and support to

[2] The different price levels were based on real consumer prices in Germany in February 2017.

dairy farms to respondents, as well as an explicit question on individual WTP for milk with additional ethical attributes, and socio-demographic questions were also included.

Ngene software was used to create a Bayesian D-efficient design (Bliemer, Rose and Hess, 2008) with a fixed alternative and a 'no-buy' alternative for the estimation of main effects and the four mentioned interaction effects. Ignoring any interaction effect by assuming its insignificance can lead to loss of information and confounding, whereas including many interaction effects leads to larger designs (Hensher, Rose and Greene, 2015). Therefore, we only estimate the interaction effects of interest, and acknowledge that this is a limitation of the design.

The design included a requirement for the combination of levels of the fixed C-alternative and a constraint for excluding alternatives with all attributes equal to the fixed C-alternative in the A-and B-alternatives. Alternative-specific constants were included for the fixed and 'no-buy' alternatives. The attribute levels were effects-coded, except for price, which was coded as a continuous variable.

A pretest consisting of two consecutive parts, with separate D-efficient Bayesian designs and 50 respondents each, was conducted online by the survey company. In the first pretest no regional production attribute was included, but a three-level biodiversity-conservation attribute (high, medium and no biodiversity conservation level). In the second pretest the choices included regionality of milk production and a two-level biodiversity conservation attribute. Since the estimated two parameters for the three effects-coded levels of biodiversity conservation in the first pretest - without regionality - were insignificant, whereas the parameter for the one effects-coded biodiversity-conservation variable for the two levels in the second pretest was highly significant we decided to use two levels for biodiversity conservation in the main survey. With three levels for biodiversity conservation, it might have been difficult for respondents to distinguish between the levels, since limiting information load is important in eliciting preferences (Hensher, 2006).

In the main survey normally distributed Bayesian priors based on the results of the pretest were used to generate an MNL D-efficient Bayesian design with 24 choice sets in three blocks with 8 choice sets each. Respondents were randomly assigned to the three blocks and the order of choice cards was randomized between respondents. The priors of the price and the ‘no-buy’ constant were fixed to facilitate the design procedure.

4. Results

4.1. Overall results

Only five respondents chose the ‘no-buy’ alternative on each choice card, the answers to the debriefing questions showed no protest responses. 11.8%, or 123 respondents chose the fixed lowest-price alternative on all cards: 107 of them because for them price is the most important factor in the buying decision; 10 of them, because the decision was difficult due to too much information; six of them chose other reasons, which however also do not show protest responses. 106 (or 86%) of the 123 “only lowest-price-alternative choosers” pay currently the lowest milk price - 0.60 € to 0.69 €. Overall, the lowest-price alternative accounted for 20% of all the choices made.

An overview of the estimated utility parameters in the choice models and goodness-of-fit indicators provide Table A. 5 and Table A. 6. The LCM with heterogeneity in preferences leads to a substantial improvement in goodness of fit. Especially the choice of the fixed option can be much better modelled with it.

In the process of LCM specification we tested different current buying behaviour variables and socio-demographic characteristics as predictors of preference heterogeneity in the class membership function and selected only the significant ones. The estimated LCM with significant covariates and best fit (see section 4.3), includes a class membership function based on gender, frequent organic milk purchasing, lowest currently paid price - 0.60 € to 0.69 € per litre (in the following referred to as cheapest-milk buyers), currently paid price between 0.70 and 0.79 €/litre, high currently paid price (above 1 €/litre), having a farmer as friend or family member and having donated for animal protection in the last two years (see list of variables used in Table A. 4). The LCM was estimated with up to 6 classes. For further analysis we use the results of the five-class LCM, since it leads to lowest values for the information criteria BIC and CAIC.

We also investigated whether heterogeneity of preferences was present depending on the socio-demographic characteristics income, education, age, having children and rural or urban residents (differentiated according to data on district type from BBSR, 2015). However, the influence of these characteristics was insignificant. Actual buying behaviour variables which were tested and also had no significant influence on heterogeneity of preferences were: frequently buying pasture milk, frequently buying regional milk and donation for environmental protection in the last two years.

By including the variable 'cheapest-milk buyers' in the class membership function of the LCM we can show which attributes appeal most to many members of this group of buyers and are also able to derive corresponding WTP values. In the sample, the group of 'cheapest-milk buyers' is represented by individuals from all income classes, not only from the lowest income classes and also all LCM classes include some respondents from the group of the 'cheapest-milk buyers'.

4.2. WTP estimation

The coefficients derived from the MLM were used in the estimation of overall mean WTP values over all respondents. MLM estimation with fixed price and all other parameters being random and normally distributed leads to significant standard deviation values, except for the last, forth, interaction effect (support of all farms in the own region). Therefore, here we present the results from the estimation with fixed fourth interaction effect.

The WTP resulting from the MLM is highest for the highest level of animal welfare (free-stall plus summer pasture) and equals 24 Cent/litre (Table 2). Biodiversity conservation is valued at 9 Cent/litre. The second most preferred housing system (tie-stall plus summer pasture) and support for small, below-average-income farms are similarly valued at 7 Cent/litre. Regional production is valued less than the afore-mentioned ethical attributes, at 3 Cent/litre. The WTP as well as the marginal utility estimate for free-stall from the MLM are negative and significant.

Table 2 WTP from mixed logit model (MLM)

Attributes/ Interactions	**WTP (€)**	**95% Confidence interval**	
Free-stall+pasture	0.24***	0.21	0.27
Free-stall	-0.02**	-0.05	0.00
Tie-stall+pasture	0.07***	0.05	0.10
Biodiversity conservation	0.09***	0.07	0.11
Support for small farms	0.07***	0.03	0.10
Support for all farms	-0.02	-0.05	0.01
Regional milk	0.03**	0.01	0.05
Interactions			
Tie-stall+pasture*Support for small farms	0.08***	0.02	0.15
Tie-stall*Support for small farms	0.08***	0.02	0.15
Regional milk*Support for small farms	-0.03	-0.08	0.03
Regional milk*Support for all farms	0.13***	0.07	0.19

Note: *** significant at 1%, ** significant at 5%, * significant at 10%

The combinations of tethering (with and without pasture) and support for small, below-average-income farms are positively valued by respondents, at 8 Cent/litre. The WTP for the interaction between support of all farms and regional milk is 13 Cent/litre, which is the second highest estimated WTP value from the MLM.

As expected, support of small, below-average-income farms is higher valued than support for all farms. Surprisingly, the mean WTP for supporting all farms in general is negative and insignificant. However, for regional milk respondents show positive WTP for supporting all farms and negative and insignificant WTP for supporting only small, below-average income farms.

4.3. Heterogeneity in preferences – LCM class differences

Since the model fit of the estimated LCM is much better and it captures heterogeneity in preferences among different consumer groups, the WTP values resulting from it are more indicative (Table 3). The five LCM classes are differentiated according to socio-demographic characteristics, attitudes and buying behaviour. The comparison is based on the estimates for the class membership function from the LCM and tests on statistical significance (Pearson Chi-square, Mann-Whitney and Kruskal-Wallis tests) of differences between the classes.

Two of the five estimated latent classes of respondents, classes 3 and 4, have higher proportion of cheapest-milk buyers and two classes, classes 1 and 2, have higher proportion of high-price milk buyers, class 5 has higher proportion of buyers with currently paid prices in the middle range (between 0.70 - 1 €/litre).

Respondents in class 4 are highly price sensitive, with lower mean income, lower mean education level and no WTP for ethical attributes (most of the members have chosen the fixed lowest-price alternative in all choice sets). There are no statistically significant differences in mean education level among the other classes 1, 2, 3 and 5. Mean age is also not significantly different between the LCM classes.

Respondents in class 3 are also highly price-sensitive, with lower currently paid milk prices, and lower mean income, but show WTP for highest animal welfare (free-stall with summer pasture) and support for small, below-average-income farmers with tethering (with and without summer pasture).

Members in class 1 show overall highest WTP values and would support small, below-average-income farms (also in combination with tethering and summer pasture), but not all farms. It includes many higher income, mainly female (69% of members), organic and regional milk buyers, who currently pay higher milk prices. 71% of the frequent organic milk buyers and half of the frequent pasture milk buyers in the sample are members of this class (Table A. 7).

Class 2, with the second highest WTP values, also has higher female representation (69% of members) and higher proportion of members, who currently pay higher milk prices. Respondents in this class show preferences for highest animal welfare (free-stall plus summer pasture), biodiversity conservation and regional production and would support small, below-average-income farms who use tethering with summer pasture.

Table 3 WTP from LCM panel model (insignificant values in grey colour)

	Class 1 - 'organic, regional, animal and farmer fairness milk buyers'			Class 2 - 'highest animal welfare, biodiversity and regional milk buyers'			Class 3 - 'lower income, price sensitive milk buyers with preferences for animal and farmer fairness'			Class 4 - 'lower income, cheapest-milk buyers with no WTP for ethical attributes'			Class 5 - 'animal and farmer fairness milk buyers'		
Attributes/ interactions	**WTP**	**95% Confidence interval**		**WTP**	**95% Confidence interval**		**WTP**	**95% Confidence interval**		**WTP**	**95% Confidence interval**		**WTP**	**95% Confidence interval**	
Free-stall+pasture	1.71***	0.79	2.63	0.45***	0.37	0.52	0.06***	0.02	0.10	-0.04	-14.85	14.77	0.10***	0.07	0.13
Free-stall	-0.38***	-0.64	-0.13	0.04	-0.02	0.11	0.00	-0.04	0.03	0.27	-18.07	18.61	-0.01	-0.04	0.01
Tie-stall+pasture	0.49***	0.18	0.80	0.04	-0.03	0.12	0.01	-0.02	0.04	-0.14	-9.50	9.23	0.04***	0.02	0.07
Biodiversity conservation	0.70***	0.37	1.03	0.16***	0.13	0.19	0.01	0.00	0.03	-0.11	-12.25	12.04	0.06***	0.05	0.07
Support small farms	0.58***	0.17	0.98	0.06	-0.01	0.13	-0.02	-0.07	0.03	0.22	-399.91	400.34	0.05***	0.02	0.08
Support for all farms	0.00	-0.21	0.22	0.00	-0.08	0.07	0.03	-0.01	0.06	0.01	-421.29	421.31	-0.03**	-0.06	0.00
Regional milk	0.30**	0.07	0.53	0.06*	-0.01	0.12	0.01	-0.01	0.03	0.26	-627.29	627.81	0.01	-0.02	0.03
Tie-stall+pasture* Support small farms	0.54**	0.08	0.99	0.21***	0.06	0.36	0.10**	0.01	0.18	0.66	-51.60	52.93	0.00	-0.06	0.07
Tie-stall* Support small farms	0.35	-0.08	0.77	-0.02	-0.31	0.28	0.09*	0.00	0.18	-0.34	-4085.13	4084.44	0.08**	0.02	0.15
Regional milk* Support small farms	0.26	-0.15	0.66	-0.10	-0.26	0.06	0.01	-0.05	0.08	-0.59	-1248.17	1246.99	0.00	-0.06	0.06
Regional milk* Support all farms	0.22	-0.33	0.76	0.15	-0.04	0.34	-0.01	-0.09	0.06	0.34	-1241.63	1242.30	0.09**	0.01	0.18

Note: *** significant at 1%, ** significant at 5%, * significant at 10%

Class-5 respondents have significant WTP for animal welfare, biodiversity conservation and farmer support, and for supporting all farms within their region.

Paired-classes income comparisons show that the mean income in class 1 is higher than in class 3 and 4, but not higher than that of class 2, and only on the 10% significance level higher than the mean income of class 5. The higher income classes (above 3,000 €/month household net income) are most represented in class 1 and class 5 and less in class 2, but all the other (lower) income classes are also represented in these LCM classes. The class with no significant WTP values, class 4, has the highest proportion of low-income individuals as members (with below 1,000 €/ month household net income), and the lowest proportion of high-income individuals together with class 3. Thus, income seems to play a role in milk preferences, but not always.

All respondents who chose the fixed lowest-price alternative (quasi-status quo) on all cards are members of class 4 and make up 88.5% of it. 86.3% of this class also currently pay the lowest milk price. In class 3 these respondents account for 71.8% of the members. Thus, class 3 and 4 are the classes with highest percentage membership of cheapest-milk buyers, one third of them are members of class 4. Cheapest-milk buyers are, however, represented in all LCM classes and account for about one third of the members of class 5 and one fourth of the members in class 2.

Cheapest-milk buyers are also represented in all income classes – they account for almost 50% of the members of the lowest income class and for almost 20% of the highest income class. 76% of all cheapest milk buyers stated WTP higher than their currently paid milk price for ethical milk attributes.

Individuals who have donated for animal protection and those having donated for environmental protection are most represented in class 1 (Table A. 7). There are also significant differences in the general attitude to agriculture between classes. Respondents in class 1, with the highest WTP values, have on average the most positive attitude to agriculture followed by class 2 and 5, class 4 respondents have the least positive attitude.

5. Discussion and conclusions

We analyse preferences and WTP for ethical attributes of milk among conventional milk buyers in Germany. By far, the highest ranked ethical milk attribute in our experiment is the highest level of animal welfare included in the experiment - free-stall plus summer pasture. Almost all respondents are willing to pay for it, including buyers with lower income and less ethical preferences in general.

Based on the mean WTP values over all respondents, the ethical attributes from our experiment can in general be ranked as follows: animal welfare, regional milk plus fair prices for all farms, biodiversity conservation, support for small below-average income farms (with and without tethering and in general), regional milk, fair prices to all farms. These results are in line with insights by Zander and Hamm (2010) into the preferences of regular and occasional consumers of organic food in five European countries for ethical attributes of organic milk. However, in their study no WTP values were elicited and the focus was exclusively on organic milk preferences.

We employed different buying and socio-demographic variables in the analysis of preference heterogeneity among buyers, and found price-consciousness, gender and frequency of organic milk consumption to be the most important determinants of respondents' ethical preferences for milk production. Emberger-Klein, Menrad and Heider (2016) identified price-consciousness as the most important determinant of WTP for fairly produced, local milk.

In some studies socio-demographic characteristics have been less important determinants of preferences for ethical attributes of food than social identification, attitudes and values (e.g. Bartels, 2010 for adoption of new organic products in general; Klein, 2011 and Stolz et al., 2011 for milk). Similarly to our study, however, Illichmann and Abdulai (2013) found significant differences in preferences between males and females (for organic milk, beef and apples) with women having lower WTP values for organic milk than men. By contrast, in our experiment women represent two thirds of the buyers with highest WTP values for ethical milk attributes. This is in line with other research, which suggests that women are more likely to buy organic products (Gil, Gracia and Sánchez, 2000) and place higher importance on local origin of products (Weatherell, Tregear and Allison, 2003).

Income also partly plays a role as a determinant of WTP for ethical milk attributes with lower income respondents showing lower WTP. However, we also find that cheapest-milk buyers are represented in all income classes and that many of them show a willingness to spend more (than what they currently pay) to buy milk with ethical attributes. This change in price-sensitivity could be triggered by the provision of information on ethical milk attributes through the CE. Feedback provided by respondents at the end of the online survey supports this conclusion. The importance of information for raising awareness and building consumers' preferences for ethical milk attributes is also confirmed by Wägeli, Janssen and Hamm (2016). Therefore, better information provision with respect to dairy production practices, for example credible and accountable statement on housing and pasture access displayed on the packaging, could change the price sensitivity of buyers.

Interestingly, in Illichmann and Abdulai (2013), survey respondents were willing to pay much higher premium for organic milk from their region - 0.58 € more. One reason for the higher premium for regional origin might be that their study focused on organic milk. Another reason for the lower importance of regional origin for respondents in our study could be the so-called embedding effect. In our CE the respondents faced trade-offs between several appealing ethical attributes. As a recent study by Waldrop, McCluskey and Mittelhammer (2017) suggests, adding multiple sustainability claims or certifications to a product may result in lower price premiums for the additional claims.

The more detailed and differentiated definition of fairness to farmers in our case leads to some interesting results, too. Overall, respondents prefer to support small, below-average-income farms and not all farms. This is in contrast to previous studies (e.g. Klein 2011) where fair production has been defined as all farmers getting back a fixed amount of the price per litre. In our experiment, however, we have specified an additional level of fairness – fairness to poorer farmers – and it is valued higher by consumers. Interestingly however, when buyers buy regional milk, support to all farms is preferred. Possible explanations of this result might be a willingness to support the whole dairy production in the own region and different viewpoints of consumers concerning fairness to farmers on the national and regional level. In general, respondents show greater support for small, below-average income farms. However, apart from contributing to environmental protection, by buying regional products, consumers typically want to support the local economy (Hasselbach and Roosen, 2015; Menapace and Raffaelli, 2016) and thus may focus more on supporting all farms in their region. Another possible reason for this result might be confounding of dropped interaction effects, which as mentioned earlier might be a limitation of the experimental design.

The existing WTP for a combination of tethering (with and without pasture) and support for small, below-average-income farms among milk buyers suggests that to many consumers fairness to farmers is more important than animal welfare, when it comes to small, below-average-income farms. This is an argument in favour of those who still reject a complete ban on tie-stalls in Germany, as it would affect mainly small farms for which an investment in free-stalls is often not economically viable. However, this might change if consumers support animal friendly housing practices through higher milk prices. The presence of preferences among respondents for fairness to weak income groups has also been found in other contexts in CE (e.g. see Markova-Nenova and Wätzold, 2017 for donations for forest conservation in developing countries).

A possible limitation of our study is the inclusion of a 'no-buy' alternative instead of a real opt-out 'none-of-these' option which restricts the possible choices for respondents. In our hypothetical experiment, one of the aims was to check to what extent milk buyers are price-sensitive and analysing the trade-off between price and ethical attributes of milk was particularly important. The inclusion of a 'none-of-these' alternative would have been inappropriate, taking into account the fact that this could have increased the probability of respondents choosing the opt-out instead of the fixed lowest-price alternative. By defining a fixed alternative and a 'no-buy' alternative we were able to check what portion of the milk buyers are only interested in price or can only afford the lowest price and would not dispense with milk.

Our study suggests that a substantial share of conventional milk buyers is willing to pay a premium for ethical attributes related to milk production. However, consumers are typically only willing to pay this premium if they have trustworthy information that the ethical standards are actually met in the production process. For this purpose credible and traceable labels are needed.

Since the highest WTP was elicited for the highest level of animal welfare – free-stall plus summer pasture – developing a nationwide pasture milk label seems appropriate, similar to the pasture milk label in the Netherlands (Stichting Weidegang, 2017). The significant WTP for support of small, below-average-income farms in combination with tie-stall and pasture indicates that a pasture label could be attractive to customers even without a complete restriction on tethering, as it is the case with the newly developed pasture milk label for the German federal state of Lower Saxony. Here, tethering is allowed, but under the condition of more pasture days per year than for free-stall cows and if outdoor access is provided every two days for at least one hour (Lower-Saxony Ministry of Food, Agriculture and Consumer Protection, 2017). The substantial WTP for biodiversity conservation through milk production implies that this could also be an attractive characteristic for a milk label.

Given that from an economic perspective the design of public policies should follow the preferences of citizens (Page and Shapiro, 2010) and that our survey captures the preferences of a substantial part of citizens with respect to ethical attributes of dairy production, the insights from our study can also be used to support the design of agri-environmental schemes. Our results indicate that, by and large, citizens support measures directed at animal welfare, biodiversity conservation and small, below-average income farms. Notably, citizens have only preferences for a general support of farms if they see a link to their own region. This suggests that the policies adopted by governments in the recent milk crisis are not only in line with what economists suggest but also not in line with the preferences of citizens.

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Appendix

Table A. 1 Sample statistics

Quota sampling based on:	**Sample in %**	**(count)**
Gender		
Male	42.5	(442)
Female	57.5	(598)
Age (years)		
18-29	15.1	(157)
30-39	14.7	(153)
40-49	18.1	(188)
50-59	18.8	(195)
>=60	33.4	(347)
Highest level of education completed		
No secondary general school-leaving certificate	0.4	(4)
Secondary general school-leaving certificate without apprenticeship qualification	5.7	(59)
Secondary general school-leaving certificate with apprenticeship qualification	33.0	(343)
Intermediate school-leaving certificate	31.4	(327)
University/ polytechnic entrance qualification	14.5	(151)
Higher education (university/ polytechnic)	15.0	(156)
Settlement size (population numbers)		
1-4.999	14.3	(149)
5.000-19.999	26.2	(272)
20.000-99.999	27.7	(288)
>=100.000	31.8	(331)
Sample size (count)	1040	

Table A. 2 Percent of cows kept in tie- and free-stalls and provided with pasture access in Germany, in total and according to farm size (data from 2009 provided by the Federal Statistical Office Germany 2010).

	Tie-stall	**Free-stall**	**Access to pasture**	**% of cows**
According to farm size:				
smallest farms (1-19 cows)	89.9%	8.4%	44.5%	6.0%
small farms (20-49 cows)	69.4%	30.1%	41.2%	24.9%
medium-sized farms (50-199 cows)	8.5%	91.2	50.6%	48.8%
large farms (≥ 200 cows)	2.9%	95.6	16.6%	20.4%
All farms	27.3%	72.0%	41.8%	100%

Note: In tie-stall systems cows are tethered and cannot move freely whereas in free-stalls they can move around the stall.

Table A. 3 Information on attributes and levels used in the text of the survey

Information pertaining to the characteristics and production processes involved in the different milk alternatives, which you will see in the next survey section.

- Animal welfare/ Housing system of dairy cows

This characteristic of the milk alternatives shows how appropriate the housing system is for the species. In Germany about one fourth of the milk cows are kept in tie-stalls, 42% of all dairy cows have access to pasture.

- Tie-stall, i.e. the dairy cows cannot walk around, but just stay up or lie
- Tie-stall with summer pasture, i.e. the dairy cows cannot walk around in the stall, but they are kept on pasture during summer
- Free-stall, i.e. the dairy cows can walk around in the stall, but not outside
- Free-stall with summer pasture, i.e. the dairy cows can move around all year round in the stall and in summer also on the pasture field

- Biodiversity conservation – Effect of the milk production on the protection of endangered species, especially birds, which breed on pastures and meadows, but also on butterflies and other insects.

Irrespective of the housing system used (e.g. if pasture access is provided or not) milk farmers can aid biodiversity conservation by e.g. longer intervals between cuts and by mowing outside the breeding times of meadow birds, and by reduced use of fertilizer and concentrated feed. Thus, milk production can have the following effect on endangered species:

- Good for biodiversity conservation– many endangered species get protected

e.g. through reduced use of mineral fertilizer and a differentiated meadow and pasture management that is oriented at protecting many different endangered species – such as ensuring no cut during the reproductive period of meadow birds.

- No special biodiversity conservation – loss of biodiversity is not mitigated

e.g. in the case of intensive grassland management without fertilizer use restrictions and with high input of concentrated feed, such as grain, maize and soy

• Support for milk farms – fair prices to producers To ensure that milk farmers get sufficient income, a specific part of the end price of milk (e.g. 10 Cent per litre) can go to a special fund for the support of either all milk farms or of only small milk farms with below-average income. - Support for all milk farms - Support for small milk farms with below-average income - No support
• Origin of the milk – through regional/local production transport distances are shortened and regional enterprises are supported - From your region (within a radius of max. 40 km) - From Germany
• Price per litre – 0.60 €; 0.78 €; 0.96 €; 1.14 €; 1.32€

Table A. 4 Overview of variables used in the presented choice models

Variable	Meaning	Coding
Attributes		
Free-stall+pasture	Free-stall+summer pasture	1, if yes, -1, if tie-stall, 0, otherwise
Free-stall	Free-stall	1, if yes, -1, if tie-stall, 0, otherwise
Tie-stall+pasture	Tie-stall+summer pasture	1, if yes, -1, if tie-stall, 0, otherwise
Biodiversity conservation	Biodiversity conservation	1, if yes -1, if no
Support small farms	Support for small farms with below-average income	1, if yes, 0, if support for all farms, -1, if no support
Support all farms	Support for all farms	1, if yes, 0, if support for small farms, -1, if no support
Regional milk	Regional milk	1, if yes -1, if no
Price	Price in € per litre	0.60, 0.78, 0.96, 1.14, 1.32
Alternative-specific constants (ASC)		
A-ASC	ASC for the A-Alternative	1, for A-alternative 0, otherwise
SQ-ASC	ASC for the lowest fixed-price alternative	1, for fixed alternative 0, otherwise
NO-ASC	ASC for the 'no-buy' alternative	1, for 'no-buy' alternative 0, otherwise
Covariates		
Gender	Female Male	1, if female 0, if male
BuyerOrg	Frequent organic milk buyers	1, if yes 0, if no
SQPlow 'cheapest-milk buyers'	Buyers with lowest currently paid price (0.60 € – 0.69 € per litre)	1, if yes 0, if no
SQP70	Buyers with currently paid price between 0.70 € – 0.79 € per litre	1, if yes 0, if no
SQPhigh	Buyers with high currently paid price (≥1.00 € per litre)	1, if yes 0, if no
Friendfarm	Buyers having a farmer as friend or family member	1, if yes 0, if no
DonAnimal	Buyers having donated for animal protection in the last two years	1, if yes 0, if no

Table A. 5 Results of panel mixed logit model

Attribute	Marginal utility	Standard error	95% Confidence interval	
Random parameters in utility functions				
Free-stall+pasture	1.15***	0.08	1.00	1.31
Free-stall	-0.11**	0.06	-0.23	0.00
Tie-stall+pasture	0.35***	0.07	0.22	0.48
Biodiversity conservation	0.43***	0.04	0.35	0.51
Support small farms	0.31***	0.08	0.16	0.47
Support all farms	-0.10	0.06	-0.22	0.03
Regional milk	0.13**	0.05	0.02	0.23
Tie-stall+pasture*Support small farms	0.40***	0.15	0.10	0.70
Tie-stall*Support small farms	0.40***	0.15	0.10	0.71
Regional milk*Support small farms	-0.12	0.13	-0.38	0.14
Nonrandom parameters in utility functions				
Regional milk*Support all farms	0.62***	0.15	0.33	0.91
Price	-4.77***	0.18	-5.13	-4.42
A-ASC	-0.33***	0.06	-0.44	-0.21
SQ-ASC	-1.21***	0.11	-1.41	-1.00
NO-ASC	-6.39***	0.20	-6.79	-6.00
Standard deviation of random parameters				
NsFree-stall+pasture	1.59***	0.08	1.43	1.75
NsFree-stall	0.52***	0.11	0.30	0.75
NsTie-stall+pasture	0.89***	0.08	0.74	1.05
NsBiodiversity conservation	0.88***	0.04	0.80	0.97
NsSupport small farms	1.09***	0.06	0.97	1.21
NsSupport all farms	0.39***	0.07	0.26	0.53
NsRegional milk	0.51***	0.05	0.42	0.61
NsTie-stall+pasture*Support small farms	1.22***	0.22	0.78	1.65
NsTie-stall*Support small farms	1.02***	0.22	0.58	1.45
NsRegional milk*Support small farms	0.83***	0.17	0.50	1.17
Goodness of fit				
Number of respondents	1,040			
Number of observations	8,320			
Log-likelihood	-7,521.17			
McFadden Pseudo-R^2	34.79%			
BIC	15,267.99			
CAIC	15,292.99			
AIC(normalized)	1.81			

Note: *** significant at 1%, ** significant at 5%, * significant at 10%.

Table A. 6 a. Results from latent class model with class membership function (insignificant values in grey colour)

Class	Class 1 - 'organic, regional, animal and farmer fairness milk buyers'			Class 2 - 'highest animal welfare, biodiversity and regional milk buyers'			Class 3 - 'lower income, price sensitive milk buyers with preferences for animal and farmer fairness'			Class 4 - 'lower income, cheapest-milk buyers with no WTP for ethical attributes'			Class 5 - 'animal and farmer fairness milk buyers'		
Attribute	**Marg. utility**	**95% Confidence interval**		**Marg. utility**	**95% Confidence interval**		**Marg. utility**	**95% Confidence interval**		**Marg. utility**	**95% Confidence interval**		**Marg. utility**	**95% Confidence interval**	
Utility parameters															
Free-stall+pasture	1.35***	1.19	1.51	1.74***	1.50	1.98	0.69**	0.16	1.23	-0.51	-176.36	175.33	0.68***	0.46	0.90
Free-stall	-0.30***	-0.45	-0.16	0.17	-0.08	0.42	-0.05	-0.42	0.31	3.53	-178.55	185.61	-0.10	-0.27	0.07
Tie-stall+pasture	0.39***	0.21	0.56	0.16	-0.13	0.44	0.11	-0.18	0.41	-1.77	-119.83	116.29	0.29***	0.12	0.46
Biodiversity conservation	0.55***	0.44	0.67	0.63***	0.49	0.76	0.14	-0.06	0.34	-1.37	-61.58	58.84	0.41***	0.32	0.50
Support small farms	0.46***	0.29	0.62	0.22	-0.06	0.49	-0.28	-0.88	0.31	2.80	-5042	5048	0.33***	0.10	0.56
Support all farms	0.00	-0.17	0.17	-0.02	-0.30	0.26	0.31	-0.13	0.75	0.09	-5459	5459	-0.19**	-0.38	0.00
Regional milk	0.24***	0.09	0.38	0.22*	-0.01	0.46	0.12	-0.15	0.38	3.35	-7971	7977	0.04	-0.11	0.20
Price	-0.79***	-1.25	-0.33	-3.87***	-4.67	-3.07	-11.53***	-13.46	-9.60	-12.97	-1391	1365	-6.68***	-7.27	-6.09
Tie-stall+pasture *Support small farms	0.42**	0.07	0.78	0.82***	0.25	1.39	1.10**	0.08	2.13	8.62	-442.16	459.41	0.03	-0.40	0.47
Tie-stall*Support small farms	0.28	-0.10	0.65	-0.06	-1.19	1.06	1.01*	-0.11	2.12	-4.47	*********	52993	0.56**	0.10	1.01
Regional milk*Support small farms	0.20	-0.12	0.53	-0.40	-1.01	0.20	0.14	-0.60	0.88	-7.64	*********	15788	0.00	-0.37	0.37
Regional milk*Support all farms	0.17	-0.24	0.58	0.60	-0.14	1.33	-0.13	-1.01	0.74	4.36	*********	16317	0.63**	0.07	1.18
SQ-ASC	-2.94***	-4.03	-1.85	-2.94***	-5.05	-0.82	-1.44***	-2.03	-0.85	11.46	-15949	15972	-3.05***	-3.37	-2.73
NO-ASC	-3.93***	-4.51	-3.36	-3.17***	-3.90	-2.44	-13.03***	-14.59	-11.47	-7.76	-2310	2294	-9.86***	-10.61	-9.12
A-ASC	-0.27***	-0.43	-0.11	-0.26	-0.59	0.08	-0.12	-0.53	0.28	-3.82	-272.92	265.28	-0.19**	-0.37	-0.01
Class membership function parameters															
Constant	-0.69***	-1.17	-0.20	-1.58***	-2.16	-1.01	-2.16***	-3.13	-1.19	-3.32***	-4.86	-1.78	0.00	(Fixed Parameter)	
Gender	0.89***	0.47	1.32	0.73***	0.23	1.23	-0.15	-0.71	0.40	-0.33	-0.83	0.17	0.00	(Fixed Parameter)	
BuyerOrg	0.93**	0.13	1.72	0.61	-0.40	1.61	0.46	-7.13	8.04	-5.68	-4008	3997	0.00	(Fixed Parameter)	
SQPlow	-0.60**	-1.17	-0.02	0.08	-0.61	0.77	2.30***	1.30	3.29	3.97***	2.41	5.54	0.00	(Fixed Parameter)	
SQP70	-056*	-1.13	0.02	-0.10	-0.77	0.57	0.95*	-0.12	2.01	1.70**	0.04	3.35	0.00	(Fixed Parameter)	
SQPhigh	1.79***	1.16	2.42	1.17***	0.41	1.93	-0.44	-8.12	7.24	1.77*	-0.10	3.64	0.00	(Fixed Parameter)	
Friendfarm	-0.41	-0.94	0.12	0.27	-0.28	0.82	-0.69*	-1.44	0.07	-0.72**	-1.39	-0.06	0.00	(Fixed Parameter)	
DonAnimal	0.91***	0.23	1.60	0.84**	0.08	1.59	-0.33	-1.60	0.94	-2.22**	-4.32	-0.11	0.00	(Fixed Parameter)	

Note: *** significant at 1%, ** significant at 5%, * significant at 10%. Fixed parameter is constrained to equal the value

Table A. 6 b. Results for goodness of fit from latent class model with class membership function

Indicator	Value
Number of respondents	1,040
Number of observations	8,320
Log-likelihood	-5,999.60
McFadden Pseudo-R^2	47.98%
BIC	12,965.02
CAIC	13,072.02
AIC(normalized)	1.47

Table A. 7 LCM class membership of frequent organic and pasture milk buyers, donors for animal end environmental protection and individuals with farmer as family or friend

LCM class		Category						Count in class and as % of respondents
		Female	Frequent organic milk buyers	Frequent pasture milk buyers	Donors for animal protection	Donors for environmental protection	Having farmer as family or friend	
1	Count	245	71	78	62	49	62	354
	% within class	69.2%	20.1%	22.0%	17.5%	13.8%	17.5%	34.0%
	% within category	41.0%	71.0%	49.1%	54.4%	56.3%	31.2%	
2	Count	95	15	22	25	16	40	141
	% within class	67.4%	10.6%	15.6%	17.7%	11.3%	28.4%	13.6%
	% within category	15.9%	15.0%	13.8%	21.9%	18.4%	20.1%	
3	Count	53	2	10	5	5	14	110
	% within class	48.2%	1.8%	9.1%	4.5%	4.5%	12.7%	10.6%
	% within category	8.9%	2.0%	6.3%	4.4%	5.7%	7.0%	
4	Count	61	0	12	1	2	18	139
	% within class	43.9%	0.0%	8.6%	0.7%	1.4%	12.9%	13.4%
	% within category	10.2%	0.0%	7.5%	0.9%	2.3%	9.0%	
5	Count	144	12	37	21	15	65	296
	% within class	48.6%	4.1%	12.5%	7.1%	5.1%	22.0%	28.5%
	% within category	24.1%	12.0%	23.3%	18.4%	17.2%	32.7%	
Total	Count	598	100	159	114	87	199	1040
Count in category as % of respondents		57.5%	9.6%	15.3%	11.0%	8.4%	19.1%	