



## **Food Environment: The Effects of Context on Food Choice**

**May 30–31, 2012, Tufts University, Boston, MA**

### **Individual and context factors determine gender-specific behaviour: the case of school milk in Germany**

**Petra Salamon, Daniela Weible, Doreen Buergelt, Inken B. Christoph, Guenter Peter**

Johann Heinrich von Thuenen-Institut (vTI), Federal Research Institute for Rural Areas, Forestry and Fisheries,  
Institute for Market Analysis and Agricultural Trade Policy, Braunschweig, Germany

petra.salamon@vti.bund.de

**Abstract:** A German federal research was established to analyse determinants on school milk demand. Among those, individual factors, like children's eating habits, attitudes, preferences and socio-economic variables were considered but also contextual factors like attitudes and habits of class teachers and school variables were regarded; and more, price effects on demand were derived via a price experiment. As girls order significantly less school milk than boys this paper aims to analysis gender-specific decisions. In the analysis, a database is used in which individual order information are merged with survey results concerning pupils, parents, class teachers, school principals and school milk managers of the sampled schools. A multilevel analysis is applied, because included explanatory variables of gender-specific school milk orders can be assigned to different groups (individual, class, school, price phase) in which the independence of variable distributions may be hampered; whereas equations are established as ordinary logistic function. Estimates for both genders comprise individual factors affecting positively the school milk orders like e.g., the provision of school milk free of charge, or when pupils think that 'milk tastes good' and contextual factors such as their class teachers' involvement. Gender-specific distinctions cover e.g., the fact that male pupils have a higher probability to order school milk and react to price incentives. Concerning the context variables, boys react to teachers and principal attitudes. In contrast, with girls prices have a very limited impact, but their parents and teachers are regarded as role models. Girls prefer more choices in product differentiation. These results indicate gender-specific programs integrating their family and teachers, and a wider range of product choices.

**Keywords:** gender differences, multilevel analysis, school milk

**Areas related to the topic:** demand analysis, price analysis

*Copyright 2012 by Petra Salamon, Daniela Weible, Doreen Buergelt, Inken B. Christoph, Guenter Peter. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies*

# **Individual and context factors determine gender-specific behaviour: the case of school milk in Germany**

## **1 Introduction**

Consumption habits already evolve early in life and dietary habits established in childhood persist into adult life. Factors influencing the emergence of habits, however, are less researched especially for food items. Several studies deal with gender specific consumption between men and women concerning product categories like meat, dairy products or beverages (MRI 2008). In addition to distinct product attributes also intrinsic attributes are mentioned to drive purchase decisions such as preferences for environmentally friendly products, or products targeting ethical consumerism like fair-trade or the acceptance of genetically modified food (i.e., Browne, et al. 2000; Christoph, Bruhn and Roosen 2008; Devitis, Luca and Maietta 2011; Loureiro and Bugbee 2005; Quin and Brown 2008). Hence, detailed knowledge on the factors determining, affecting and forming consumption habits and food choice based on gender is scarce.

The importance of a sufficient consumption of dairy products during childhood is often emphasized and, in particular, girls have a high need for calcium, often covered insufficiently only (DGE 2008; Alexy, Clausen and Kersting 2008). In this context, school milk<sup>1</sup> is seen as an additional mean to fulfil dietetic requirements. But participation in the European School Milk Scheme declined quite constantly over the course of the years. Thus, one focus of the research project ‘Focus on School Milk’<sup>2</sup>, established by the German Federal Government, was to assess characteristics of pupils determining their school milk demand. As relevant individual factors, children’s eating habits, attitudes, preferences and socio-economic variables were considered. In addition, product prices and contextual factors like school variables or class characteristics were studied, as well.

One essential outcome of the project was that gender affects school milk demand significantly, and that girls demand less school milk than boys (Christoph et al. 2010; Salamon et al. 2011; Weible et al. 2011). Unaffected by price, the gender-specific ‘gap’ remains quite stable. Additionally, the outcome also confirms findings in literature on school milk (Weindlmaier and Fallscheer 1997; Robinson 1978). Although this gender difference is

---

<sup>1</sup> The term ‘school milk’ denotes (non-)flavoured milk and milk products which are given to schoolchildren at school and are subsidized by the EU within the European School Milk Scheme (EC No 657/2008).

<sup>2</sup> The German Federal Ministry of Food, Agriculture and Consumer Protection set up the project whereby the accompanying research was done in cooperation by the Department of Nutritional Behaviour of Max Rubner-Institute (MRI) and the Institute for Market Analysis and Agricultural Trade Policy of Johann Heinrich von Thünen-Institute (vTI).

known, determinants driving these discriminative decisions are widely unknown. Knowing driving factors could help to design and to target an appropriate and effective intervention program for groups with special needs like e. g., girls. Knowing their specific requirements, perhaps, may pave the way for better-aligned food products.

So, an important objective of this paper is to identify factors driving individual decisions of gender-specific pupil groups and their parents concerning school milk. Differences and commonalities between these gender groups will be pointed out and explained. For analyses, individual as well as contextual data is employed. Data was collected during the research project “Focus on School Milk.” A multilevel analysis is applied, as required by the hierarchical structure of the database and, thus, separating effects of individual and contextual variables. In the paper, following the introducing, Section 2 provides a short overview on the required milk consumption and gender differences, especially among youths. Then, in Section 3 an overview of the available database derived from the school milk project is presented. Section 4 deals with the applied approach - multilevel analyses, and then subsequently, the results of the estimated model are shown in Section 5. Finally, Section 6 deals with the limitations of the approach and also provides some conclusions.

## **2 Background**

### **2.1 Children’s’ milk consumption**

Several national nutrition surveys depict gender differences existing in food patterns of youths. With respect to milk, yoghurt, butter milk and similar products, the so-called “Eskimo study” indicates a higher consumption of boys aged 6 to 11 years and 12 to 17years compared to girls of the same age (Mensink et al. 2007). Weindlmaier and Fallscheer (1997) also depict gender-specific differences in breakfast behaviour of German pupils. Around 10 percent more boys than girls drink milk as part of breakfast. Moreover, girls often take no beverage to school, and they rarely drink milk at school. These findings clearly contrast nutritional patterns. Looking at dietary recommendations with regard to dairy products, youths between 7 and 12 years are supposed to consume 400-420 millilitres of milk and milk products per day. For teens, these recommendations rise to 425-450 millilitres for girls and 450-500 millilitres for boys per day. In Germany, girls aged 10 to 12 fall short of this reference, whereas boys’ consumptions are just slightly below. Regardless of gender, half of the teens between 12 and 18 do not achieve the recommended values (DGE 2008; Alexy, Clausen and Kersting 2008). Children who drink milk and consume dairy products regularly will continue to do so as adults (Pudel and Westenhöfer 1998: 39). Moreover, it has been suggested that food

preferences may be more easily modified during childhood than later on. Thus, children are a target group for intervention programmes aiming to increase the intake of milk and milk products (Griffin 1999; Wind et al. 2006).

## **2.2 Factors influencing pupils' demand decisions**

Consumer decisions in the area of food purchases can mostly be described as habitual, low involvement decisions. This decision type follows well-practised patterns leading to a decision making appearing as a customary phenomenon. All steps in the process like searching, evaluating and selection seem to be collided into one capturing only very little time. Such purchases are done quickly and only low risks are involved, purchasing acts are occurring very often and in short time intervals.

Consumers purchase decisions are driven by different factors, in particular, economic, psychological, cultural and social factors. The first group considers, for instances, individual income and prices of the product or substitutes while the other three play a role in influencing preferences. These factors may be more important than considerations of price or income. In the case of food items basic nutritional requirements of the regarded individual, as explained above, have to be considered, too.

Instead of grouping determining factors into the above mentioned categories they can be categorized into individual and contextual factors. Individual factors comprise such influences which vary across the individual. They cover attitudes, habits, preferences and socio-economic factors. When analysing demand decisions of pupils one has to keep in mind that taste is one of the major motives for food choice among children and adolescents. In contrast, contextual factors affect a group or different groups of individuals. A good example is the price which is charged as contextual factor. For a certain product, the price in a certain shop is identical for all buyers. In the case of school milk class and school characteristics are contextual factors. Factors forming the environment of individuals have been shown to be important for the development of food preferences (Wind et al. 2006). In developing targeting programmes, the child's environment has to be taken into account which allows studying important factors in shaping consumption preferences. As school milk is, in general, consumed at school, the school environment and the involved persons play an important role and have to be considered in analysing pupils' decisions.

In our special case, pupils and their parents are regarded as one individual decision-unit. In principle, in primary school the choice to order school milk is taken by the parents as they pay for the school milk, but they need to rely on their children to carry out their wishes by drinking school milk. While an individual decision to order school milk is predominantly

determined by pupils' and parents' characteristics as described above, various groups may form the environment of pupils and also affect their decisions. Here, the teachers as well as the school principals and the school milk managers<sup>3</sup> may execute influence on pupils' decisions, intentionally or unintentionally. In broader terms, the dairy industry and the state must be considered as they set the prices and other factors like product availability. Both groups show different interests in school milk; they differ in their attitudes towards, and in their knowledge about the product. Just as with other products, directly or indirectly, they influence pupils' attitudes and behaviour, and thus, also the decision whether or not to order school milk.

### **3 Data and previous findings**

As already mentioned, the further analysis is based on data originating from the German research project 'Focus on School Milk'. School milk sales within the European School Milk Scheme have a very long tradition. In 1972, the European Union established the school milk regime as a consumption aid to encourage consumption of healthy dairy products among children (EC No 1080/77). Today, an educational intention was added in so far as the Programme contributes to nutritional education by providing a better knowledge on products (EC No 657/2008). Within the programme, all children in a nursery, a primary or a secondary school are entitled to receive a maximum subsidized quantity of 250 ml milk equivalent per school day. School milk always covers a whole range of dairy products eligible for school milk subsidies, not only fluid milk. Prices of school milk are regulated by a maximum price policy, and in return, delivering firms are guaranteed a subsidy when they act in compliance with existing regulations (BMELF 1985).

Main objective of the research project was to quantify the price effect and to identify, if possible to quantify, other determining factors of school milk demand. Depending on the results, the German government planned to develop a strategy for better participation in the School Milk Program. A representative sample of primary schools in North Rhine Westphalia, a federal state of Germany, formed the basis for the data generation. It was drawn randomly taking into account different strata. In the primary schools of that sample, a price experiment was conducted in the school years 2008/09 and 2009/10 to allow the analysis of price effects. Within the price experiment the prices of school milk were reduced stepwise

---

<sup>3</sup> School milk managers are the persons who handle the school milk at the schools. In most cases these are the caretakers.

during the school year 2008/09. Starting with 35 cents per package<sup>4</sup> in Price Step 1, the price was reduced to 25 cents (Price Step 2), 15 cents (Price Step 3) and finally to 0 cent (Price Step 4) at the end of the school year. Parents were informed about each price change by a letter distributed to all pupils. Untimely information on price adjustments was avoided. During the price experiment teachers collected the individual school milk orders for the corresponding order period and reported the data regularly for the school year 2008/09. Depending on the respective school and its supplier, data of orders covered various intervals from 1 to 5 weeks. To avoid involved problems in allocation, information was aggregated for each complete price step and recalculated per school day. In school year 2009/10 prices were increased stepwise again, but no detailed information on school milk orders was compiled.

Further information was gained by written questionnaires developed by the Max Rubner-Institute, Federal Research Institute of Nutrition and Food in Karlsruhe, Germany. These questionnaires were designed for pupils, their parents, class teachers, school principals and school milk managers. In general, the questionnaires contained questions on nutritional behaviour, consumption preferences, attitudes towards healthy nutrition, milk and school milk, ideas about the School Milk Program (promoters and barriers), suggestions for improvement, knowledge about nutrition and milk as well as socioeconomic indicators. Questionnaires for school personnel such as school principals, school milk managers additionally contained questions on food, meals and specifically milk offered at schools. Additionally, questions about the organisation of school milk distribution, decisions on the product range, attitudes towards milk and school milk and educational offerings on nutrition and milk by the school were raised. To examine attitudes, all respondents except children were requested to rank statements from “totally disagree” to “totally agree” using a five-point Likert scale. All questionnaires underwent pretesting. Prior to pupils’ interviews the parents’ written consent was obtained.

All data collection at schools (order data and questionnaires) was restricted to the class years two, three and four including pupils aged between 7 and 10 years old<sup>5</sup>. The processed data set consists of 7,334 pupils from 552 classes and 101 schools.

For more details concerning the project, see also Salamon et al. (2010) and Salamon et al. (2011).

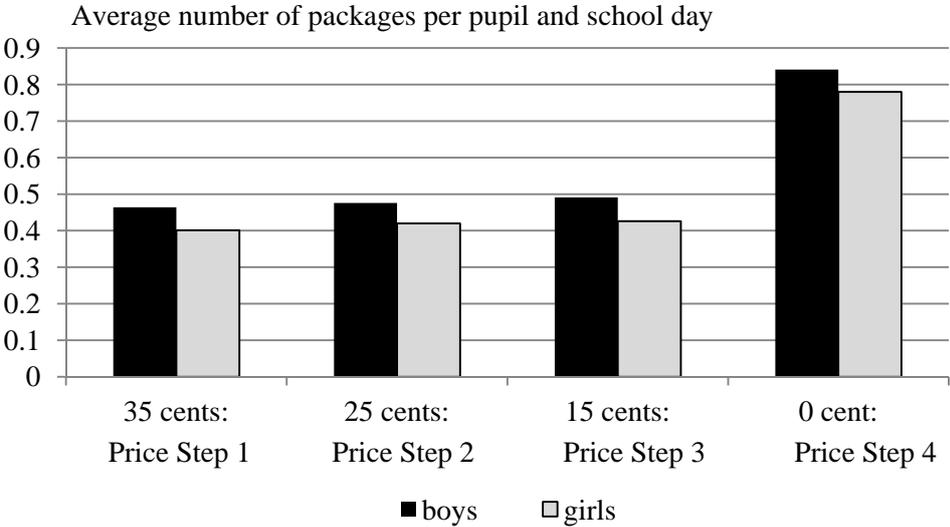
---

<sup>4</sup> Price of non-flavoured school milk was 30 cents per package. From the second to the seventh Price Steps, the same price is charged for pure and flavoured milk.

<sup>5</sup> Pupils of the first class year were not included due to their insufficient ability to read and write.

In principle, data for the econometric analysis stems from different sources: In addition to school milk orders by pupils, the majority of the explanatory variables were generated by the questionnaires given to pupils, parents, class teachers, school principals and school milk managers. Further information like social index<sup>6</sup>, municipal size and school size, as well as information on delivery firms, was also available and was incorporated.

Previous analyses of the price experiment and questionnaires indicate that gender is a highly significant variable in school milk demand as already mentioned in the introduction (Christoph et al 2010; Salamon et al. 2011; Weible et al 2011). Figure 1 illustrates the gender difference in school milk orders depending on price.



**Figure 1: School milk orders differentiated by price and gender**  
Source: Own calculations.

At the initial price step, every boy, on average, ordered 0.46 school milk packages per school day while every girl ordered only 0.40 packages, showing a gap of 0.06 packages. With decreasing school milk price, orders increase for both groups. When the price of one package was reduced to 25 cents, the orders increased on average to 0.48 packages per school day for the boys and to 0.42 packages for the girls. That means, the gender difference still accounts for 0.06 packages and remains stable throughout the next two price steps. At Price Step 4 with a price of zero, orderings increase dramatically to an average of 0.84 packages per school day for boys compared to 0.78 packages for girls. Thus, the gender difference still remains when the school milk is free of charge.

<sup>6</sup>Index describing the socioeconomic status of the district derived from the spending on welfare aid at county level, the share of people with a migration background.

#### **4 Applied methodology: The multilevel approach**

Multilevel analysis is primarily used in social sciences, including sociology, education, psychology, but also in other fields such as the bio-medical sciences (Snijders and Bosker 2003). According to Bickel (2007: 8), multilevel modelling can be viewed as “a better way of doing regression analysis under specific circumstances”. These circumstances are those in which observations are nested or grouped in identifiable contexts, e. g., pupils in classes, employees in firms, longitudinal measures of subjects, etc.

In contrast to the OLS (*ordinary least squares*) regression, multilevel regressions have an inherently hierarchical structure. They are designed to deal with nested data and thus, nesting of observations within groups is fundamental to multilevel models. In fact, nesting is the primary reason for doing multilevel analysis (Bickel 2007). Due to clustering, observations of the same group are usually more similar than the observations of different groups violating the assumption of independence of all observations. Estimates of the standard errors of conventional statistical tests are much too small if this assumption is violated, ending in many spuriously ‘significant’ results (Hox 2002).

Thus, the multilevel approach assumes that individual decision-making is dependent on environmental clusters. However, the definition of clusters may differ and the variability between clusters must be taken into account. In the following, the explanatory variable at the individual level is named X, the explanatory variable at the group level is Z (also named contextual variable). The X variable, although it is a variable at the individual level, may also contain a group aspect. The mean of X in one group may be different from the mean in another group. In this case, X may have a positive between-group variance (Snijders and Bosker 2003: 39).

A main difference between regression and multilevel models is that the equation defining the hierarchical linear model contains more than one error term: one (or more) for each level (Snijders and Bosker 2003: 38). Current developments of multilevel approaches are more and more concerned with a proper treatment of the error structure for these models. While the pioneers’ multilevel methods were mostly represented by the selection of variables supposed to have fixed effects, more recent multilevel approaches specify the value of variables as a mix of fixed and random effects. In a fixed effects multilevel model, the micro level coefficient is expressed as an exact function of macro level variables. In contrast, random effects multilevel models contain error terms in the macro equations. Including these error terms at the macro level imply a more complex error structure in the single equation version of the multilevel regression. Random coefficient models allow the decomposition of the

variance of the dependent variable into the within-context variance and the between-context variance (DiPrete and Forristal 1994).

Within the multilevel analysis applied here, we examine pupils who are subject to repetitions along the different price steps and clustered in classes and schools. With such data, it is usually illuminating to consider the variability associated with each level of nesting (Snijders and Bosker 2003: 9). In the following, a multilevel approach based on an ordinary logistic model is considered: a random-intercept model that includes random effects at several hierarchical levels.  $Y_{ijk}$  is the outcome or response of the  $i^{\text{th}}$  pupil of the  $j^{\text{th}}$  class in the  $k^{\text{th}}$  school which is either 0 or 1. For individual  $i$ , we can observe average orders for  $p$  price steps. On each price step it holds that pupils who decide to consume school milk do so almost every school day (value is equal one) or vice versa (value is equal zero). There are also pupils with an average ordering between 0 and 1. To keep both proper and simple, there is one value for each pupil per price step which is 1 for those who order school milk in 50 per cent or more cases, and 0 for all others. Thus, demand for each individual is represented by four observations – one for each price step.

It is assumed that the given random effects  $U_{jk}$  and  $U_k$  represent unobserved class and school characteristics, respectively. Further, for pupil  $i$  of class  $j$  in school  $k$  is assumed that

$$\pi_{ijk} = \text{probability}(Y_{ijk} = 1)$$

and the logit of this probability satisfies

$$\text{logit}(\pi_{ijk}) = \beta_0 + \beta_1 X_{ijk} + \beta_2 X_{jk} + \beta_3 X_k + U_{jk} + U_k,$$

Where  $X_{ijk}$ ,  $X_{jk}$  and  $X_k$  represent observed characteristics at individual, class and school levels, with corresponding fixed effects  $\beta_1$ ,  $\beta_2$ , and  $\beta_3$ . Further, it is assumed that the random effects are independent and normally distributed, with

$$U_{jk} \sim N(0, \sigma_2^2),$$

$$U_k \sim N(0, \sigma_3^2).$$

Residual errors are assumed to have a mean of zero, and a variance to be estimated.

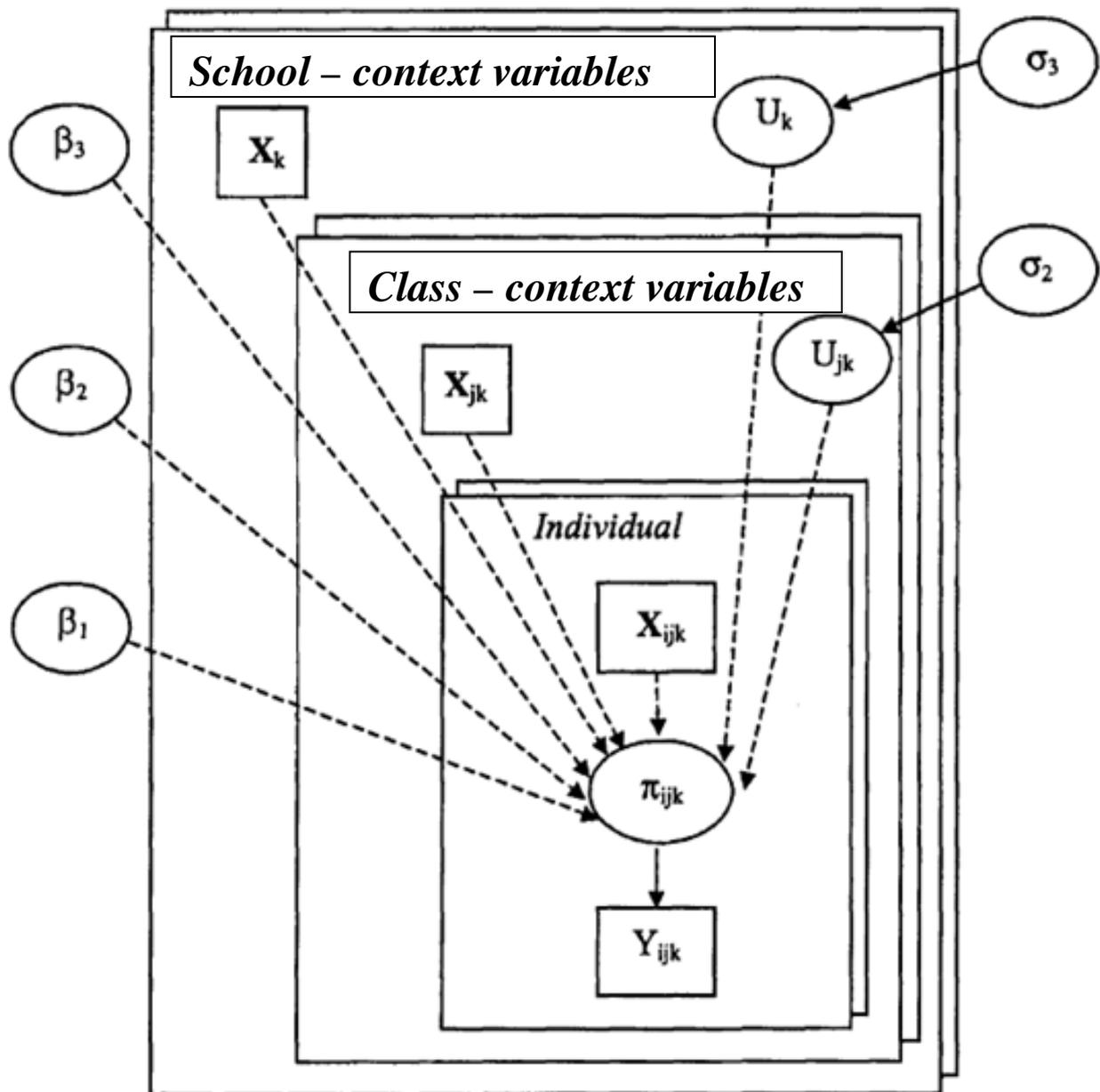
The linearized form of the logistic multilevel model is described in the following equation:

$$Y = \pi + \epsilon \quad \text{with} \quad \pi = f(X\beta + ZU).$$

Thus, outcome variable  $Y$  is expressed as the sum of the probability plus some individual-dependent residuals. This error term has a mean of zero and a (conditional) variance given by a diagonal matrix with entries  $\pi(1 - \pi)$ . This is a particular property of these dichotomous variables. As a consequence, the logistic multilevel model does not include a separate parameter for the level-one variance. The level-one residual variance of the dichotomous outcome variable follows directly from the occurrence probability (it can only adopt  $\pi$  or  $1 - \pi$ ). Further,  $f$  is the

inverse logit transformation (Snijders and Bosker 2003: 207ff; Rodriguez and Goldman 2001: 340-343; Hox 2002: 30f).

Following Rodriguez and Goldman (2001) the model written above can be illustrated as a chart (see Figure 2) whereas the nested structure (pupils of classes in schools) is shown by using stacked sheets. To simplify the graph, individual repetitions along the price steps are neglected. Boxes symbolize known quantities and oval boxes unknown quantities. Full arrows denote probabilistic dependences whereas broken arrows denote deterministic relationships (Rodriguez and Goldman 2001: 341).



**Figure 2. Three-level logit model with class and school effects on an individual level binary outcome**

Source: Adaptation based on Rodriguez and Goldman 2001: 341.

However, because there are four observations for each pupil, this longitudinal data structure of the pupils' sample leads to a four-level model (instead of a three-level model). While repeated measures on individual's school milk demand are incorporated at the first level, thus individual variables are to be found at the second level. In contrast, contextual variables which reflect the environment of pupils in different groups can be found at the third concerning class variables and at the fourth level with respect to the school variables (Heck and Thomas 2009: 44; Snijders and Bosker 2003: 9). Thus, school milk demand of a single pupil is determined by the price as well as by individual and context characteristics.

In this analysis gender is not considered as an explanatory variable; but, in contrast, as different sub-groups with their own specific environment and interaction between individual and context factor. Driven is this approach by the hypothesis that customary habits and the related decision making processes evolve differently for both genders.

## 5 Analysis and results

Data handling and estimation were performed with the statistic program STATA Version 11 using the procedure *xtmelogit* for logistic random intercept model. As a pre-process a correlation matrix was generated depicting the correlation across all available explanatory variables to minimize the risk of multicollinearity. Beginning with the empty model which contains no explanatory variable, also known as an intercept-only model, multilevel analysis is a step-by-step approach including possible variables at different levels. When a variable led to insignificant results for the estimated coefficients of boys as well as girls, or the regression did not converge, this respective variable was excluded. To identify gender-specific determinants, separate analyses were done with the same STATA command. Variables either significant for boys or for girls were kept for both estimations to enable a comparison of estimated coefficients for both groups.

Generated results for multilevel analysis are shown in Table 1 (empty model) and Table 2 (random-intercept model), in which the first level is identified by price step variable, second level by pupils' variables, the third level by classes' and the fourth level is defined by schools' variables.<sup>7</sup>

---

<sup>7</sup> As in common terminology we call this model a three-level model. In contrast to common terminology, the *xtmixed* documentation of STATA calls such a three-level model a two-level because the lowest level, here repeated measurements, is not considered as a level (Rabe-Hesketh and Skrondal 2007).

**Table 1. Results of logistic multilevel analyses (empty model)**

	Boys		Girls	
<i>Fixed part:</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>Coef.</i>	<i>Std. Err.</i>
Constant	0.66***	0.08	0.19*	0.08
<i>Random part:</i>	<i>Var.</i>	<i>Std. Err.</i>	<i>Var.</i>	<i>Std. Err.</i>
$\sigma_4^2$ : school	0.29	0.09	0.31	0.09
$\sigma_3^2$ : class	0.61	0.10	0.68	0.09
$\sigma_2^2$ : pupil	3.22	0.18	2.63	0.15
number of schools		101		101
number of classes		550		548
number of pupils		3,676		3,658
Log restricted Likelihood		-8,609.38		-8,842.26

\* significant at the 10 percent level; \*\* significant at the 5 percent level, \*\*\*significant at the 1 percent level

Source: own calculations with STATA.

Indicating the random part of the first model, the empty model without any independent variables shows the decomposition of the variance across the identified levels. For boys and girls, the share of variance explained by the pupils' structure is the major part of the unexplained variation (boys: 3.22 and girls: 2.63); followed by the classes' structure and the schools' structure with a considerably lower share. Already here, differences between boys and girls are to be found, as the individual variance is higher for boys than girls while, with the contextual variables, it is just the other way around. Furthermore, Table 1 contains the numbers of the considered schools, classes and pupils. Boys and girls are nearly equally distributed with about 3,650 pupils respectively.

Table 2 shows the results of the random-intercept model with the boys on the left side and the girls on the right side. Here, the fixed parts contain respectively, the extent to which the explanatory variables contribute significantly to the likelihood that boys or girls order school milk. In total, 23 variables are included in the model whereby two are on Level-1 (price level); 12 are on the individual Level-2; four on the contextual Level-3 containing class information and five variables on the contextual Level-4 representing the school level. In the following, statistically significant variables in explaining school milk orders for both boys and girls are described, followed by a description of variables that are only significant in one of the models.

#### *Significant variables explaining school milk order decisions of both genders*

Independent of gender, distributing "school milk free of charge" influences the demand highly significant with a positive impact on order decisions, whereas the value concerning boys is slightly higher. Concerning the individual factors the following effects occur: We found

negative impacts of the variable “age” which indicates a decreasing demand for school milk with increasing age. Here, the negative impact on girls’ orders is higher than on boys’ orders. Furthermore, good as well as bad taste of milk has a significant positive (“milk tastes good”) or negative effect (“milk does not taste good”). In both cases, boys react more explicitly than girls do. Nevertheless, if pupils order school milk because milk contributes to health, the demand is positively affected. Here the reaction of girls is slightly stronger. Female and male pupils, who “mainly drink milk and milk products at home”, also order significantly more school milk. However, the effect is higher with male pupils. In the underlying research project, involved persons were asked to assess several statements within a five-point Likert scale. For every statement which is listed in Table 2 in inverted commas, they had the choice to agree, to be indifferent or to disagree with the statement. When parents agree with the statement “I feel good if my child drinks school milk during breaks”, there is a significant effect on pupils’ milk orders. These children ordered more school milk, whereas the impact is higher for girls.

With respect to the context variables, the analysis results in the following insights: As expected, attitudes and behaviour of teachers influence pupils’ decision. A significant negative impact concerning school milk orders is found if their teachers disagree with the statement “School milk contributes to a healthy diet”. Here, the negative impact is more pronounced with boys than with girls. Additionally, the agreement with the statement “To offer school milk is still a problem as some children do not tolerate milk” has a positive influence. At first glance, this result is counter-intuitive, but the agreement to this statement could be interpreted as a high involvement of teachers with the school milk issue and the underlying difficulties. Thus, an intensive examination with the topic has a positive impact for both genders’ orders.

On Level 4 (school level) contextual variables are regarded, as well. If “parents initiated to provide school milk at school”, this leads to a lower school milk demand for both, i. e., boys and girls. It shows that the support from the responsible person at the schools is mandatory for the success of the school milk program, and that such a program cannot be realised only by parental engagement. One of the persons responsible for the success of the program is the school milk manager who organizes the distribution at school. Whether the milk manager agrees or disagrees with the statement “Every school should provide school milk”; demand declines.

**Table 2. Results of logistic multilevel analyses (random-intercept model)**

	<i>Coefficient</i>			
	<b>Boys</b>		<b>Girls</b>	
<i>Fixed part:</i>				
Constant	0.58		-2.14	*
<b>price (level-1)</b>				
school milk price	-0.47	**	-0.06	
school milk free of charge (yes=1)	3.59	***	3.42	***
<b>pupils (level-2)</b>				
Age	-0.17	*	-0.24	**
migration background (without=1)	0.24		0.31	*
reason for (not) drinking school milk:				
<i>milk tastes good</i>	2.50	***	2.26	***
<i>milk tastes not good</i>	-0.94	***	-0.49	*
<i>milk is healthy</i>	0.52	**	0.66	***
mainly drinks milk (products) at home (yes=1)	1.25	**	0.79	*
positive image of milk	0.46	*	-0.03	
negative image of milk	-0.07		-0.78	*
<b>parents (level-2)</b>				
parents like to drink milk and/or eat milk products	-0.04		1.19	*
“It is important to me that my child drinks milk and/or eats milk products”				
<i>I agree</i>	1.11	**	0.30	
“I feel good if my child drinks school milk during breaks”				
<i>I agree</i>	0.86	***	0.94	***
<i>I disagree</i>	-0.62	*	-0.20	
<b>class teachers (level-3)</b>				
teacher drinks milk with the pupils during morning break	0.00		0.51	*
“School milk contributes to a healthy diet”				
<i>I disagree</i>	-1.01	*	-0.89	*
“To offer school milk is still a problem as some children don’t tolerate milk”				
<i>I agree</i>	0.82	*	0.69	*
“Persons that I appreciate, think that children should drink school milk”				
<i>I disagree</i>	-0.58	*	-0.32	
<b>school principal (level-4)</b>				
parents initiated to provide school milk at school (yes=1)	-0.64	**	-0.52	*
“Every school should provide school milk”				
<i>I agree</i>	-0.80	**	0.14	
<b>school milk manager (level-4)</b>				
“Every school should provide school milk”				
<i>I agree</i>	-1.55	***	-1.10	*
<i>I disagree</i>	-2.18	**	-1.96	*
<b>school characteristics (level-4)</b>				
number of different milk flavours	0.08		0.30	*
<i>Random part:</i>	<i>Var.</i>	<i>Std.Err.</i>	<i>Var.</i>	<i>Std.Err.</i>
$\sigma_4^2$ : school	0.01	0.08	0.11	0.09
$\sigma_3^2$ : class	0.41	0.19	0.74	0.19
$\sigma_2^2$ : pupil	3.80	0.41	2.94	0.32
number of schools		67		68
number of classes		295		297
number of pupils		1,319		1,442
Log restricted Likelihood		-2,296.59		-2,640.99

\* significant at the 10 percent level; \*\* significant at the 5 percent level, \*\*\*significant at the 1 percent level

Source: own calculations with STATA.

### *Significant gender-specific differences in explaining school milk order decisions*

One result was that in fact the price of school milk has a negative impact on ordering decisions; however, the variable is not significant at all for girls (see also Table 2). According to those results, boys respond significantly to changing school milk prices, but girls do not. In contrast, a migration background influences female pupils' demand negatively. In contrast, a migration background displays no significant effect on demand in the case of male pupils.

In the pupils' questionnaire, several statements were asked with respect to the image of milk. These statements were comprised into one variable that indicates whether pupils' image of milk is positive, negative or indifferent. Our results depict, if boys have a positive image of milk this has a positive effect on demand. In contrast, in the case of girls, a negative image has a negative impact on school milk orders. In reverse, however, the negative image with boys and the positive image with girls do not have any significant consequence. Interestingly, girls seem to mimic their parents' eating and drinking habits, as these habits have a significantly positive effect on the orderings: if their parents like to drink milk and/or eat milk products orderings will increase. Boys instead, are more driven by their parents' wishes than by their parents' habits. Parents' agreement with "It is important to me that my child drinks milk and/or eats milk products" increases boys' demand significantly. This is confirmed by the parents' disagreement with the statement "I feel good if my child drinks school milk during breaks" which results in lower probability of ordering school milk when boys are regarded.

Also when contextual factors are considered, again girls imitate existing habits. It has a significantly positive influence on girls' decisions if their teachers drink milk with them during morning breaks. In contrast, boys respond with a decrease in school milk demand if their teachers disagree with the statement "Persons that I appreciate, think that children should drink school milk" and if school principals agree with the statement "Every school should provide school milk":

Finally, an increasing number of school milk types, which are available to choose from, are significant for the girls' decision. Depending on the school milk supplier, the schools can choose from different flavoured school milk products. Most common flavours are chocolate, vanilla and strawberry milk. As the positive coefficient indicates, orders for school milk rise if different flavours are available. This reflects that girls prefer a wider range of products from which they can choose.

## 6 Qualification and conclusions

Some limitations in the results have to be kept in mind. First, the data set shows a self-selection bias as the schools were selected randomly but not all pupils, respectively, their parents, participated in answering the issued questionnaires. Pupils who in principle would buy school milk show a tendency to answer slightly more questionnaires. But concerning boys and girls there were no noticeable differences. Not all possibly relevant levels and explanatory variables to explain school milk orders could be incorporated in the estimation. For example, regional information on the schools, information on school milk suppliers, and seasonality in consumption patterns could not be included in the model as they hindered the convergence of the model. Furthermore, the interaction between different variables was not considered in this analysis. Lastly, the project's focus on the federal state North Rhine-Westphalia limits the results and thus, no conclusions for whole Germany are possible.

Analysing individual decisions on school milk demand, the applied logistic multilevel approach reveals important influencing factors for both boys as well as girls. In addition to the price the distribution free-off charge can either be assigned to the individual level consisting of the child and their parents' sphere, or they belong to contextual levels consisting of class or school variables. A total of four levels are incorporated within the model. At the first level, there are pupils' orders depending on price step. This allows determining the effects of price changes and the impact of a free-off charge distribution. The next level comprises the individual sphere and the higher levels 3 and 4 reflect on the contextual levels class and school. Summarizing the results, the following can be concluded:

For both genders some individual factors positively affect the school milk orders, such as the provision of school milk free of charge; if the milk tastes good; if they think milk is healthy; if they display a habit to drink milk at home, and if their parents feel good about their children drinking milk. Additionally, some contextual factors like their teachers' involvement positively affect the order decisions. Hence, strengths of the impacts differ between boys and girls. Girls' are more affected by health issues and the parents' feelings while boys are more affected by taste. Also a set of determinants influencing the order decisions of both genders negatively exists: So individual factors such as age of pupils, and the fact that milk does not taste good, lead to a lower ordering of school milk. Here differences in the value of the coefficients are to be found as well. The impact of age is higher on girls while the impact of price and taste is higher with boys.

Also some contextual variables affect the school milk demand negatively. Attitudes of teachers who do not agree that school milk is healthy, or if teachers disagree with the

statement “Persons that I appreciate think children should drink school milk” or the fact that parents have initiated school milk provision at the respective school have to be mentioned.

Despite those individual and contextual factors influencing school milk demand for boys and girls in the same way there are also gender-specific factors. In principle, male pupils have higher orders of school milk and stronger reactions to price incentives. A positive image of milk is reflected in significantly higher order decisions of boys. Concerning the context variables, they react to teachers and principal attitudes. A differing behaviour by girls can be detected. The prices of school milk do not play a role in their decision, but their parents’ and teachers’ habits as well as the presence of a migration background do. Girls will react negatively if the image of milk is negative and they prefer to have the choice between different products.

These results indicate that the lower participation of girls in the School Milk Program requires specific programs. For the girls a positive image campaign including their families and their teachers is required which should provide a special focus on health issues. Also their specific needs concerning a wider range of product choices should be fulfilled to improve their school milk orders.

## References

- Alexy, U., K. Clausen und M. Kersting (2008): Die Ernährung gesunder Kinder und Jugendlicher nach dem Konzept der Optimierten Mischkost. *Ernährungsumschau* (2008) 3, 168-177.
- Bickel, R. (2007): *Multilevel Analysis for Applied Research: It’s just Regression*. The Guilford Press, New York.
- BMELF (1985): Schulmilch-Beihilfen-Verordnung vom 8. November 1985 (BGBl. I S. 2099), die zuletzt durch Artikel 3 der Verordnung vom 10. März 2009 (BGBl. I S. 491) geändert worden ist (SchulMBhV 1985). Bonn.
- Browne, A. W., P. J. C. Harris, A. H. Hofny-Collins, N. Pasiecznik and R. R. Wallace (2000): Organic production and ethical trade: definition, practice and links. *Food Policy*, Vol. 25: 69-89.
- Christoph, I. B., M. Bruhn and J. Roosen (2008): Knowledge, attitudes towards and acceptability of genetic modification in Germany. *Appetite*, Vol. 51: 58-68.
- Christoph, I. B., G. Peter, A. Rothe, P. Salamon, S. A. Weber and D. Weible (2010): School milk demand - interaction between policy and other factors: some preliminary findings of a regional project. Selected paper prepared for presentation at the 1st Joint EAAE/AAEA Seminar "The Economics of Food, Food Choice and Health", Freising, Germany, September 15-17, 2010.
- Devitis, B. De, A. I. De Luca and O. W. Maietta (2011): Gender differences in pro-social behavior: the case of fair-trade food consumers. Selected paper prepared for presentation at the EAAE 2011 Congress “Change and Uncertainty; challenges for agriculture, food and national resources”, Zurich, Switzerland, August 30 to September 2, 2011.

- DiPrete, T. and J. Forristal (1994): *Multilevel Models: Methods and Substance*. Annual Review of Sociology, Vol. 20: 331-357.
- DGE Deutsche Gesellschaft für Ernährung e.V. (2008) (eds.): *Ernährungsbericht*. Bonn: Deutsche Gesellschaft für Ernährung.
- EC No 1080/77: Regulations (EC) No 1080/77 of 17 May 1977 on the supply of milk and milk products at reduced prices to schoolchildren. Brussels.
- EC No 657/2008: Regulation (EC) No 657/2008 of 10 July 2008 laying down detailed rules for applying Council Regulation (EC) No 1234/2007 as regards Community aid for supplying milk and certain milk products to pupils in educational establishments. Brussels.
- Griffin, M. (1999): *FAO's International Survey of Milk in Schools: Summary, Conclusions and future Directions*. Bulletin of Commission C Meeting and Conference on Milk Support Systems and WTO II, IDF (The International Dairy Federation), Athens, 14-18 September, No. 341/1999: 24-64.
- Heck, R.H. and S.L. Thomas (2009): *An Introduction to Multilevel Modeling Techniques*. 2. Edition, Routledge, New York.
- Heine, W. (1999): *Ernährung vom Säuglings- bis zum Jugendalter*. In: Biesalski, H.K., P. Fürst, H. Kasper, R. Kluth, W. Pöler, C. Puchstein and H.B. Stähelin (eds): *Ernährungsmedizin*. Stuttgart: 201-211.
- Hox, J. (2002): *Multilevel Analysis: Techniques and Applications*. Lawrence Erlbaum Associate, Mahwah, New Jersey.
- Kurth, B. M. (2007): *Der Kinder- und Jugendgesundheitsurvey (KiGGS): Ein Überblick über Planung, Durchführung und Ergebnisse unter Berücksichtigung von Aspekten eines Qualitätsmanagements*. Bundesgesundheitsblatt – Gesundheitsförderung – Gesundheitsschutz, 50: 533-546.
- Loureiro, M. L. and M. Bugbee (2005): *Enhanced GM foods: Are consumers ready to pay for the potential benefits of biotechnology*. Journal of Consumer Affairs, Vol. 39 (1): 52-70.
- Mensink, G. B., A. Richter, C. Vohmann, A. Stahl, J. Six, S. Kohler, J. Fischer and H. Heseker (2007): *EsKiMo –Das Ernährungsmodul des Kinder- und Jugendgesundheits-surveys (KiGGS)*, Springer Gesundheits- und Pharmazieverlag, Neu-Isenburg, 2007.
- MRI Max Rubner-Institut (2008) (eds.): *Nationale Verzehrsstudie II - Ergebnisbericht, Teil 2*.
- Pudel, V. and J. Westenhöfer (1998): *Ernährungspsychologie*. Hogrefe, Göttingen u.a.
- Qin, W. and Brown, J. L. (2008): *Factors explaining male/ female differences in attitudes and purchase intention toward genetically engineered salmon*. Journal of consumer behaviour, Vol. 7 (2): 127-145.
- Robinson, J.S. (1978): *Special Milk Program Evaluation and National school Lunch Program Survey*. U.S. Department of Agriculture, Food and Nutrition Service, Washington D.C.
- Rabe-Hesketh, S. and A. Skrondal (2007): *Multilevel and Longitudinal Modeling Using Stata*. 2. Edition, Stata Press, College Station.
- Rodriguez, G. and N. Goldman (2001): *Improved estimation procedures for multilevel models with binary response: a case-study*. Journal of the Royal Statistical Society. Series A, Vol. 164 (2): 339-355.
- Salamon et al. (2012): *Endbericht zur ökonomischen Begleitforschung zum Bundesmodellvorhaben „Schulmilch im Fokus“*. Johann Heinrich von Thünen-Institut, Institut für Marktanalyse und Agrarhandelspolitik, Braunschweig, forthcoming.
- Salamon, P., C. Pfau, M. Grillenberger, I.B. Christoph, A. Straßburg, S.A. Weber, G. Peter, A. Gonzalez, J. Bonfig and D. Weible (2010): *School Milk Demand: Design and First Results of the German Federal Research Project ‘Schulmilch im Fokus’*. Landbauforschung, Vol. 60 (1): 1-10.
- Snijders, T.A.B. and R.J. Bosker (2003): *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*. Sage, London.

- Weible, D., D. Buergelt, I. B. Christoph, G. Peter, A. Rothe, P. Salamon and S. A. Weber (2011): School milk demand in Germany: The role of individual as well as contextual factors - preliminary results. Selected paper prepared for presentation at the EAAE 2011 Congress "Change and Uncertainty; challenges for agriculture, food and national resources", Zurich, Switzerland, August 30 to September 2, 2011.
- Weindlmaier, H. and T. Fallscheer (1997): Schulmilchversorgung in Deutschland: Situation, Problembereiche, Ansatzpunkte für eine Erhöhung des Distributionsgrades. Sonderveröffentlichung durch den Fachverband Kartonverpackungen (FKN), Wiesbaden.
- Wind, M., I. de Bourdeaudhuij, S.J. te Velde, C. Sandvik, P. Due, K.-I. Klepp and J. Brug (2006): Correlates of Fruit and Vegetable Consumption among 11-Year-Old Belgian-Flemish and Dutch Schoolchildren. *Journal of Nutrition Education and Behavior*, Vol. 38(4): 211-221.