

ESSAYS ON THE DEMAND FOR CHILD CARE SERVICES

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To my parents

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Contents

Introduction	viii
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Essay I: Child care choices in Swiss households	1
--	----------

1. Introduction	1
2. Child care use in Switzerland.....	5
3. Literature review	10
4. Model specification and econometric approach.....	15
4.1. Model specification.....	15
4.2. Econometric approach	16
4.3. Marginal effects and elasticities.....	21
5. Experiment design and data description	23
5.1. Choice cards.....	24
5.2. The sample	28
6. Empirical results	33
7. Conclusions	43
References	47

Essay II: The demand for school-meals in Switzerland	54
---	-----------

1. Introduction	54
2. Empirical specification.....	57
3. Survey design and data	61
4. Regression results	69
4.1. Willingness to pay for a school-meal.....	74
5. Conclusions	77

References 79

Essay III: Willingness to pay for school-meal and after-school services 84

1. Introduction 84

2. Empirical specification..... 88

3. Survey design and data 93

 3.1. Sample characteristics..... 94

 3.2. Service characteristics and willingness to pay..... 95

4. Data 101

5. Regression results 106

6. Conclusions 111

References 113

Introduction

In Switzerland, as in many developed countries, a growing number of parents face a pertinent challenge in trying to reconcile family and work commitments. Parents working full-time or part-time may purchase child care services (such as school-meal and after-school services) provided at school or by other professionals, while others directly provide personal care to their children until school age and reduce their participation to the labor market. Access to child care services represents a key issue and local governments play an important role in the market for child care services. The availability of child care services is not homogeneous across Swiss cantons and municipalities. Therefore, households may face some constraints in optimizing the allocation of time between work and family. To define effective policies to improve child care services and households choices, governments need information on households' demand for different types of child care services. The main objective of this thesis is to investigate socioeconomic factors affecting the demand for child care services and households' willingness to pay for these services. We address these issues by means of three different essays.

In the first essay, we analyze preferences of Swiss families for child care facilities. A choice experiment is used to study the effects of the facilities' characteristics as well as socioeconomic factors on hypothetically-selected child care modes. The experimental data are analyzed using a discrete choice model under different multinomial logit specifications. We correct for the selection bias due to households' participation in the labor force. The results suggest that there is a potential demand for extra-familial formal care. Price, distance, opening hours, number of children per staff member, and scheduling flexibility have an important impact on the choice of the mode of care.

The second essay focuses on the demand for school-meals by Swiss families using a stated preferences approach. We collect data from number phone structured interviews. A Poisson model with random-effects is used to explore factors affecting the demand for school-meals. Findings suggest that there is an unmet need for this service. Price, household income, satisfaction with the service, family composition and region of residence have an important impact on the number of school-meals demanded. We estimate that the willingness to pay for a single school-meal is around 11.60 Swiss francs and does not depend on household income.

Finally, the third study investigates decisions of families living in the City of Lugano about the use of school-meal services and after-school services. Moreover, we analyze the willingness to pay for these services. Data on revealed and stated preferences from 906 households are collected by means of a questionnaire. Factors affecting households' decisions are explored using Tobit, Heckman and Cragg models, which account for possible sample selection problems. Three factors significantly affect the willingness to pay for school-meal services and after-school services: parents' level of education, household income, and the number of children living in the household. Also, experience with other school services matters in the decision to use a service or not. We also find evidence that unsatisfied demand includes high-income and highly-educated households, who exhibit higher willingness to pay for school-meal and after-school services.

Child care choices in Swiss households

1. Introduction

In Swiss families, as well as in many developed countries, the single breadwinner model¹ has lost much of its relevance. Women employment rates have increased and both parents work in most families. This change has been accompanied by a decline in the fertility rate and an increase in part-time work for employed women².

In Switzerland, parents face an important challenge when trying to reconcile family commitments with work commitments. Some of them postpone having children or do not have as many as they would like. Some parents choose to work full-time or part-time and pay for formal child care service³, others provide full-time personal care directly to their children until school age. These choices may not be optimal for the individual since they are constrained by the availability of child care facilities.

An optimal balance of time allocated between work and family contributes positively to a child's development. Moreover, working parents may have

¹ Fathers spend their time at work providing family income, while mothers spend their time caring for children at home.

² In Switzerland, the fertility rate was 2.10 children per woman, in 1970 and 1.50 in 2009. Since 1991, part-time work has increased among employed women from 49.1% to 57.2%, in 2009.

³ Formal child care services include child care centre (care provided by professional staff within a facility specifically equipped), family day care (care provided by some parents to a small group of children in the caregiver's private residence) home or nanny (care provided by a dedicated persona at children's home). Informal care mode is the private care which is usually unpaid and considers: parents or relatives, neighbors and friends.

more chances of maintaining and exploiting their human capital as compared to non-working parents. Finally, the optimal balance reduces health and stress risks, which contributes to strengthening the relationship between the two parents and between the parents and their children.

In choosing an optimal balance between work and family, access to child care services is a key aspect. In the market of child care services, government generally plays an important role. During the last decades, several European countries decided to regulate and support development of the child care sector⁴. There are several reasons for this intervention. First, child care services are considered a merit good. Second, the provision of child care services is characterized by asymmetric information. Third, child care services can contrast declining birth rates and increased women participation in the labor market. This guarantees economic growth and a sustainable pension system. Finally, child care services may increase gender equity, since these services give the possibility to have a more equal allocation of care responsibilities for young children as well as more career possibilities for mothers.

In Switzerland, the regulation of child care services is organized mainly at the cantonal and the municipal level. Subsidies to child care institutions are given by municipalities, cantons and the federal state. Recently, the Swiss federal government promoted a federal program of financial assistance to formal child care services. The goal of this program was to create new child care facilities (day care centers, child care centers, day schools and lunchtime care facilities). The federal law came into force from February, 2003. A credit of 200 million of Swiss francs was allotted for the first four years and a new credit of 120 million approved in 2006 (for the period

⁴ For a more detailed discussion see OECD (2007) and OECD (2004).

2007-2010). During the first period (2003-2006) only 80 million⁵ were used to create new child care facilities. This led to around 13'500 new places in child care facilities.

In order to define an effective policy to improve child care services, governments need information on the household's demand for different types of child care services.

The main goal of this paper is to contribute to design effective policies towards the supply of child care services by investigating the demand for child care services of Swiss households. We apply a multinomial logit model and a sample selection model. The latter approach corrects for the selection bias generated by the individuals' participation to the labor market.

Our study moves from a lack of evidence on stated preferences about child care facilities by Swiss households. Data on child care choices are generally based on revealed or stated preferences⁶. The revealed preference method focuses on the households' actual decisions. The stated preference method draws upon individual choices in hypothetical situations defined by the researcher. In Switzerland, as in other countries, the observed utilization of child care services does not give a realistic picture of the situation, because the supply of child care service is limited in some regions. In many cases only a single type of extra-familial formal care is available in a certain region. In this way the revealed preferences approach leads to biased predictions: the actual choice behavior is limited by current market conditions. Therefore, the revealed preferences method is not useful to elicit

⁵ The reasons behind this were the complication of the procedure to create new places, the fact that cantons and municipalities had to co-finance the program, and money was provided only for the start-up of the facilities.

⁶ See Louviere et al. (2000).

consumers' preferences. The stated preferences method may be favored, because it is possible to consider the full set of possible choices.

Following the stated preferences approach, we then simulate households' decisions with hypothetical choices (i.e. vignettes or choice experiments) between the several types of child care available (i.e. child care centers, family day care home, nanny and the actual care mode). The respondents are asked to choose their preferred alternatives. Using this approach, we can estimate the demand for child care services and the influence of each services' attributes on its demand.

The remainder of this paper is organized as follows. In Section 2 we describe the main characteristics of child care demand in Switzerland. In Section 3 we provide the literature review. The paper continues with a presentation of the random utility theory and the models used in Section 4. The experiment design, the survey procedures and the data description are presented in Section 5. The estimation results are provided in Section 6. The paper ends with Section 7, where we provide concluding remarks and some policy considerations.

2. Child care use in Switzerland

In this section we give you an overview on the use of child care services using data from the Swiss Labour Force Survey (SLFS). Switzerland is a federal state made of 26 cantons. Cantons generally differ not only with respect to geographical characteristics, but also for cultural and socioeconomic aspects of the population and the organization of the child care system. The provision of child care facilities is a task of municipalities. In principle, municipalities are not obliged to provide child care facilities. It follows that municipalities can be characterized by the availability of public and/or private child care providers.

Since 1991, the Swiss Federal Statistical Office (SFSO) conducts the SLFS on the strength of a federal Council mandate. The main purpose of this survey is to collect data about working aspects and professional life in general. It also provides insights on the living conditions of the unemployed, retired people, housewives as well as students. In 2005, the survey included a special topic: balancing work and family life. The SLFS is based on a representative sample of Swiss households. 37'000 households were randomly selected from the telephone directory during spring 2005. Two years earlier, the federal Council decided to supplement the traditional SLFS sample with a sample of 15'000 foreigners selected from the central register. Consequently, total sample counts 52'000 people. Thus, on average, every participant in the SLFS 2005 represents some 100 members of Switzerland's permanent resident population aged 15 and over. An institute commissioned by the SFSO conducted phone interviews with the selected households. Data protection was guaranteed by the Federal Statistics Act and by the Data Protection Act. All data were treated confidentially and used solely for statistical purposes.

From the complete data set we extrapolated respondents with at least one child of pre-school age (younger than 5 years old). The final sample used for this Section consists of 5'501 households. The analysis and the evaluation of the data report values that are projections of the total population.

Overall, the type of child care services used by Swiss households has not changed substantially over the last years (Figure 1). Around 82% of respondents do not use formal child care services. This means that child care is provided by parents, grandparents, relatives, neighbors or friends. The child care centre mode (day care provided by professional staff with several children in a specifically equipped facilities) is used by 11% of households and only 7% use the family day care home services (day care provided by a person who, usually, has one or more children of their own and provides the care at her/his home). Some parents prefer to provide full-time child care for their young children. The preferences for different types of non-parental care vary: some parents prefer to use relatives or neighbors; other parents prefer to demand formal care. Whatever the preferences, considerations of price, accessibility and quality often mean that working parents use a combination of care sources.

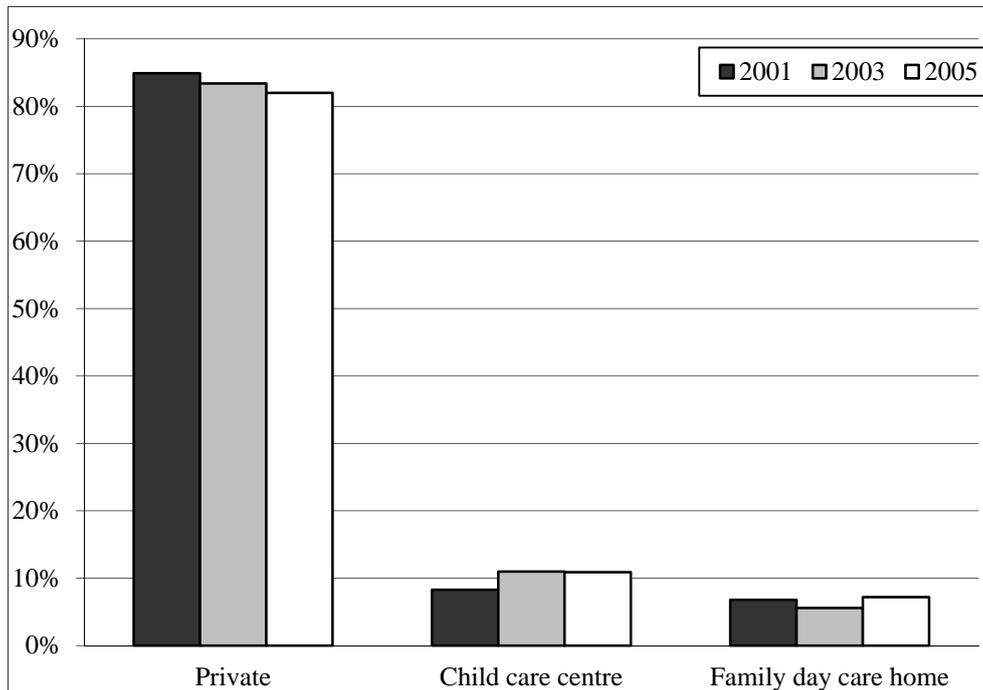


Figure 1: Child care mode used by respondents (SLFS 2001, 2003, 2005).

Table 1 shows that German-speaking cantons use more informal services and less family day care home than Latin⁷ cantons. Child care services are used by around 10% of the respondents in both linguistic regions.

Care Mode	German (N=402'000)	Italian and French (N=185'000)
Private	86.3%	77.0%
Child care center	10.0%	11.2%
Family day care home	3.7%	11.8%
Total	100%	100%

Table 1: Child care mode by speaking regions (SLFS 2005).

⁷ French- and Italian-speaking cantons of Switzerland.

We can analyze the child care mode chosen with respect to the employment rate of mothers (Figure 2). Private care mode is chosen by more than 90% of unemployed mothers. Conversely, mothers who work more than 50% prefer a formal care mode, i.e. child care center (around 20%) or family day care home (15%).

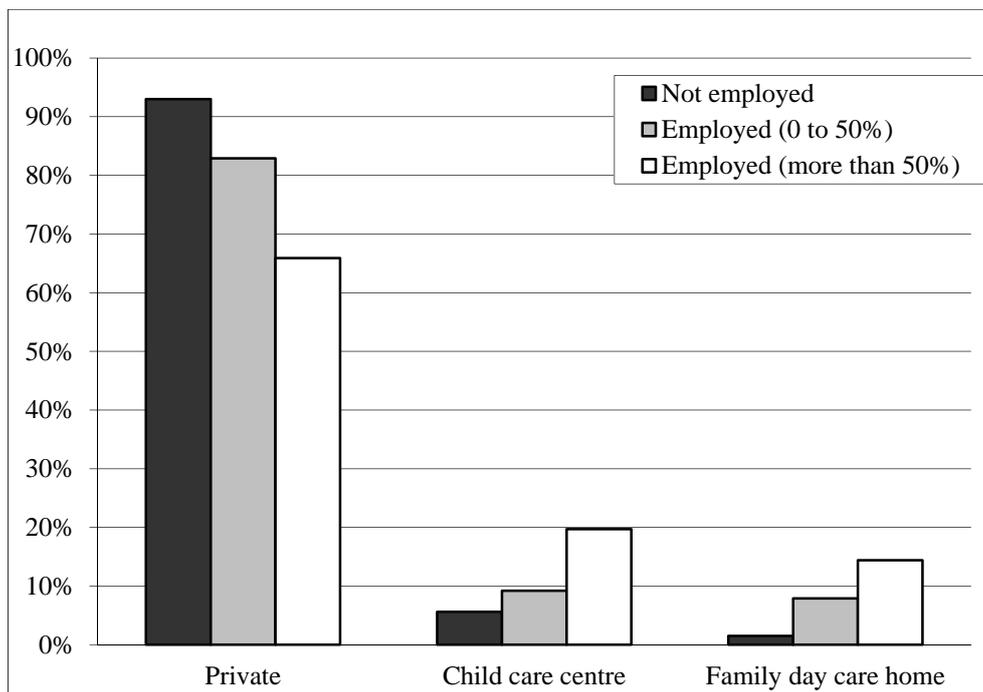


Figure 2: Mothers' care mode and employment rate (SLFS 2005).

Clearly, choices about child care services reported in the SLFS dataset do not necessarily reflect the true preferences of the Swiss households. This is because in some regions, households face a limited supply of child care services.

Indeed, formal child care facilities often have long-waiting lists. This suggests that, given today's prices, the supply is lower than the demand (see Banfi et al. 2009). Moreover, the supply in rural regions is quite limited.

About 31% of the respondents with children younger than 5 years old experienced restrictions to work due to the insufficient supply of child care services. In 49% of the cases the main reason for these limitations is the expensive price of child care services and in about 26%, parents reported a lack of child care services in their region.

3. Literature review

Recent literature is rich with studies focusing on the choice of child care services. This can be divided in two branches. On the one side we find studies that analyze the choice of child care services as well as factors affecting this choice. On the other side we find studies focusing on the link between child care provision and parents' supply in the labor market. Generally, the latter studies assume that the choice of child care services depends on price only. Indeed, several studies focus on the sensitivity of women in the labor market participation to changes in the price of child care services (see Blau (2001) and Anderson and Levine (2000) for an overview).

In our study, we are interested in the analysis of the factors that influence the choice of child care services. For this reason, in this literature review we will discuss three papers that concentrate their analysis on the demand for child care services and mainly represent the approach that we will use. Connelly and Kimmel (2003a) consider parents' employment decision both as endogenously and exogenously determined. Conversely, studies by Banfi et al. (2009) and Del Boca et al. (2005) assume that the parents' employment decision is exogenous.

Connelly and Kimmel (2003a) estimate two separate econometric models. Using an ordered probit model, they first consider the importance of child care costs on the choice between three employment states (full-time, part-time and not employed). The analysis is conducted separately for married and unmarried mothers. The second econometric model concerns the choice of the type of child care. They use a multinomial logit model to investigate the role of child care expenditure on the type of care for the youngest child in the family. Several preliminary regressions are used to construct predicted prices for child care, predicted wages and, predicted probabilities

of full-time employment for different types of child care choice. These predicted measures are then included in the econometric models. Data are from overlapping 1992 and 1993 panels of the Survey of Income and Program Participation (SIPP) in the United States. The sample includes 4'241 married women and 1'523 single women with at least one child under the age of six. One limitation of this study is that the authors consider only employed mothers. This may lead to selection bias. The authors justify their choice since their main interest is child care that facilitates employment of mothers. The results show that for both married and single women, full-time employment is more responsive to changes in the price of child care than part-time employment. Moreover, employment elasticities are larger for single mothers than for married mothers. In the model of the type of child care, the authors find that an increased probability of full-time employment is associated with an increase in the use of child care centers for both married and single mothers. Also, price elasticities of different types of child care are larger for single women than for married women.

Del Boca et al. (2005) explore the determinants of formal (public and private) as well as informal child care choices among dual worker families. They combine two data sets: the ISTAT Multiscopo from the Italian Institute for Statistics and the Survey of Households Income and Wealth (SHIW) from the Bank of Italy. As many as 483 households with children under the age of three and working mothers are considered for the year 1998. The authors assume that women are the principal caregiver in the household and only working mothers use child care services. Moreover, they assume that working hours match hours of use of child care services. In the empirical estimations, only working mothers are considered since they face more difficulties in reconciling full time work and care of children. A multinomial logit model is applied. The baseline alternative consists of mothers using informal child care. The remaining two alternatives are:

public child care and private child care. Socioeconomic characteristics (age and years of schooling), children's characteristics (number of children younger than 5), family characteristics (presence of grandmother, presence of children between 12 and 17 years, whether the mother works full time) and characteristics of child care (availability of places and costs) are included. Three model specifications are defined according to the type of covariates included: individual's characteristics; with individual's and household's characteristics; and individual's, household's and child care characteristics. Because of the characteristics of the Italian labor market, where working hours are generally not flexible, employment is not treated as endogenous. The authors find evidence that availability of public child care affects the demand in a remarkable way. In addition, an increase in costs of public child care reduces the use of public as well as private child care, which leads to a switch to informal child care. The presence of a grandmother is also an important choice factor. The authors notice that a growing number of households have only one child and a growing number of mothers would like to continue working. This raises concern for an understanding of the market for child care services and an explanation of parents' decisions.

Related to Switzerland, a recent study by Banfi et al. (2009) uses a choice experiment to study the effects of services characteristics and socioeconomic factors on the choice of child care (child care centre, family day care home, nanny and private care). The authors develop a choice experiment focusing on the choice of different types of child care. The experiment simulates a choice between several options. Each option is characterized by a number of attributes. The respondents are a random sample from the population of families living in 9 Swiss cantons participating in the study. Three linguistic regions of Switzerland as well as rural and urban areas are analyzed. The survey is carried out between 2003

and 2004. The final sample includes 2'972 records from 597 families with at least one child younger than 5 years old. The demand for child care services is analyzed by means of a multinomial logit model where the private care mode is the reference alternative. Characteristics of the service (for instance, price and distance), size of family structure (additional children), children's characteristics (children's age) and socioeconomic characteristics (for instance, age and education) are included. The model considers the employment decision as exogenous with respect to the hypothetical choice of child care modes. The results suggest that the demand for extra-familial day care can be considerably higher than what is observed. The authors do not consider only the price, they also consider distance from home, opening hours, number of children per staff member - which can be interpreted as quality of service - and scheduling flexibility in their model. Also parents' income and level of education significantly affect the choice of the child care services. Price elasticity is about 1 for child care centre and family day care home and 2.6 for the nanny option. The risk of sample selection bias due to employment decision is not addressed.

One important limitation of the above study is that the possible endogeneity in employment decision is not addressed. Moreover, they focus on a limited number of explanatory factors, which may lead to omission bias. To overcome these problems, we propose a model specification with new explanatory variables and two alternative econometric approaches that consider the possible endogeneity of the employment's decision. The selection bias due to employment decision is taken into account by using the inverse Mills ratio and a two-steps procedure (Greene 2007). Our data are comparable to those used in Banfi et al. (2009).

Due to the great variation of the data collected and used in the studies, there is not always a feasible comparison between the results. In Table 2 we

provide a summary of the most important studies related to our research and discussed above.

Study	Data	Model	Variables
Banfi et al. (2009)	2'972 records from 597 households Switzerland	Multinomial Logit Model: private, child care, family home, nanny. Employment exogenous.	Characteristics of the service; Family composition; Children's characteristics; Socioeconomic characteristics
Del Boca et al. (2005)	483 working wives Italy	Multinomial Logit Model: informal, private, public. Employment exogenous.	Characteristics of child care service; Family composition; Children's characteristics; Socioeconomic characteristics
Connelly and Kimmel (2003a)	4'241 married women and 1'523 single women Only employed mothers USA	» Ordered Probit Model: full- time, part-time, not employed. Employment endogenous. » Multinomial Logit Model: relative, home based, centre based. Employment exogenous.	Price of child care service; Family composition; Socioeconomic characteristics

Table 2: Summary of literature review.

4. Model specification and econometric approach

In this study, we sketch a model to analyze the choice of child care services by Swiss households. The empirical model is based on the random utility theory⁸ (RUT). The following empirical analysis is based on a choice experiment approach⁹. In our case, the information on consumers' preferences are collected using a questionnaire that includes choice cards. In this Section we present the RUT and discuss our econometric approach.

4.1. Model specification

According to the random utility theory, the utility of a service or a good is dependent on observable (deterministic) components plus a stochastic element (ε) that captures the influence of unobserved factors¹⁰. Among different characteristics of goods, individuals choose the ones that maximize their utility.

The random utility theory can be applied to child care services assuming that parents evaluate the characteristics of different types of child care services and then choose the ones that maximize their utility, given the constraints of prices and a fixed money income. The assumption is that households consider the tradeoffs between benefits gained and the incurred costs, including service prices and other opportunity costs depending on the household characteristics.

⁸ See Louviere et al. (2000) or Ben-Akiva and Lerman (1985).

⁹ Choice Experiment is a non-market valuation method that makes it possible to infer people's preferences for a set of alternatives, described by a set of relevant attributes.

¹⁰ See Louviere et al. (2000).

If we consider an individual's decision on which one of several alternative services to purchase, we can define a set of alternatives, $A = \{0, 1, \dots, J\}$. p_{ij} denotes the vector of prices attached to the elements of A . Let a_{ij} indicate the alternative chosen and P_{ij} be its price, where P_{ij} is an element of p_{ij} . Let the utility of the individual be a function of a_{ij} . Each individual has an income Y_i and vector of socioeconomic characteristics, z_i , that affect preferences. Each child care service has a vector of attributes w_j . For individual i choosing child care service j , utility is given by the conditional indirect utility function:

$$U_{ij} = V(Y_i - P_{ij}, w_j, z_i) + \varepsilon_{ij} \quad (1)$$

where V is the deterministic part of the utility function and ε_{ij} is an independently and identically distributed stochastic error term. This last term represents the unobserved heterogeneity across households and alternatives (i.e., child care modes) and is assumed to be random. Although many RUM applications are based on an assumed linear form for equation (1), utility functions that are non-linear in attributes can be specified.

4.2. Econometric approach

The econometric analysis is performed by means of a multinomial logit model. A multinomial logit model is a regression model which generalizes logistic regression by allowing more than two discrete outcomes. That is, it is a model that is used to predict the probabilities of the different possible outcomes of a categorically distributed dependent variable, given a set of independent variables.

In the case of child care we consider three alternative modes of child care: private, child care centre and family day care home. The “nanny” alternative has been included in the private care mode because few respondents choose this mode and care is provided at home.

In a multinomial logit framework, utility associated to one of the outcomes is normalized to zero, namely $U_{i0} = 0$. Therefore, U_{ij} is the random utility of choosing alternative child care modes as compared to the baseline category (i.e., status quo). The comparison type of child care is private care.

From expression (1) and assuming an extreme value type I distribution for the stochastic term ε_{ij} , the probability that a household i makes choice j out of a set of available alternatives $A = \{0,1, \dots, J\}$ can be written in a logistic form as:

$$Pr_{ij} = Pr(U_{ij} > U_{ij'}) = \frac{\exp(V_{ij})}{\sum_{j'=0}^J \exp(V_{ij'})} \quad (2)$$

for $j' \neq j = 0,1, \dots, J$. $J + 1$ is the total number of alternatives. This is the base equation of a multinomial logit¹¹. Using (1), the model in equation (2) can be rewritten as:

$$Pr_{ij} = \frac{\exp(Y_i - P_{ij}, w_j, z_i)}{\sum_{j'=0}^J \exp(Y_i - P_{ij'}, w_{j'}, z_i)} \quad (3)$$

¹¹ For more information see Greene (2003) and Thomas (2000).

Equation (3) is indeterminate¹² and requires a normalization assumption that leads us to write:

$$Pr_{ij} = \frac{\exp(Y_i - P_{ij}, w_j, z_i)}{1 + \sum_{j=1}^J \exp(Y_i - P_{ij}, w_j, z_i)} \quad (4)$$

where alternative $j = 0$ is the comparison outcome.

Since number of alternatives is equal to three, the equation (4) can be written as:

$$Pr_{ij} = \frac{\exp(Y_i - P_{ij}, w_j, z_i)}{1 + \sum_{j=1}^2 \exp(Y_i - P_{ij}, w_j, z_i)} \quad (5)$$

for $j = 0,1,2$.

Note that the level of choice attributes varies across different cards. The parameters are, as usual, in multinomial logit models, alternative-specific.

Several child care attributes such as distance from home, opening hours, number of children per staff member and flexibility are included in our model as explanatory variables (w_j). Household's socioeconomic characteristics (z_j) are included such as education, nationality and age of respondent. In our model, we tried to limit the number of parameters to a reasonable number. Some of the variables in the data, which would have

¹² This arises because the probabilities sum to one, so only J parameter vectors are needed to determine the $J + 1$ probabilities.

otherwise required several dummy variables, have been reduced to a single dummy¹³. In Section 5.2 we provide a detailed list of variables and their definition.

From an econometric point of view we should consider the potential simultaneity problem due to the introduction in the model specification of a variable that represents the parent's employment status. The working decision of mothers and fathers could be influenced by the choice of the child care services.

To solve the endogeneity problem, we identify three econometric approaches to estimate the equation (5). The first approach considers estimating the equation with the data on households where both parents work. This approach has been used, for instance, by Del Boca et al. (2005) for working mothers. The second approach follows Powell (2002) and estimates the model by including in the explanatory variables a correction term, i.e. the inverse Mills ratio. Heckman (1976) proposes a two-stage estimation procedure using the inverse Mills ratio to take into account the selection bias. In a first step, a regression on the labor market participation of the mothers is modeled with a probit model. The results are then used to compute the inverse Mills ratio, which is then included as an explanatory variable in the second stage estimation procedure, i.e. the multinomial logit model. Finally, a third approach allows to solve the selectivity problem and is proposed by Greene (2006) and Greene (2007). This is an extension of the multinomial logit model.

Greene (2006) explains that there is a tendency to extend the two-step approach of Heckman to other frameworks. Greene notices that this

¹³ For instance, education is available in 13 categories, but only the university degree shows a significant effect on choice probabilities.

approach is inappropriate for several reasons. The impact on the conditional mean of the model of interest does not take the form of an inverse Mills ratio. Moreover, the bivariate normality assumption needed to justify the inclusion of the inverse Mills ratio in the second model generally does not appear anywhere in the model. Finally, the dependent variable, conditioned on the sample selection, is unlikely to have the distribution described by the model in the absence of selection. He argues that one cannot generally “correct for selectivity” by dropping the inverse Mills ratio into the model at a convenient point. He proposes an internally consistent method of incorporating “sample selection” in a model. The method is based on the premise that motivated Heckman’s canonical studies on the subject, that the force of “sample selectivity” is exerted through the behavior of the unobservables in the model. As such, the key to modeling the effect is to introduce the unobservables that might be affected into the model in a reasonable way that maintains the internal consistency of the model itself.

Greene (2007) proposes a maximum simulated likelihood procedure to estimate the model. The first step is to incorporate the unobservable heterogeneity in the multinomial logit model by augmenting the utility function with a common individual term. The estimation proceeds in three steps. First, the starting values for the uncorrected multinomial logit model are obtained by simple linear regression. Then, the multinomial logit model is computed ignoring the selection. When these iterations are completed, the solver returns immediately to the iterations to compute the parameters of the full model. This step is used to improve the starting values and the technique is purely mechanical.

The last model is the newest from the econometric point of view. For comparison purposes we also estimate the model using the other two approaches proposed by Del Boca et al. (2005) and Powell (2002).

4.3. Marginal effects and elasticities

The coefficients of a multinomial logit regression provide limited information from an economic point of view. Marginal effects and elasticities are more meaningful and can be computed from the estimated coefficients. The marginal effect captures the impact of a unit change in the continuous explanatory variable on the probability of observing a specific outcome in the dependent variable. Discrete changes are usually computed for binary variables to compute probability changes in the state (0 to 1). These effects can be computed for different value of the explanatory variable, e.g. the mean.

The marginal effect of the continuous explanatory variable is defined by the partial derivative of the probability of outcome j , (Pr_j), with respect to the explanatory variable x . The marginal effect and the elasticity of a continuous variable x can be obtained from the above equations as:

$$\frac{\Delta Pr_j}{\Delta x} \cong \frac{\partial Pr_j}{\partial x} = Pr_j \left[\beta_j^x - \sum_{k=1}^2 Pr_k \beta_k^x \right] \quad (6)$$

for $j = 0,1,2$ and $\beta_0^x = 0$; and

$$\varepsilon_x = \frac{\partial Pr_j}{\partial x} \frac{x}{Pr_j} \quad (7)$$

where β_k^x represents the coefficient of the explanatory variable x related to outcome k , which is an element of the parameter vector $[\beta, \gamma, \delta]$.

Similarly, the marginal effect for a dummy variable x is given by:

$$\frac{\Delta Pr_j}{\Delta x} = Pr_j(x = 1) - Pr_j(x = 0) \quad (8)$$

5. Experiment design and data description

Since child care services are not supplied everywhere in Switzerland, we therefore use a choice experiment approach to investigate the demand for child care services and their characteristics. The choice experiment approach is essentially a structured method of data generation. It relies on carefully-designed choice tasks which help in revealing the influence of different factors. To design a choice experiment requires a careful definition of the attributes, including those which are relevant for policy purposes.

As proposed by Louviere and Hensher (1983), individuals enrolled in a choice experiment face a hypothetical setting and choose their preferred alternative among the several included in the choice set. Usually, individuals are asked to perform a sequence of such choices using choice cards. Each alternative is described by a number of attributes or characteristics. A monetary value is included among important attributes, when the profile of the alternative is described to the individual. Therefore, when individuals make their choices, they implicitly trade-off between levels of attributes in different alternatives.

The choice experiment method provides the value of a good by evaluating preferences for its attributes. As a consequence, it also provides a large amount of information that can be used to refine the design of the good.

The choice experiment also avoids the “yea-saying” problem present in contingent valuation method. For some individuals there is a tendency to agree with every question regardless of content. Respondents may choose one of the alternatives or the status quo. There is a trade-off between attributes and the cost of alternatives.

One limitation¹⁴ of the choice experiment is related to the decisions of respondents. If choices are complicated, decisions could not reflect a utility maximization process but rely on short-cuts. This is known as the “cognitive skills” phenomenon. We can find this situation, for instance, when respondents consider just one attribute instead of the entire set. To reduce cognitive difficulties, one could define a choice situation with a limited number of attributes.

Another problem mentioned in literature¹⁵ is the assumption that the sum of attributes’ values equals the value of the whole good, although not all attributes can be considered in the choice experiment¹⁶.

All these limitations have to be taken into account when choosing an evaluation technique. In our case, the advantages of a choice experiment method prevail over the drawbacks. Overall, we consider this method interesting and appropriate in estimating the demand for hypothetical¹⁷ child care services.

5.1. Choice cards

The experiment simulates the choice among several child care options. The respondent - the parent who takes mostly care of the child (usually the mother) - has to choose one option. Within each choice situation (card) the respondent has to choose one option out of four alternatives proposed.

¹⁴ See for example Bateman et al. (2002).

¹⁵ Bateman et al. (2002), Hanley et al. (2001).

¹⁶ In this case, the value is captured in the constant term.

¹⁷ Child care services are considered hypothetical because they are not available for a large number of households.

As discussed earlier, we identify three categories for the extra-familial day care for children:

- » **Child care centre.** Day care is provided by professional staff within a facility specifically equipped for this purpose. Several children are hosted in the facility.
- » **Family day care home.** Day care is provided by some parents to a small group of children, which include their own children. Children are looked after in the caregiver's private residence.
- » **Baby-sitter ("nanny").** Child care is provided by a dedicated person at the home of the children.

We include a fourth alternative: **private care.** This represents parental care as well as all the other options arranged within the circle of relatives and friends. This kind of child care differs from the others above since it is usually unpaid.

The range of attributes of each choice varies within a realistic scenario for Switzerland. As an example we can consider the distance between home and child care service, which varies from 5 to 25 minutes.

Child care centre, family day care home and nanny are characterized by the following attributes:

- » **Price for half day care.** To simulate the Swiss customary pricing policy, prices are proportional to the household income. Thus, differences in income between rural and urban areas are indirectly considered by the hypothetical prices. The proposed prices are subsidized for low and medium income families. The price of the child care centre has been set between 0.3% and 0.6% of the family's income

per half day of care¹⁸. The price of the family day care home is set between 0.2% and 0.5% of the family's income per half day of care. Finally, the price for the nanny option is set within a range corresponding to the market rates in 2005, namely between 60 and 100 Swiss Francs (CHF) per half day of care.

- » **Distance from home.** Distance is set between 5 and 25 minutes without specifying the mode of transport. The families are asked to assume taking their preferred mode of transport¹⁹.
- » **Opening hours.** For each alternative, we define five different ranges of opening hours. Child care centres are usually open from Monday to Friday. For the family day care home and baby-sitter, some choice cards consider the possibility of care on Saturday and Sunday. The working hours varies between 9 and 14 hours a day.
- » **Number of children per staff member.** This characteristic represents a quality aspect of the child care. The number of children per caregiver varies between 3 and 7 for the child care centre, and between 3 and 6 for the family day care home.
- » **Flexibility.** This attribute represents the scheduling flexibility. In the most restrictive form, the child care service is available on some days only, with the possibility of re-scheduling days on a monthly basis. In the most flexible form, there is the possibility to use the service at short notice and without restriction on the number of hours.

Figure 3 shows an example of choice card presented to the families during the experiment. Each family received six different choice cards.

¹⁸ The average price level corresponds, approximately, to the price currently set by the child care facility.

¹⁹ We want to avoid the possibility of refusing an alternative only because a specific mode of transport has been suggested. For the nanny alternative distance is set to zero.

Respondents were asked to imagine that the three alternatives to private care were available in their residence area and did not require any registration in a waiting list.

SITUATION 1	Child care alternatives			ALTERNATIVE 4 Private care
	ALTERNATIVE 1 Child care centre	ALTERNATIVE 2 Family day care	ALTERNATIVE 3 Nanny	
CHARACTERISTICS				
Price for half a day	CHF 40 per child	CHF 30 per child	CHF 60	
Distance from home	10 minutes	15 minutes	-	
Opening hours	Monday-Friday 7 a.m.- 6 p.m.	Monday-Friday 8 a.m. - 4 p.m.	Monday-Saturday 8 a.m. - 4 p.m.	I solve the care of the child in a private way.
Number of children per staff-member	5 children	4 children	Number of children of the family	
Flexibility of the service	Fixed day, monthly adaptation	Monthly adaptation without fixed days	Weekly adaptation	
My choice is:	<input type="checkbox"/> ↓	<input type="checkbox"/> ↓	<input type="checkbox"/> ↓	<input type="checkbox"/>
Days per week (e.g. 1 day, 2.5 days...)

Figure 3: Example of a choice card.

A complete design, which includes all the levels of attributes, would require a very high number of cards. For this reason we combined different levels of attributes using an orthogonal factorial design (Louviere et al., 2000; Champ et al., 2003). Using this approach, redundant combinations of the levels of attributes are omitted. Thus, it is possible to cover the whole space of attributes combinations with a limited number of alternatives. Through this technique, we do not need to present all the combinations to the respondents.

5.2. The sample

The respondents are randomly selected from the household population living in 9 Swiss cantons participating in the study and representing the 3 linguistic regions of Switzerland²⁰. The municipalities in the selected cantons provide a number of child care facilities. To obtain a balanced sample across rural and urban areas, special attention is given to the regional distribution of households. Parents with children below the age of five are randomly chosen from the database of the market research company who made the survey.

Households are initially contacted by phone and are asked about their family composition and the age of their children. Households with at least one child of five years or younger are asked further questions about their current child care choices as well as socioeconomic characteristics. In a second stage, households are mailed six choice cards with the alternative day care modes and related instructions. In a third stage, households are contacted by phone and asked to reveal their choices. The survey is carried out between October

²⁰ These are Bern, Luzern, Zug, Basel-City, Aargau, Ticino, Vaud, Wallis and Jura. In Switzerland, the total number of cantons is 26.

2003 and July 2004 and the average length of the interview is about 24 minutes.

As many as 694 households participated in the first stage of the survey, 88% of which completed the choice cards. The final sample including valid observations consists of 2'813 records from 599 families. Consequently, it is possible that the final sample is not representative of the total population. Nevertheless, the final sample is not significantly different from the initial sample as is with respect to the main characteristics. Moreover, the participation rate is relatively high, which suggests that the sample is fairly representative of the population in the 9 cantons.

The list of variables used in the analysis and their description is provided in Table 3.

Data show that the child care centre and the family day care home represent 30% and 25% of choices respectively. Private child care is selected in 45% of cases²¹.

²¹ Baby-sitter is included in private child care.

Variable	Description
Price CC	Price of the child care service (CHF/half-day)
Distance CC	Distance from child care service (multiples of 5 min.)
Open CC	Opening hours
Number CC	Number of children per staff member
Flexibility CC	Dummy, scheduling flexibility (hourly, daily or weekly)
Price FH	Price of the family day care home (CHF/half-day)
Distance FH	Distance from family day care home (multiples of 5 min.)
Open FH	Opening hours
Number FH	Number of children per staff member
Flexibility FH	Dummy, scheduling flexibility (hourly, daily or weekly)
Age	Age of respondent
Mother	Dummy, respondent is the mother
Nationality	Dummy, respondent is Swiss
University	Dummy, respondent has a university degree
Income	Household monthly income, in 1'000 CHF
Urban	Dummy, urban region
German	Dummy, German-speaking part of Switzerland
Age child	Age of the child considered in the survey
Child(ren) < 5	Number of additional child(ren) younger than 5
Child(ren) 5 – 12	Dummy, additional child(ren) between 5 and 12
Child(ren) 13 – 18	Dummy, additional child(ren) between 13 and 18
Adults > 18	Dummy, more than two adults older than 18

Table 3: List of variables and description.

Table 4 provides a summary statistics of variables used in the econometric analysis: characteristics of child care centre and family day care services, household composition and children's characteristics, and socioeconomic characteristics.

As for the characteristics of the service, we consider price, distance from home, opening hours, number of children per staff, and flexibility. The average price that parents are willing to pay for child care mode is 28.70 Swiss francs per half-day. The price for family day care home is 6 Swiss francs lower (22.70). For both services, the average distance from home is

for both services 3 times five minutes, which means 15 minutes of travel. Parents consider this distance a reasonable one. Opening hours are fairly the same in both modes, about 11 hours per day. This means that parents need more child care than the usual amount of working hours per day. The respondents prefer, on average, 5 children per staff member in child care centers and 4.5 children in family day care home. About 60% of the respondents are in favor of more flexibility in terms of hours, days or weeks for both types of services.

As for the socioeconomic aspects, 61% of households live in urban areas, whereas 39% live in rural areas. German-speaking households represent 57% of the total sample. French and Italian speaking households represent the remaining subsample (43%). Mothers are in charge of children's care in 91% of cases, whereas fathers in 9% of cases only. The average age of individuals is 34 years. The respondents are Swiss in 85% of the cases and have a university degree in 11% of the cases. The average monthly income is about 6'360 Swiss francs.

Regarding family composition and children's characteristics, the average age of children is about 2.5 years. With respect to the average number of additional child (or children) in the household, we consider three age classes: younger than 5 years, between 5 and 12 years, and between 13 and 18 years. The first class considers the average number of additional children (1.4), whereas the second (41%) and third (5%) classes are dummies that indicate if there is an additional child in the household or not. In 97% of cases, there are more than two adults (older than 18 years) living in the family.

Variable	Mean	Std. Dev.	Min	Max
<i>Characteristics of services</i>				
Price CC	28.67	11.29	6	60
Distance CC	2.99	1.42	1	5
Open CC	11.22	1.74	9	14
Number CC	5.03	1.40	3	7
Flexibility CC	0.6	0.49	0	1
Price FH	22.72	10.15	3	50
Distance FH	3.01	1.40	1	5
Open FH	10.98	1.67	9	14
Number FH	4.49	1.12	3	6
Flexibility FH	0.61	0.49	0	1
<i>Socioeconomic characteristics</i>				
Age	33.92	4.48	22	54
Mother	0.91	0.29	0	1
Nationality	0.85	0.35	0	1
University	0.11	0.31	0	1
Income	6.36	1.92	1.5	10
Urban	0.61	0.49	0	1
German	0.57	0.50	0	1
<i>Children's characteristics and family composition</i>				
Age child	2.45	1.28	0	5
Child(ren) < 5	1.39	0.53	1	3
Child(ren) 5 – 12	0.41	0.49	0	1
Child(ren) 13 – 18	0.05	0.22	0	1
Adults > 18	0.97	0.16	0	1

Table 4: Descriptive statistics for the sample (N=2'813).

Our data suggest a positive hypothetical demand for child care centre and family day care home. This should imply an increase in the Swiss utilization rates of these services. However, since many families could use extra-familial child care as their complementary care option, their choices may understate their current use of extra-familial care.

6. Empirical results

The objective of this section is to discuss estimation results of the multinomial logit model²². Before discussing these results, we remind the reader one basic assumption of the multinomial logit model. The odds ratio between a pair of alternatives does not depend upon a third alternative. This assumption - more commonly referred to as independence of irrelevant alternatives (IIA) - can be violated when the decision is made in a nested manner. One can argue that households first decide whether they intend to use child care facilities, and subsequently they examine different types of child care modes outside their home. The better choice is conditional upon the previous decision of using external child care.

We consider four models. In all these models, the comparison group is the private care mode:

- » **Model 1.** We run multinomial logit regression using the whole sample and do not correct for endogeneity due to the fact that parents may work. This approach is used, for instance, by Banfi et al. (2009).
- » **Model 2.** We run multinomial logit regression using the subsample of parents who work. Del Boca et al. (2005) and Connelly and Kimmel (2003) use this approach, which may be affected by a selection bias.
- » **Model 3.** Our regression accounts for the selection bias by including the inverse Mills ratio (see Powell, 2002). The selection variable is whether or not the respondent is employed. In this case, the selection equation is estimated using a probit model (see Table 6).

²² We also tried to estimate a panel data structure for the multinomial logit model, but the procedure, in NLOGIT, did not converge.

» **Model 4.** We follow the Greene's procedure and apply a multinomial logit model with selectivity. The selection variable is whether or not the respondent is employed.

As discussed in the previous Section, Model 4 is our preferred model since it considers all the sample. Model 1 to 3 are estimated for comparison purposes. Consequently, we first summarize the results of the first three models and then we focus more in details on Model 4.

About the expected impact of the variables, we can hypothesize that price, distance and number of children per staff member would have a negative sign, because, for instance, an increase in price would reduce the use of a certain child care mode. Opening hours and scheduling flexibility are expected to have a positive impact, because these variables allow parents to have more freedom of action during the day. Older parents should be more likely to use child care services, and the same is expected for parents with a high level of education and income. Families living in urban areas could have a positive impact due to the fact that these kinds of services are more present in rural regions. We cannot hypothesize the sign of the variables related to the nationality of the respondents and the linguistic region where they live. About the age of child, we can suppose that for "older" children, parents will reduce the use of formal child care services. Related to the family composition, we expect a negative impact of the variables that indicate the presence of additional children or adults in the family.

Table 5 reports the estimated coefficients from all the regressions. These coefficients show the effects of the explanatory variables on the probability of choosing a child care centre and family day care home as compared to the baseline category (private child care mode).

The full sample considered in Model 1 consists of 2'813 observations: 2'547 from mothers (90.54%) and 266 from fathers (9.46%). Variables that

characterize the child care service exhibit the expected signs and are significant. The other variables (for instance, socioeconomic characteristics or family composition) also have the expected sign. Only the children's age, in the choice of the child care centre mode, has a positive and unexpected sign although this is not significant.

Variable	Model 1				Model 2				Model 3				Model 4			
	Child Care Centre		Family Home		Child Care Centre		Family Home		Child Care Centre		Family Home		Child Care Centre		Family Home	
	Coeff.	S.E.	Coeff.	S.E.												
Constant	-1.719 **	0.859	-1.598 *	0.895	-1.582	1.177	-2.241 *	1.258	-2.798	1.944	-0.711	2.161	-1.554	1.177	-2.234 *	1.291
Price CC	-0.052 ***	0.007	0.015 **	0.007	-0.053 ***	0.009	0.008	0.009	-0.053 ***	0.009	0.008	0.009	-0.053 ***	0.009	0.008	0.009
Distance CC	-0.296 ***	0.036	0.100 ***	0.037	-0.252 ***	0.048	0.138 ***	0.051	-0.252 ***	0.048	0.137 ***	0.051	-0.253 ***	0.049	0.137 ***	0.051
Open CC	0.078 ***	0.029	0.012	0.030	0.088 **	0.039	-0.018	0.042	0.088 **	0.039	-0.018	0.042	0.088 **	0.040	-0.018	0.042
Number CC	-0.153 ***	0.035	0.003	0.036	-0.153 ***	0.048	0.008	0.050	-0.154 ***	0.048	0.008	0.050	-0.154 ***	0.048	0.008	0.051
Flexibility CC	0.187 *	0.102	0.048	0.106	0.281 **	0.139	0.049	0.147	0.280 **	0.139	0.055	0.147	0.283 **	0.140	0.053	0.148
Price FH	0.017 ***	0.007	-0.047 ***	0.007	0.015 *	0.009	-0.046 ***	0.009	0.015 *	0.009	-0.046 ***	0.009	0.014	0.009	-0.046 ***	0.010
Distance FH	0.131 ***	0.036	-0.335 ***	0.038	0.152 ***	0.049	-0.320 ***	0.053	0.152 ***	0.049	-0.321 ***	0.053	0.148 ***	0.049	-0.323 ***	0.055
Open FH	-0.026	0.030	0.063 **	0.031	-0.033	0.042	0.090 **	0.042	-0.032	0.042	0.088 **	0.042	-0.032	0.043	0.092 **	0.042
Number FH	-0.029	0.043	-0.096 **	0.045	-0.087	0.059	-0.045	0.062	-0.089	0.059	-0.044	0.062	-0.088	0.060	-0.045	0.064
Flexibility FH	-0.134	0.101	0.190 *	0.107	-0.042	0.139	0.130	0.149	-0.038	0.139	0.133	0.150	-0.045	0.139	0.129	0.152
Age	0.072 ***	0.013	0.045 ***	0.014	0.082 ***	0.018	0.042 **	0.020	0.103 ***	0.033	0.015	0.037	0.080 ***	0.019	0.040 *	0.021
Mother	0.929 ***	0.180	0.841 ***	0.192	1.081 ***	0.215	0.963 ***	0.231	0.480	0.802	1.711 *	0.916	1.091 ***	0.228	0.975 ***	0.225
Nationality	-0.406 ***	0.137	-0.196	0.149	-0.375 **	0.187	0.026	0.212	-0.215	0.275	-0.185	0.317	-0.368 **	0.184	0.038	0.210
University	0.813 ***	0.165	0.474 ***	0.178	0.738 ***	0.194	0.297	0.210	1.116 **	0.515	-0.155	0.570	0.754 ***	0.197	0.310	0.216
Income	0.197 ***	0.050	0.127 **	0.054	0.255 ***	0.068	0.293 ***	0.073	0.341 ***	0.127	0.186	0.143	0.254 ***	0.070	0.292 ***	0.072
Urban	0.403 ***	0.102	0.068	0.105	0.624 ***	0.141	0.177	0.146	0.592 ***	0.145	0.211	0.151	0.635 ***	0.144	0.189	0.150
German	-0.663 ***	0.101	-0.671 ***	0.105	-0.770 ***	0.137	-0.756 ***	0.146	-0.997 ***	0.319	-0.467	0.362	-0.768 ***	0.140	-0.755 ***	0.149
Age child	0.038	0.039	-0.049	0.041	-0.062	0.052	-0.101 *	0.056	-0.080	0.057	-0.079	0.061	-0.061	0.053	-0.100 *	0.059
Child(ren) < 5	0.032	0.098	0.219 **	0.101	0.024	0.135	0.243 *	0.141	-0.175	0.284	0.479	0.309	0.036	0.135	0.255 *	0.147
Child(ren) 5 – 12	-0.683 ***	0.111	-0.255 **	0.116	-0.892 ***	0.151	-0.531 ***	0.160	-1.173 ***	0.386	-0.193	0.425	-0.881 ***	0.153	-0.517 ***	0.167
Child(ren) 13 – 18	-0.722 ***	0.233	-1.337 ***	0.284	-1.282 ***	0.341	-1.643 ***	0.399	-1.177 ***	0.371	-1.769 ***	0.428	-1.264 ***	0.359	-1.633 ***	0.422
Adults > 18	-0.972 ***	0.316	-1.058 ***	0.321	-1.652 ***	0.440	-1.666 ***	0.476	-1.953 ***	0.579	-1.292 **	0.638	-1.652 ***	0.449	-1.668 ***	0.495
Work - Mills ratio	-	-	-	-	-	-	-	-	1.620	2.026	-1.988	2.285	-	-	-	-
Pseudo R ²	0.131				0.161				0.161				-			
Log-Likelihood	-2'604.2				-1'400.1				-1'399.0				-16'134.80			
Number of obs. (N)	2'813				1'557				1'557				2'813			

Note: *, ** and *** denote statistical significance at 10%, 5% and 1% levels, respectively. Private care mode is the comparison group.

Table 5: Estimation results of the multinomial logit models with and without selection bias corrections.

Model 2 includes 1'557 observations of working parents, 1'335 of which are mothers (85.74%) and 222 are fathers (14.26%). The estimation results are similar to those of Model 1. There is only one exception, which is the impact of the nationality for the family day care home. This variable now shows a positive sign, although the effect is not significant. Other variables lose their significance (for instance, the number of children per staff member and the level of education in the family day care home). For both child care modes, the child's age shows the expected sign, which is also significant for the family day care home.

To correct the possible selection bias related to parents who work, Model 3 includes the inverse Mills ratio. As for the characteristics of the child care modes, results are similar to those of the above models. However, the impact of socioeconomic aspects and the family composition is poorly significant. It is the case, for instance, of income for the family day care home and the presence of other children between 5 and 12 years old. Furthermore, the effect of the level of education for the family day care home becomes negative. Also, the number of additional children younger than 5 years for the child care centre becomes negative. Both variables are not significant. Finally, the correction term - the inverse Mills ratio - does not seem to be statistically significant.

Model 4 uses the whole sample and addresses the selection bias problem. In our case the selection is on the variable work, which is a binary variable that takes value 1 if the respondent is employed and 0 otherwise. Most coefficients are statistically significant and have the expected sign. Choice attributes such as price, distance and opening hours are highly significant for both child care modes. The flexibility and the number of children per staff member are highly significant only for child care centres. However, for family day care homes, these variables show the expected sign. This suggests that a price increase significantly reduces the demand for child care

centers and family day care homes. The distance to the child care provider significantly reduces the probability of using the two formal child care modes. Increasing opening hours positively affect the use of child care centres and family day care homes. Finally, many household characteristics have a significant impact on choice probabilities, in particular for the child care centre mode.

Variable	Work	
	Coeff.	S.E.
Constant	0.228	0.302
Age	0.025***	0.007
Mother	-0.823***	0.102
Nationality	0.169**	0.072
University	0.457***	0.089
Income	0.095***	0.014
Urban	-0.031	0.052
German	-0.255***	0.052
Age child	-0.020	0.020
Child(ren) < 5	-0.217***	0.050
Child(ren) 5 – 12	-0.310***	0.057
Child(ren) 13 – 18	0.125	0.116
Adults > 18	-0.336**	0.159
Pseudo R ²	0.078	
Log-Likelihood	-1'783.4	
Number of obs. (N)	2'813	

Note: *, ** and *** denote statistical significance at 10%, 5% and 1% levels, respectively.

Table 6: Results of the Probit Model for the selection procedure.

Marginal effects and elasticities estimates at the sample mean are calculated for significant variables of Model 4 and summarized in Table 7.

Variable	Child Care Centre		Family Home	
	Marginal Effect	Elasticity	Marginal Effect	Elasticity
Price CC	-0.012	-1.16		
Distance CC	-0.063	-0.62	0.041	0.55
Open CC	0.020	0.73		
Number CC	-0.033	-0.55		
Flexibility CC	0.056	0.11		
Price FH			-0.009	-0.94
Distance FH	0.053	0.53	-0.066	-0.90
Open FH			0.018	0.89
Number FH				
Flexibility FH				
Age	0.014	1.61	0.002	0.24
Mother	0.164	0.46	0.095	0.36
Nationality	-0.080	-0.23		
University	0.138	0.07		
Income	0.034	0.74	0.033	0.99
Urban	0.121	0.25		
German	-0.111	-0.19	-0.079	-0.18
Age child			-0.013	-0.14
Child(ren) < 5			0.042	0.25
Child(ren) 5 – 12	-0.151	-0.19	-0.030	-0.05
Child(ren) 13 – 18	-0.156	-0.03	-0.198	-0.05
Adults > 18	-0.236	-0.76	-0.178	-0.77

Note: Marginal effects and elasticities at the means of independent variables.

Elasticity for a binary variable is marginal effect/mean.

Table 7: Marginal effects and elasticities of significant variables for the Multinomial Logit Model with selectivity.

Swiss families (nationality) are about 8% less likely to choose child care centre mode with respect to foreign citizens. Compared to Latin-speaking households, families residing in the German-speaking regions of Switzerland are about 11.1% less likely to use child care centre and 7.9% less likely to use family day care home, with respect to Italian- and French-speaking regions. Residents of urban areas are about 12.1% more likely to

purchase child care centre as compared to residents of rural areas. This can be explained by the fact that the learning experience on the characteristics of child care centers is lower in rural areas than in urban areas.

Elderly parents are significantly more likely to choose a formal child care mode. Parents with a university degree are more likely to use child care centers in 13.8% of times. The demand for non-private child care modes increases significantly with family income. The income elasticity for child care centre mode is 0.74 and for family day care home mode is 0.99. Banfi et al. (2009) report an income elasticity for child care centre mode equal to 0.56.

Mothers responding to the survey are more likely to use child care centre as compared to private child care at home in 16.4% of times, and 9.5% more likely to use family day care home. In around 10% of the sample the father is the respondent to the survey and is generally in charge of child care within the family. In these cases, households are less likely to use an external child care mode. The rather unconventional feature of these households could be linked to some unobserved characteristics of families, which affect the choice of child care. Fathers who are more likely to respond to the survey may be in charge of child care either because they are (temporarily) unemployed or they have a preference for taking care of their children at home.

Families with additional children younger than 5 choose family day care home about 4.2% of times more often than other families. Conversely, households with additional children older than 5 are less likely to use a non-private child care option. The presence of other children between 5 and 12 years old reduces the use of child care centre of about 15.1% and the use of family day care home of about 3% as compared to other families. The presence of other children between 13 and 18 years old reduce the use of

child care centre of about 15.6% and the use of family day care home of about 19.8%. Finally, the presence of more than two adults (older than 18) reduces the use of child care centre of about 23.6% and the use of family day care home of about 17.8%. The presence of teenagers in the family could be interpreted as the availability of additional resources to take care of younger children.

Regarding the effect of prices, households have a similar response. Own price elasticity of both formal care modes ranges from 0.94 to 1.16, in line with Banfi et al. (2009). This suggests that a price increase of 10% reduces the choice of child care mode by about 11.6% and the choice of family day care home by about 9.4%.

The own distance elasticity is 0.62 and 0.90, respectively for the child care centre and family day care home. This indicates that a distance increase of 10% reduces the choice of child care mode by about 6.2%, and the choice of family day care home by about 9%. For the child care centre, Banfi et al. (2009) report an elasticity of 0.74. The own opening hours elasticity is 0.73 for the child care centre option and 0.89 for the family day care option. This means that a 10% increase of the opening hours increases the use of child care centre mode by about 7.3%, and the use of family day care mode by about 8.9%.

The ratio of children per staff member is reported only for the child care centre option. The result suggests that the probability of choosing a child care centre decreases when the staff is reduced. The elasticity is 0.55. Also the effect of the scheduling flexibility of the child care centre is significant and suggests that more flexibility increases the use of this type of child care. Banfi et al. (2009) find a similar effect for family day care home, although flexibility is defined in a different way.

In Table 8 we compare our elasticities with those reported by Banfi et al. (2009). In particular, we compare the results for the characteristics of the service (price, distance, opening hours, number of children per staff member and scheduling flexibility). We consider Model 1, which is the same used by Banfi et al. (2009), and Model 4, where we correct for the selectivity problem. We conclude the estimated elasticities are similar. This suggests that the results do not improve substantially after correction procedures for the selection bias have been considered.

	Banfi et al. (2009)	Model 1	Model 4
Price CC	-1.20	-1.16	-1.16
Distance CC	-0.74	-0.70	-0.62
Open CC	n.a.	0.60	0.73
Number CC	-0.59	-0.56	-0.55
Flexibility CC	n.a.	0.07	0.11
Price FH	-0.98	-0.94	-0.94
Distance FH	-0.94	-0.89	-0.90
Open FH	n.a.	0.62	0.89
Number FH	-0.34	-0.30	n.a.
Flexibility FH	n.a.	0.11	n.a.

Table 8: Comparison of elasticities.

7. Conclusions

In Switzerland, extra-familial child care services are underprovided. The government has recently extended an incentive program to finance child care services, such as child care centres and family day care homes. The effective promotion of child care facilities requires detailed information on factors affecting parents' choices. These choices may be limited since different child care modes are not available everywhere in the country. For instance, there are differences between rural and urban areas. A combination between formal and private care modes would be beneficial for households.

In this paper, we analyzed Swiss households' choices concerning child care modes for preschoolers (children younger than 5 years old). We used a stated preferences approach, because these types of services are not yet available in certain regions.

Our choice experiment considered four modes of child care: child care centre, day care family home, baby-sitter and private child care. Due to the low number of observations for the baby-sitter option, we considered this option within private child care. Several socioeconomic characteristics of households, children's characteristics and family composition are collected throughout the experiment. Information on the characteristics of services such as price, distance from home, number of children per staff member, opening hours and flexibility are also collected. The number of children per staff member could be seen as a proxy of quality. Our approach is similar to the one used in Banfi et al. (2009), although opening hours is not used by these authors and scheduling flexibility is specified in a different way.

Our sample is composed of 600 families living in nine Swiss cantons. It would be interesting to have data about all the 26 Swiss cantons. In our

analysis, we have data from all speaking-regions of Switzerland (i.e. German or Italian and French).

To understand the factors affecting the use of child care modes, we run multinomial logit regressions. Compared to previous studies, we consider a new correction technique to account for the selection bias due to labor force participation. We also use new variables, such as the presence of more than two adults in the household and improve the specification of scheduling flexibility of child care mode.

Our results suggest a potential demand for formal services. The demand depends mainly on the characteristics of these services. The most important characteristics are affordability (price), access (distance) and opening hours.

An increase in the price of formal child care mode results in an increase in the demand for private services and a reduction in child care services and family day care homes. These results are consistent with a child care market where child care demand is relatively price elastic. When access to formal child care is easier (low distance between family home and child care facility), the demand increases significantly. An increase in opening hours results in an increase in the demand for formal services.

Another interesting result is the family's cultural background. Families living in the Italian- or French-speaking parts of Switzerland are more likely to choose formal care modes. Conversely, families living in the German-speaking parts tend to prefer the private care mode.

More educated parents and households with higher income are more likely to use child care centers. Similarly for families living in urban regions. In terms of family structure, the presence of other children younger than 5 years old increases the probability of using a family day care home. Conversely, the presence of other children between 5 and 18 years old or

other adults (more than 2) increases the probability of using a private child care mode.

Immigrant families are more likely to choose child care centers compared to other families. This could suggest that policies aiming at social integration are beneficial.

Our results are important to understand how the Swiss child care market works and to help explaining parents' decisions. The results are also cue for effective policy development aimed at providing an adequate and affordable (because of the subsidized prices) supply of child care services in Switzerland.

The promotion of public child care services has a positive social and economic impact since it may affect the fertility rate, labor supply of women and integration opportunities of children. This is particularly important in the current context of Switzerland. A growing number of families have only one child and a growing number of mothers would like or need to work more. As a consequence, an effective policy promotion should consider diversified and flexible child care alternatives. The optimal care mode could vary across different communities, i.e. selected groups of families.

An alternative solution could be to promote an employer-sponsored child care. Many employers could support the staff in need for child care by means of financial assistance or onsite child care services. Employer-sponsored child care could be seen as a means of attraction and retention towards workers. Investing in employer-supported child care provision could help employers in reaping a range of business benefits, including enhanced ability to recruit employees, lower labor turnover rates, higher levels of labor productivity, and improved community relations. Family-friendly companies are becoming a choice for many workers. Employees could enjoy a whole range of benefits when their employer offers child care

programs. Some of the most obvious benefits include greater flexibility in working hours, shorter commuting times, improved peace of mind, knowing children are close by, ability to return to work faster, greater contentment with work-life balance. A number of strategies for employer-sponsored child care could be considered: on-site child care, leasing an existing child care centre, investing in permanent places at a nearby child care centre, and school holiday care.

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The demand for school-meals in Switzerland

1. Introduction

In most OECD countries, parents face considerable challenges when trying to reconcile their family and work commitments, since all-day child care facilities are not always available (OECD 2007). Parents who decide to work full-time or part-time may pay a substantial amount for private child care services. Some parents prefer to stay out of the job market and provide full-time care directly to their children. Problems with the organization of child care before and after school and during lunchtime are even more considerable for families with children at primary school. Consequently, supervised school-meal services and extra activities may improve choices of households and are probably beneficial for those parents who give value to opportunities at work.

In Switzerland, municipalities are mainly responsible for the decision to offer supervised school-meal services. Generally, the cantons play a secondary role in this decision process. For this reason, the supply of school-meal services is not homogeneous across and within cantons¹. Moreover, in most cantons, the supply of supervised school-meal services is limited.

¹ Switzerland is a federal state with a largely decentralized education system. Primary school education is mandatory and generally supplied by the state. The tasks of the education system are shared between three political levels - confederation, cantons and municipalities - which work together in their respective areas of responsibility to ensure high quality in education. The organization and the regulation of the school system is not homogeneous across the territory since each of the 26 cantons has its own subsystem of primary schools. The cantons and their municipalities are responsible for the organization and financing of primary schools. In particular, municipalities assume competences on pre-school, primary and lower secondary levels.

Recently, several Swiss cantons and municipalities discussed the possibility to increase supply of school-meal services. For this purpose, it is important to collect and analyze information on households' preferences and willingness to pay for meal services.

In this paper, we analyze the demand for school-meals for children attending primary schools in Swiss cantons characterized by limited supply of supervised school-meal services. We consider four cantons which are representative of the northwest part of Switzerland. These cantons and their municipalities are about improving offer of child care services at primary school, introducing a meal service available between the end of the morning classes and the beginning of the afternoon classes. We analyze the hypothetical choice of the number of school-meals demanded by parents during the week (from Monday to Friday), conditional household and service characteristics. Using a stated preferences approach, we collect data on the weekly demand of school-meals by 905 parents. To identify factors affecting parents' preferences, we apply count data models. We then assess the willingness to pay for the new service and discuss improvements in the pricing policy for an efficient provision of school-meals.

Literature lacks empirical studies on the demand for school-meals. Two studies vaguely relate to our analysis, although their focus is on the demand for different types of diet rather than the demand for meals. Lee (1987) investigates the demand for varied diet in US households between 1977 and 1978. Count data models such as Poisson and negative binomial models are used to examine the impact of household characteristics on the number of different food items consumed during a week. The results show that an increase in food expenditure increases the number of food items consumed at home, and the number of food items consumed at home in turn is positively related to the number of household members. Akin et al. (1983) analyze participation in the US National School Lunch Program by 1'222

children. Following the traditional utility theory, the authors write the demand for school-meals as a function of the price of meals, the price of complements and substitutes, the budget constraint and various socioeconomic variables. A vector of nutrient taste variables is added to the demand function. Demand is estimated by means of ordered probit models where the dependent variable is the quantity of school-meals. Based on the estimates, a 50 percent increase in the price of school lunches for students is expected to reduce the participation by 20 percent. The authors affirm that taste variables are important in assessing the demand for school-meals.

The most relevant contribution of this paper is a first empirical analysis on the demand for primary school-meal services, which allows to disentangle factors affecting households' choices of meal services and to calculate the willingness to pay for school-meals.

The paper is structured as follows. In Section 2, we discuss the empirical specification. Section 3 is devoted to the survey design and data description. The regression results are presented in Section 4. Concluding remarks and policy considerations are discussed in Section 5.

2. Empirical specification

We assume that the household weekly demand for school-meal services is generated by the following function:

$$Q = f(P, Y, Z) \quad (1)$$

where Q is the hypothetical number of school-meals, P is the price of a meal, Y is the household monthly income, and Z is a vector of socioeconomic variables.

The vector Z includes a dummy that takes value 1 if the child is cared by non-family members, dummies for cantons, a dummy for the area of residence: urban or countryside. Other variables considered in Z are: a dummy that indicates if the respondent is the child's mother, age of the respondent, a dummy that indicates if the respondent is Swiss, the percentage of work of the respondent, and a dummy that takes value 1 if the respondent has a university degree. A dummy that indicates if the respondent is satisfied with the current care mode and the age of the child considered in the survey are also included. We also consider the number of additional children younger than 2, between 3 and 5, between 6 and 10 and between 11 and 15, and a dummy that indicates if there are more than two adults older than 16 in the household. Finally, we use a dummy that takes value 1 if both parents live in the household.

The dependent variable in equation (1) is a count variable that indicates the number of times parents buy a school-meal for their children. From the econometric point of view, the linear regression model is not suitable for count outcomes. The reason is that the results can be inefficient and biased.

Models that specifically account for the generation process of the data are more suitable for count outcomes. In the literature, we find two main econometric models: the Poisson regression and the negative binomial regression. Some authors (Akin et al. 1983) also use ordered logit or probit models. However, as pointed out in several econometric textbooks (Greene 2003, Cameron and Trivedi 2005), the most appropriate models are count models. A final advantage of this econometric model is that the calculation of welfare is relatively simple. Therefore, for the estimation of equation (1) we consider the Poisson regression.

For comparison purposes, we also estimate model (1) using a negative binomial regression. Finally, we considered the possibility of applying a two-part model and a zero-inflated count model. However, due to the fact that in our sample the zeros and the positive values come from the same generation process, these two econometric approaches are not advisable (Cameron and Trivedi 2005).

In literature, several studies use count models to explore the demand for hospitalizations, number of beverages, number of visits to a national park or number of patents. For instance, Cameron and Trivedi (1986) analyze factors affecting the frequency of doctors' consultations, Mullahy (1986) explores factors that influence the number of beverages, and Carpio et al. (2008) investigate the demand for agritourism in the United States.

To consider unobserved heterogeneity that remains constant over time, we estimate a random-effects version of the Poisson panel regression². Since model (1) includes several time-invariant covariates, the fixed-effects version of the count model is neglected.

The Poisson probability density function is given by:

² See Hausman et al. (1984), Cameron and Trivedi (1998), Greene (2003) and Baltagi (2008).

$$P(Q = q) = \frac{e^{-\lambda} \lambda^q}{q!} \quad (2)$$

where $q = 0, 1, 2, \dots$ is a random variable indicating the number of times an event occurs and λ is the parameter of the Poisson distribution. Precisely, λ is the expected number of times an event will occur within a given time. This is a one-parameter distribution with both the mean and the variance of Q equal to λ .

In our case, the Poisson distribution (2) assumes that all families have the same expected demand in term of number of school-meals. This assumption is not very realistic. Therefore, to allow for heterogeneity in λ , one can use a Poisson regression. This leads to the following Poisson regression model, where λ is a function of a vector of socioeconomic and household characteristics (z'):

$$\lambda = \exp(z'_i \beta) \quad (3)$$

where the subscript i indicates the household.

Taking the exponential of $z'_i \beta$ forces the expected count λ to be positive, which is required for Poisson distribution.

Given equations (2) and (3) and the assumption that the observations are independent, it is straightforward to estimate our regression by means of maximum likelihood. The log-likelihood function for the Poisson regression model is given by:

$$\ln L(\beta) = \sum_{i=1}^N \{q_i z_i' \beta - \exp(z_i' \beta) - \ln q_i!\} \quad (4)$$

In our model specification, the parameter estimates (β) indicate the impacts of the k^{th} -independent variable on the number of school-meals. The sign of the parameter estimates indicate the direction of the impact.

The parameter estimates can be used in several ways³. In this study, we mainly use the results to compute the percentage change in the expected count for δ unit change in one of the explanatory variables, z_k , holding all the other variables constant. This can be computed as:

$$100 \times \{\exp(\beta_k \times \delta) - 1\} \quad (5)$$

Consequently, we will discuss changes in households' socioeconomic characteristics in terms of percentage change in the number of school-meals households are willing to buy.

³ See Long J.S. and Freese J. (2003) for a discussion on this issue.

3. Survey design and data

For the estimation of model (1) we use a stated preferences approach, i.e. we collect data on a hypothetical market. The main reason for the choice of this approach is the limited number of municipalities offering supervised school-meals. Because most of the families do not have the possibility to buy supervised school-meal services in the cantons considered in our analysis, they cannot reveal their demand in a real market.

In order to collect data for the estimation of model (1), we conducted a phone survey in four Swiss cantons⁴. The survey was administered during November 2007. The interviewers used a software to input the answers. The average length of the interviews was about 17 minutes.

In the first part of the questionnaire we asked information on the demand for supervised school-meal services, while in the second part we collected information on socioeconomic characteristics of the households. At the beginning of the interview, the characteristics of a typical supervised school-meal service⁵ were presented.

We gathered data necessary to our study by interviewing families with at least one child in the school age (primary school) and living in one of the four cantons of the northwest part of Switzerland, a German-speaking

⁴ The empirical analysis reported in this paper is based on a dataset that has been built for a project commissioned to the Institute Mecop at the University of Lugano and financed by four Swiss cantons (Aargau, Basel-City, Basel-Land and Solothurn).

⁵ The school-meal service starts at the end of the morning classes and ends at the beginning of the afternoon classes. During this period, children have their lunch, the opportunity to play, to rest or to do homework. The staff is trained to take care of children. The meal service is delivered within the school or in another building/facility nearby.

region. Also, we collected information on the use of alternative child care services when parents are unable to directly provide care to their children.

During 2007-2008, primary school was attended by 63'155 pupils: 32'150 boys (50.9%) and 31'005 girls (49.1%). Foreign pupils represent 24.7% of the children population. There are 3'166 classes in total, each of them with 20 children on average.

Parents were chosen randomly from a database. A letter and a coupon were sent to each family to explain the study and ask for engagement. Of those, 60% of families (3'645) agreed to answer the questionnaire. Among these families, we randomly selected 905 families (see Table 1).

	Households	Percentage
Aargau	226	24.9%
Basel-City	227	25.1%
Basel-Country	227	25.1%
Solothurn	225	24.9%
Total	905	100%

Table 1: The sample of interviewed households by canton.

Households were asked to consider up to five levels of a price for the meal service and to state the maximum number of meals they would buy at each level of price. Other characteristics of the service are unchanged (for instance number of children per staff member or opening hours). The initial price was set according to a household's monthly income. We considered three initial levels: 2.50 Swiss francs for low-income families (208 households, 30.63%), 7.50 Swiss francs for medium-income families (250 households, 36.82%) and 12.50 Swiss francs for high-income families (221 households, 32.55%). The initial price was then increased by 2.50 Swiss

francs step by step. The experiment stopped as soon as the respondent declared he was unwilling to buy any meal service at the proposed level of price. Clearly, the maximum number of meals a household is willing to buy is equal to five, i.e. the number of days the meal service could be available within a week.

Frequencies of demanded school-meals at a given price are presented in Table 2 (initial price of 2.50 Swiss francs), Table 3 (initial price of 7.50 Swiss francs) and Table 4 (initial price of 12.50 Swiss francs). A total of 269 households (39.62% of the sample) declare they are not willing to purchase school-meals at the proposed initial price. This implies that around 60% of households are interested in at least one school-meal. Generally, considering the three subsamples we observe (in line with the demand law) that for a given level of quantity, the number of households purchasing this number of meals decrease when the price increases; and for a given price, the number of households demanding a certain number of school-meals decrease when the quantity increases.

Quantity	2.50 CHF		5.00 CHF		7.50 CHF		10.00 CHF		12.50 CHF		Total	
	Obs.	%	Obs.	%	Obs.	%	Obs.	%	Obs.	%	Obs.	%
0	85	14.24	2	0.34	34	5.70	29	4.86	29	4.86	179	29.98
1	25	4.19	31	5.19	32	5.36	27	4.52	10	1.68	125	20.94
2	42	7.04	40	6.70	31	5.19	15	2.51	13	2.18	141	23.62
3	28	4.69	28	4.69	16	2.68	11	1.84	3	0.50	86	14.41
4	8	1.34	8	1.34	3	0.50	1	0.17	0	0.00	20	3.35
5	20	3.35	14	2.35	5	0.84	4	0.67	3	0.50	46	7.71
Total	208	34.84	123	20.60	121	20.27	87	14.57	58	9.72	597	100

Table 2: School-meals demanded by low-income households.

Quantity	7.50 CHF		10.00 CHF		12.50 CHF		15.00 CHF		17.50 CHF		Total	
	Obs.	%	Obs.	%	Obs.	%	Obs.	%	Obs.	%	Obs.	%
0	100	16.03	29	4.65	56	8.97	27	4.33	16	2.56	228	36.54
1	43	6.89	47	7.53	29	4.65	17	2.72	13	2.08	149	23.88
2	66	10.58	45	7.21	22	3.53	12	1.92	6	0.96	151	24.20
3	27	4.33	20	3.21	9	1.44	6	0.96	3	0.48	65	10.42
4	5	0.80	3	0.48	3	0.48	2	0.32	0	0.00	13	2.08
5	9	1.44	6	0.96	2	0.32	1	0.16	0	0.00	18	2.88
Total	250	40.06	150	24.04	121	19.39	65	10.42	38	6.09	624	100

Table 3: School-meals demanded by medium-income households.

Quantity	12.50 CHF		15.00 CHF		17.50 CHF		20.00 CHF		22.50 CHF		Total	
	Obs.	%	Obs.	%	Obs.	%	Obs.	%	Obs.	%	Obs.	%
0	84	14.95	28	4.98	51	9.07	21	3.74	20	3.56	204	36.30
1	41	7.30	41	7.30	23	4.09	19	3.38	8	1.42	132	23.49
2	60	10.68	43	7.65	19	3.38	6	1.07	2	0.36	130	23.13
3	23	4.09	14	2.49	10	1.78	7	1.25	3	0.53	57	10.14
4	6	1.07	5	0.89	4	0.71	4	0.71	3	0.53	22	3.91
5	7	1.25	6	1.07	2	0.36	1	0.18	1	0.18	17	3.02
Total	221	39.32	137	24.38	109	19.40	58	10.32	37	6.58	562	100

Table 4: School-meals demanded by high-income households.

On average, a low-income family would buy 2.62 lunches during a week, a medium-income family about 2.10 lunches, and a high-income family 1.87 lunches. Considering all prices proposed, the average price that parents are willing to pay for a school-meal is about 10.60 Swiss francs.

The characteristics of the households in our sample are presented in Table 5 and summarized in Table 6. These are grouped in two main categories: socioeconomic characteristics of households, family composition and children's characteristics. These variables are used as explanatory variables to estimate the count model defined in the previous Section.

Variable	Description
Price	Price of the service (CHF)
Income	Household monthly income, in 2'000 CHF
Care by others	Child is cared by others
BL	Dummy, family lives in canton Basel-Country
BS	Dummy, family lives in canton Basel-City
AG	Dummy, family lives in canton Aargau
Urban	Dummy, urban region
Mother	Dummy, respondent is the mother
Age respondent	Age of the respondent
Nationality	Dummy, respondent is Swiss
Work	Level (%) of work of respondent
University	Dummy, respondent has a university degree
Satisfaction	Dummy, satisfied with current care mode
Age child	Age of the child considered in the survey
Number child(ren) < 2	Number of additional child(ren) younger than 2
Number child(ren) 3 - 5	Number of additional child(ren) between 3 and 5
Number child(ren) 6 - 10	Number of additional child(ren) between 6 and 10
Number child(ren) 11 - 15	Number of additional child(ren) between 11 and 15
Adults > 16	Dummy, more than two adults older than 16
Parents	Both parents live in household

Table 5: List of variables and description.

Variable	Mean	Std. Dev.	Min	Max
Price	10.59	4.96	2.5	22.5
<i>Socioeconomic characteristics of households</i>				
Income	4.12	1.39	1	7
Care by others	0.57	0.50	0	1
BL	0.29	0.45	0	1
BS	0.27	0.44	0	1
AG	0.23	0.42	0	1
Urban	0.86	0.35	0	1
Mother	0.92	0.27	0	1
Age respondent	39.77	5.53	25	88
Nationality	0.82	0.38	0	1
Work	37.89	33.38	0	100
University	0.17	0.38	0	1
Satisfaction	0.41	0.49	0	1
<i>Children's characteristics and family composition</i>				
Age child	8.20	1.95	5	11
Number child(ren) < 2	0.11	0.33	0	2
Number child(ren) 3 - 5	0.39	0.54	0	5
Number child(ren) 6 - 10	1.09	0.67	0	4
Number child(ren) 11 - 15	0.26	0.52	0	2
Adults > 16	0.87	0.33	0	1
Parents	0.82	0.39	0	1

Table 6: Descriptive statistics for the sample (N=1'796).

Regarding socioeconomic characteristics, our survey includes households living in urban (86%) and rural (14%) areas. Respondents are from canton Aargau in about 23% of the cases, from canton Basel-City in about 27%, from canton Basel-Country in about 29% and from canton Solothurn in about 21%. Mothers are responsible for the care of children in about 92% of the cases, fathers only in 8%. For this reason the average level of employment of the respondent is relatively low (38%). The average age of the respondent is 34 years old. The respondents are Swiss in 82% of cases and have a university degree in about 17% of cases. As many as 57% of

children are cared for by someone other than the parents, for instance relatives or neighbors, during lunchtime. Only in 41% of the cases, parents are satisfied with the current child care mode. The average household's monthly income is between 6'000 and 8'000 Swiss francs.

Variables related to family composition and children's characteristics include the number of children and adults in the household as well as the age of the children. The average age of children is about 8 years old. On average, households include 0.11 additional children younger than 2 and 0.39 additional children between 3 and 5. On average, families have one additional child between 6 and 10 years old and 0.25 additional children between 11 and 15 years old. In about 87% of households, there are more than two adults (older than 16 years old) and in 82% of households both parents live together.

4. Regression results

In this Section we present the estimation results of the count models used to analyze the hypothetical demand for school-meals: a Poisson regression, a negative binomial regression and a Poisson regression with random-effects. Count data models help us to identify the most important factors that influence the number of school-meals demanded by parents during the week. Using the results of the Poisson regression with random-effects, we then calculate the willingness to pay for a school-meal.

Table 4 shows the results of the three count regression models that we considered. For comparison purpose we report the results of a pooled Poisson regression and of a pooled negative binomial regression. The use of a negative binomial regression instead of a Poisson regression is indicated in presence of significant overdispersion, when the variance exceeds the mean. We performed a formal test of the null hypothesis of equidispersion⁶. The coefficient of our test is 0.089 and is highly significant, which suggests equidispersion. Consequently, the Poisson regression represents an appropriate approach. The results of the two pooled models are similar.

To take into account the unobserved heterogeneity that remains constant over time, we estimate a random-effects version of the Poisson panel regression. We then discuss the sign of the estimated parameters and their significance.

As expected, the price of a school-meal has a negative and highly significant effect on the number of school-meals demanded. This means that a higher price would decrease the number of school-meals demanded, in line with the law of demand.

⁶ See Cameron and Trivedi (2005) for details.

Focusing on children's characteristics and family composition, we observe that three coefficients are significant: the number of children between 6 and 10 years old, the number of children between 11 and 15, and the presence of both parents in the family. The impact of these variables on the number of school-meals demanded is negative. This means that the presence of other children older than 6 and the presence of both parents decrease the number of school-meals demanded. This could be explained by the fact that parents already prepare meals for their children or the child considered in the interview takes his lunch at home. Also, the number of additional children younger than 2 and the number of additional children between 3 and 5 reduces the number of school-meals demanded. However, these two variables are not significant. Similarly, for the presence of children older than 16. Finally, the child's age has a positive impact on the number of school-meals demanded, although the effect is not significant.

The last group of variables includes socioeconomic factors. The household income is positive and highly significant⁷. As expected, a higher income increases the number of school-meals demanded. The level of education of the respondent has a positive effect, although not a significant one. The area of residence and the age of the respondent are also not significant. Conversely, the canton of residence is significant and has a positive impact in the case of Basel-City and Basel-Country. The impact is measured with respect to the reference canton: Solothurn. Living in canton Aargau has not a significant impact.

All the other variables are not significant: whether the child is cared for by other individuals outside the family; whether the mother is the respondent;

⁷ Since we considered different initial levels of price according to household income, we included categories of income in our estimations. We also estimate separate models for income classes. The results are unchanged.

whether the respondent is Swiss; the percentage of work of the respondent. We did not take into account possible endogeneity in employment decisions. The reason is that we are analyzing a hypothetical new service and the level of employment of the respondent can be considered as endogenous.

Variable	Poisson		Negative Binomial		Poisson with RE	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Constant	0.637 ***	0.235	0.651 **	0.258	0.644	0.404
Price	-0.045 ***	0.006	-0.045 ***	0.007	-0.085 ***	0.007
Income	0.084 ***	0.023	0.083 ***	0.026	0.184 ***	0.036
Care by others	0.037	0.047	0.035	0.052	0.120	0.080
BL	0.119 *	0.064	0.113	0.069	0.179 *	0.104
BS	0.230 ***	0.064	0.233 ***	0.070	0.200 *	0.105
AG	0.112 *	0.066	0.107	0.071	0.083	0.104
Urban	0.169 **	0.073	0.167 **	0.079	0.158	0.113
Mother	0.039	0.083	0.024	0.091	-0.064	0.140
Age respondent	0.003	0.004	0.003	0.005	0.002	0.007
Nationality	-0.130 **	0.053	-0.128 **	0.059	-0.132	0.091
Work	0.003 ***	0.001	0.003 ***	0.001	0.002	0.001
University	0.124 **	0.059	0.126 **	0.065	0.141	0.104
Satisfaction	-0.281 ***	0.045	-0.291 ***	0.049	-0.418 ***	0.073
Age child	0.004	0.015	0.004	0.016	0.015	0.025
Number child(ren) < 2	-0.046	0.067	-0.042	0.073	-0.072	0.110
Number child(ren) 3 - 5	-0.148 ***	0.054	-0.148 **	0.058	-0.125	0.087
Number child(ren) 6 - 10	-0.201 ***	0.039	-0.197 ***	0.042	-0.218 ***	0.062
Number child(ren) 11 - 15	-0.182 ***	0.047	-0.180 ***	0.051	-0.196 **	0.074
Adults > 16	-0.121	0.085	-0.111	0.095	-0.165	0.159
Parents	-0.242 ***	0.077	-0.243 ***	0.085	-0.245 *	0.139
Pseudo R ²	0.057		0.044		-	
Log-Likelihood	-2'666.30		-2'657.10		-2'555.83	
Number of obs. (N)	1'754		1'754		1'754	

Note: *, ** and *** denote statistical significance at 10%, 5% and 1% levels, respectively.

Table 7: Estimation results of the regression models.

Finally, we discuss the level of satisfaction with the child care service. This level is related to child care services actually used by parents when children

are not at school. Satisfaction with other child care services has a negative and highly significant impact on the number of expected school-meals demanded. This suggests that parents already satisfied with other child care services are also more likely to hold a satisfactory solution for lunches and hence are less willing to change.

Before focusing on the interpretation of the coefficients of the last model, we shortly discuss the differences between the Poisson regression and the negative binomial regressions along with the Poisson with random-effects. The signs of all the coefficients are the same. Differences are observed as with respect to the level of significance. Generally, the coefficients of the Poisson with random-effects are less significant than the Poisson regression and the negative binomial regression. In particular, the dummy that represents households living in urban areas, the nationality of the respondents, the percentage of work of the respondent, the level of education of the respondents and the number of additional children between 3 and 5 years old are not significant anymore in the Poisson model with random-effects.

Using equation (5) defined in Section 2 above, we interpret the coefficients of the Poisson model with random-effects. We are interested in the percentage change in the expected count for a unit change ($\delta = 1$) in the explanatory variable, holding other variables constant. In Table 8 we report the percentage change for the significant coefficients in the Poisson regression model with random-effects.

The percentage change in the expected count for a unit change in the price of the service is -8.1%. This implies that an increase in the price of the school-meal by one Swiss franc decreases the expected number of school-meals demanded by parents by 8.1%, given other variables are held constant in the model.

As for children’s characteristics and family composition, if the number of additional children between 6 and 10 years old and the number of additional children between 11 and 15 years increases of one unit, meals demanded by parents are expected to decrease by 19.6% and 17.8%, respectively. The presence of both parents living in the household reduces the expected number of school-meals by 21.7%.

Variable	Poisson with RE
	% change
Price	-8.1
Income	20.2
BL	19.6
BS	22.1
Satisfaction	-34.2
Number child(ren) 6 - 10	-19.6
Number child(ren) 11 - 15	-17.8
Parents	-21.7

Table 8: Percentage change in expected count.

As for household income, an increase by one unit (that means 2’000 Swiss francs) increases the expected quantity of school-meals demanded by 20.2%, *ceteris paribus*. Families living in the canton Basel-Country and the canton Basel-City increase the expected number of school-meals demanded by 19.6% and 22.1%, respectively as compared to families living in canton Solothurn.

Finally, parents satisfied with their current child care mode are expected to reduce the expected number of school-meals by 34.2%.

4.1. Willingness to pay for a school-meal

The estimation results of the Poisson model with random-effects can be used to calculate the willingness to pay for school-meals. This is obtained from the integral of the expected demand function. The willingness to pay for a single meal can be calculated using the following equation (Haab and McConnell, 2002):

$$WTP(meals) = -\frac{1}{\beta_p} \quad (6)$$

where β_p is the parameter corresponding to the price variable.

In Switzerland, the current pricing policy applied to school-meals for children consists of a price which depends on the household income. From an economic point of view, this policy lacks efficiency since cantons and municipalities do not match marginal costs and marginal benefits for a meal. Even though the meal service is highly subsidized by the local government, there may be a margin to improve the efficiency of the service by taking the willingness to pay for different categories of consumers into account.

For the whole sample, we calculated that the willingness to pay for a meal is about 11.60 Swiss francs. To our knowledge, this is the first attempt to estimate the willingness to pay for school-meal services. Consequently, our valuation of the willingness to pay cannot be compared with the results of other studies.

For discussion purposes, we hypothesize that the average cost for a meal is about 25.00 Swiss francs. This is the minimum level calculated by the city

of Lugano, in 2010. The estimated willingness to pay for a meal is clearly below the full cost hypothesized for the service. However, the local government could extract some willingness to pay in order to reduce the deficit or to finance an increase in the supply of meals.

From the pricing strategy point of view, it would be interesting to use information on the willingness to pay for different income levels. To calculate the effect of price for different income categories, we can slightly modify our Poisson regression with random-effects using two approaches: the first one interacts the price variable with a set of dummy variables representing different income categories; the second one introduces a new variable that represents the interaction between price and income.

In Table 9 we report the results of three different models: the first considers three categories of income (below 6'000 Swiss francs, between 6'001 and 8'000 Swiss francs, above 8'000 Swiss francs); the second considers two income categories (below and above 8'000 Swiss francs); the third considers the interaction between price and income.

The sign and the magnitude of coefficients do not vary across the three models, except for price interactions. Only the significance of the workload of the respondent differs across the models. In the first two models it is significant, whereas in the last model it is not.

The results reported in Table 9 are also similar to those of the Poisson regression with random-effects reported in Table 7. The signs of the coefficients are the same. Four additional variables become significant: households living in urban areas, age, intensity of work (except for the third model where we interact price and income) and the level of education of the respondent. Conversely, the presence of both parents in the family is not significant anymore.

The willingness to pay for a school-meal does not seem to depend on household income because the interaction variables are never significant.

Variable	Poisson with RE		Poisson with RE		Poisson with RE	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Constant	-0.207	0.420	-0.202	0.413	-0.263	0.428
Price	-0.079 ***	0.009	-0.091 ***	0.008	-0.096 ***	0.017
Price (up to 6'000)	-0.012	0.013	-	-	-	-
Price (6'001 - 8'000)	-0.012	0.008	-	-	-	-
Price (above 8'000)	-	-	0.012	0.008	-	-
Price x Income	-	-	-	-	0.002	0.004
Income	0.141 ***	0.048	0.139 ***	0.043	0.153 ***	0.057
Care by others	0.084	0.076	0.083	0.076	0.084	0.076
BL	0.192 *	0.100	0.192 *	0.100	0.195 *	0.100
BS	0.183 *	0.101	0.183 *	0.101	0.186 *	0.101
AG	0.126	0.100	0.126	0.100	0.122	0.101
Urban	0.191 *	0.109	0.192 *	0.109	0.187 *	0.109
Mother	-0.026	0.133	-0.025	0.133	-0.028	0.133
Age respondent	0.013 *	0.007	0.013 *	0.007	0.014 *	0.007
Nationality	-0.073	0.087	-0.073	0.087	-0.076	0.087
Work	0.002 *	0.001	0.002 *	0.001	0.002	0.001
University	0.215 **	0.099	0.215 **	0.099	0.217 **	0.100
Satisfaction	-0.330 ***	0.070	-0.330 ***	0.070	-0.326 ***	0.070
Age child	0.020	0.024	0.020	0.024	0.020	0.024
Number child(ren) < 2	-0.037	0.106	-0.037	0.106	-0.040	0.106
Number child(ren) 3 - 5	-0.043	0.083	-0.043	0.083	-0.040	0.083
Number child(ren) 6 - 10	-0.171 ***	0.060	-0.171 ***	0.060	-0.163 ***	0.060
Number child(ren) 11 - 15	-0.192 ***	0.071	-0.192 ***	0.071	-0.188 ***	0.071
Adults > 16	-0.200	0.150	-0.200	0.150	-0.199	0.150
Parents	-0.135	0.133	-0.135	0.133	-0.154	0.133
Log-Likelihood	-2'514.20		-2'514.20		-2'515.25	
Number of obs. (N)	1'754		1'754		1'754	

Note: *, ** and *** denote statistical significance at 10%, 5% and 1% levels, respectively.

Table 9: Estimation results of the Poisson regression with random-effects.

5. Conclusions

In Switzerland, the provision of extra-familial child care services at primary school level is lacking. To improve the provision of school-meal services, the government has extended the program of incentives to finance child care services before, during or after school. To be effective, policymakers need detailed information about the conditions under which parents are willing to use this type of services.

Using a stated preferences approach, we analyzed households' choices concerning the school-meal service for children attending primary school in four Swiss cantons. Our results attest a significant interest for the provision of school-meals in primary schools. The number of school-meals demanded during a week depends mainly on the price, the household monthly income, the number of additional children between 6 and 10 years old and between 11 and 15 years old, if parents live in the same household, the canton of residence and the satisfaction with the current child care mode used.

The most important variables that influence the decision to purchase school-meals are: satisfaction with the current child care mode (-34.2%), if both parents live in the same household (-21.7%), and the household income (20.2%).

A growing number of parents are willing to increase their working time, especially mothers. The effect of factors considered in our models may have important implications for the enactment of a school-meal service in primary schools of the four cantons considered. Our results may help public authorities to understand how different factors influence households' behavior, which could be taken into account to improve the supply of school-meal's service.

Two important aspects should be considered in designing a more efficient pricing policy for meal services. First, local governments are currently running deficits for the provision of this type of service. Second, there is a lack of supply of meal services in public schools and parents are often forced to reduce their time at work or to pay for private meal services. A new pricing policy could then extract some of the willingness to pay to reduce the deficit of the local government and to improve the supply of meal services.

Since the interaction variables are never significant, we cannot affirm that the willingness to pay for a school-meal depends on household income. This may suggest that the current pricing policy applied in Swiss schools cannot find a ground for price discrimination according to expected benefits from the meal service. Hence, it merely redistributes income across income categories for equity reasons.

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Willingness to pay for school-meal service and after-school service

1. Introduction

The organization of child care before and after school and during lunchtime represents a growing problem for households with children at primary school. Parents who decide to work full-time or part-time may pay a substantial amount for private child care services and this solution is not always sustainable. For this reason some parents may prefer to stay out of the job market and provide care to their children. The improvement of supervised school-meal services and after-school services may be beneficial for households, namely for parents who give value to opportunities at work.

In this paper we analyze households' willingness to pay (WTP) for school-meal services and after-school services for children attending primary schools.

We use data provided by 906 interviewed parents in the City of Lugano¹, in the southern part of Switzerland. In Switzerland, municipalities are mainly responsible for the decision to offer supervised school-meal services and supervised after-school services at primary schools. Generally, the cantons play a secondary role in this decision process. It follows that, the supply of these services is not homogeneous across municipalities². The City of

¹ Lugano is one of the ten biggest communes of Switzerland, the first in canton Ticino, with about 59'000 inhabitants.

² Switzerland is a federal state with a largely decentralized education system. Primary school education is mandatory and generally supplied by the state. The tasks of the education system are shared between three political levels - confederation, cantons and municipalities - which work

Lugano has recently discussed the possibility to increase the supply of child care services at primary school during lunchtime and after the end of afternoon classes. Consequently, the analysis of households' preferences and willingness to pay for these services is of relevance.

To investigate households' willingness to pay for school-meal services and after-school services, we apply a behavioral model which considers two main sequential decision: to use or not to use the service and how much parents are willing to pay for the service. Factors affecting households' decisions are explored using the Tobit, Heckman and Cragg models, which account for possible sample selection problems. For comparison, we also include results from the application of ordinary least squares (OLS) to the unadjusted individual observations.

In our analysis we test, in particular, the following aspects: whether socioeconomic characteristics (income and level of education) and households' structure (number of children and presence of housewives) influence the WTP for school-meal and after-school services; whether WTP varies among income groups; and how WTP is affected by the use of other types of school services; finally, whether the WTP of households not yet using the service (but interested in using it) is higher than the WTP of households who already use the service.

The literature lacks empirical studies on the decision to use and the willingness to pay for school-meal and after-school services. Most of the studies focus on specific countries (e.g. Seppanen et al. 1993) and authors

together in their respective areas of responsibility to ensure high quality in education. The organization and the regulation of the school system are not homogeneous across the territory since each of the 26 cantons has its own subsystem of primary school. The cantons and their municipalities are responsible for the organization and the financing of primary schools. In particular, municipalities assume competences on pre-school, primary and lower secondary levels.

present a nationwide picture of the structure of school services. Other studies examine the relationship between school programs and the performance of students (Pierce et al. 1999) or the impact of school programs on personal and social skills (Durlak and Weissberg 2007). For instance, Gottfredson et al. (2004) analyze whether after-school programs reduce delinquent behavior. Vandell and Shumow (1999) point out that parents and children consider a wide variety of options for the programs, but the authors do not analyze how parents decide to use or not to use school services along with their willingness to pay.

To our best knowledge, there are no studies on the willingness to pay for school-meal and after-school services, although willingness to pay is widely considered in the utilization of other goods such as health care (Tianviwat et al. 2008), energy (Banfi et al. 2008), environmental resources (Carlsson and Johansson-Stenman 2000) and museums (Tohmo 2004).

One critical aspect of the investigation of data on willingness to pay for school services is represented in the sample selection problem. If respondents who are not willing to pay for the services are included in the analysis, we could obtain biased estimates. The problem can be solved by means of sample selection models such as the Tobit, the Heckman and the Cragg models.

The Tobit model is commonly used in contingent valuation analysis. For instance, Cantrell et al. (2004) use a Tobit model to measure the willingness to pay for increased catch rates. Silberman et al. (1992) report empirical evidence on the existence value for beach nourishment.

Bockstael et al. (1990) analyze sport fishery and consider that a part of the population does not participate in sport fishing trips. To correct the sample selection bias that occurs due to non-participants in the recreational activity of interest, the authors apply and compare Tobit, Heckman and Cragg

models. Finally, Rockel and Kealy (1991) apply Heckman and Cragg models to investigate the use of non-consumptive wildlife-related activities.

Our paper is structured as follows. In Section 2, we discuss the empirical specification and the models considered in our analysis. Section 3 is devoted to the survey design and description of some sample and service characteristics. The data used in our estimations are discussed in Section 4 and the regression results are presented in Section 5. Concluding remarks and policy considerations are discussed in Section 6.

2. Empirical specification

Following Bockstael et al. (1990), we assume that the relationship explaining individual i 's willingness to pay for school-meal or after-school services can be written as:

$$WTP_i = \beta z_i + u_i \quad (1)$$

where z_i is a vector of explanatory variables, β is a vector of unknown parameters and u_i is a stochastic element assumed to be $N(0, \sigma_u^2)$. In our case, the vector of explanatory variables consider the number of children, level of education, household income, the use of other school services and if mother is not working (housewife).

This specification is correct if all individuals in the sample have positive willingness to pay for the service. Nevertheless, this is not true since some of the households are not interested in using the service. These households do not report a WTP and are, therefore, assumed to have zero willingness to pay, which represents a corner solution. Our empirical specification can be adapted to consider the sample selection bias due to the fact that the dependent variable is not observed for the whole sample. Only parents that already use or are interested in using the service report a willingness to pay.

We modify Equation (1) by means of three different approaches to estimate the willingness to pay for school-meal services and after-school services when the sample includes non-participants.

The first approach applies a Tobit model³, which represents a well-established econometric technique to estimate relationships with censored data⁴. Equation (1) can be modified as follows:

$$WTP_i = \begin{cases} \beta z_i + u_i & \text{for } \beta z_i + u_i > 0 \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

From Equation (2) we see that the sample selection rule is $u_i > -\beta z_i$, which is the probability that the individual participates, i.e. $Prob(u_i > -\beta z_i)$.

From a behavioral perspective the most important aspect of the Tobit model is that the same relationship is assumed to determine both, the willingness to pay and the participation decisions. Hence, the same characteristics that cause parents to use school-meal or after-school services also influence their willingness to pay. Consequently, the coefficients of determinants of choice and willingness to pay have the same magnitude.

A different way of addressing the selection problem is considered in our second approach which applies the Heckman model⁵. The idea is to partition the z vector into two sets of variables, z_1 and z_2 , with z_1 affecting the willingness to pay and z_2 affecting participation. The sets of variables are not mutually exclusive. In our case the two sets of variables defer for the variable that take into account if households already use a school service.

Let consider:

³ See Tobin (1958).

⁴ Censoring occurs when data on the dependent variable is lost (or limited).

⁵ See Heckman (1989).

$$WTP_i = \begin{cases} \beta_1 z_{i1} + u_i & \text{for } WTP_i > 0 \\ 0 & \text{otherwise} \end{cases} \quad (3)$$

and allows that a second function determines whether or not the willingness to pay is positive. Thus:

$$\begin{cases} WTP_i > 0 & \text{for } w_i^* > 0 \\ WTP_i = 0 & \text{for } w_i^* \leq 0 \end{cases} \quad (4)$$

where $w_i^* = \beta_2 z_{i2} + v_i$. The stochastic variable v_i is assumed to be $N(0, \sigma_v^2)$. The covariance between u and v is denoted by σ_{uv} , which equals $\sigma_u \sigma_v \rho$, where ρ is the correlation between errors.

From Equation (4) the sample selection rule is $v_i > -\beta_2 z_{i2}$.

When $\sigma_u = \sigma_v$, $\rho = 1$, $\beta_1 = \beta_2$ and $z_1 = z_2$, the Heckman model is identical to the Tobit. For this reason we can consider the Tobit model as a special case of the Heckman.

Heckman considers a two-step estimating procedure. The first step is a probit model to estimate the vector β_2/σ_v . The estimated coefficients are then used to estimate the vector β_1 and σ_{uv}/σ_v , for all observations where $WTP_i > 0$.

The Heckman model introduces a problem of interpretation when z_{i1} and z_{i2} have no variables in common. A conceptual difficulty stems from the fact that the model describes a joint probability between w_i^* and WTP_i . However, it allows different factors and different error structures to affect the participation and the willingness to pay.

To overcome the sample selection problem we consider a third approach: the Cragg model⁶. Differently from the Heckman model, the willingness to pay equation is conditional on a positive response in the participation model. The Cragg model takes the form:

$$WTP_i = 0 \text{ if } w_i^* \leq 0 \quad (5)$$

where $w_i^* = \beta_2 z_{i2} + v_i$. Conditional on $w_i^* > 0$, we have:

$$WTP_i = \begin{cases} \beta_1 z_{i1} + u_i & \text{for } \beta_1 z_{i1} + u_i > 0 \\ 0 & \text{for } \beta_1 z_{i1} + u_i \leq 0 \end{cases} \quad (6)$$

Compared with the more general version of the Heckman model, the Cragg model presents two effective changes. An individual is observed not to participate, it may be for one or two reasons; respondent may have been eliminated because of factors in either the z_1 or z_2 vector.

Also, the Cragg model considers a two-steps estimation procedure. The first stage is identical to the first stage of the Heckman procedure, which is a probit model. The second stage is estimated using only non-zero observations, similar to the Heckman. However, the sample selection rule of the second stage is different from the Heckman. The sample selection rule is based on the willingness to pay decision variables (the z_{i1} 's).

In this Section we presented three different approaches to consider the sample selection problem in our estimation about the factors affecting the

⁶ See Cragg (1971).

willingness to pay for school-meal and after-school services. We propose the Tobit, Heckman and Cragg models. The regression results are discussed in Section 5.

3. Survey design and sample and service characteristics

The target population of our study includes parents with children at primary school in a middle size City (Lugano) in Switzerland. A questionnaire accompanied with a cover letter was given to children attending primary schools. The filled-in questionnaire was supposed to be handed back to the teacher within one month.

The questionnaire was submitted to parents during September 2009. The estimated average length to fill it in was about 15 minutes.

During 2009-2010, primary school in Lugano was attended by 2'071 pupils, divided in 5 regions and 18 schools. Of these, 906 questionnaires were handed back, which represents a response rate of 43.75%.

The questionnaire combined queries from five areas: before-school service, school-meal service, after-school service, characteristics of new services proposed and socioeconomic characteristics of households.

The before-school service, i.e. caring for children early in the morning is not yet provided in the City of Lugano. Consequently, we considered a hypothetical situation where parents state their preferences regarding this type of service. Conversely, school-meal service and after-school service included two parts: the first one was dedicated to households already using the service (revealed preferences), whereas the second one was dedicated to those parents who do not yet use the service (stated preferences).

The information we collected takes into account the way of caring for children when a school service is not available; when parents need services (days and time during the week); satisfaction with services; reasons for not yet using the services; and parents' willingness to pay for each service.

Information on socioeconomic characteristics of households include parents' age, the number of children and their age, the number of other adults living in the household, nationality, income and level of education, the type and place of job, working hours and, finally, if parents have health problems that could affect the care of children. We asked information separately from both parents.

3.1. Sample characteristics

The respondents to our questionnaire are mainly mothers (83%) with an average age of 40.5 years. Instead, the average age of fathers is 44. Mothers are Swiss in 64.8% of the cases, fathers in about 61% of cases⁷. Both parents are Swiss in about 52% of cases and at least a parent is Swiss in 74% of the cases. As for the level of education, mothers have a university degree in 17.7% of the cases and fathers in 22.7%. Both parents have a university degree in 13.4% of the observations and at least one parent has a university degree in 33% of the cases. At least one parent has a high school degree (university or another high school) in 68% of the cases.

The average yearly household income is 80'630 Swiss francs. 19.84% of the sample has a high-income (above 100'000 Swiss francs), 60.59% has a medium-income (between 50'000 and 100'000 Swiss francs) and 19.57% has a low-income (below 50'000 Swiss francs).

Households have, on average, more than 2 children (2.1). Two or more children live in the household in 74% of the cases. Only in about 5% of the

⁷ Parents belong to 45 different nationalities. The most common nationalities after the Swiss one are the Italian and the Portuguese.

households there are other adults (grandparents or baby-sitter) living with parents and children.

Both parents work in about 47% of the observations. Usually, fathers work full-time (more than 90% of the cases) and mothers work part-time (about 49%). In 11% of cases both parents work full-time. About 34% of mothers are housewives and about 22% have an administrative job. Only 16.43% of mothers work full-time. About 92% of fathers have not changed their workload after the birth of the first child. Instead, 65.8% of mothers have reduced their working activity. And 21% of mothers withdrew from the job market where they previously worked full-time. In little cases did we observe an increase in the workload of parents after the birth of their first child.

About 56% of mothers are employees and 36% work at home. Fathers are self-employed in 81% of cases and 30% of them are managers.

Both parents are healthy in 98% of the cases. Health problems that could affect the care of children are present in 2% of the sample.

3.2. Service characteristics and willingness to pay

Our questions might be helpful to improve policies on primary school services. We are able to ascertain whether households would be interested in services provided in other schools since a transport service could be organized by the school authorities. We can investigate whether households would be willing to pay according to their income and whether they would be interested in increasing time at school for their children, i.e. in a full-day school model.

About 61% of the households are not interested in using a school-meal service or an after-school service if it is provided in a different school. These parents prefer the provision of services in the school where their children take classes. About 64% of the respondents would agree to fix a price for these services according to household income and about 57% of them believe that a full-day school model should be considered by the local authorities.

We now present some summary statistics about households' opinion on three types of service: before-school, school-meal and after-school services.

16.5% of the respondents are interested in the before school service, which is not actually present in Lugano. Currently, in about 93% of the cases the mother takes care of children early in the morning. About 53% of parents declare that this service should start at half past seven in the morning, about one hour before morning classes⁸. The most demanded days are Mondays and Tuesdays. About 64% of the sub-sample interested in this service would use it all the week. On average, parents are willing to pay 5.52 Swiss francs per day.

Regarding the meal service, between morning and afternoon classes, we can identify three sub-groups of parents: those who already use the service (18.43% of the sample), those not yet using the service but interested (57.40%), and last sub-group considers respondents that are not using and not interested in the service (24.17%). About 94% of parents already using the service are satisfied with the current organization. The average willingness to pay for a meal is 5.92 Swiss francs.

Households not using the meal services prepare meals at home or are assisted by children's grandparents. In 70% of the cases, the lack of meal

⁸ Usually, morning classes start between eight and half past eight.

services is not seen as a problem. The average willingness of parents to pay in the meal service is 6.69 Swiss francs per meal.

The mean willingness to pay for school-meal service of the whole sample is computed by considering a zero WTP for those parents who are not interested in the service and, consequently, do not state their WTP. The average willingness to pay for the school-meal service is 4.93 Swiss francs. The distribution of the willingness to pay for the school-meal service of the whole sample is presented in Figure 1.

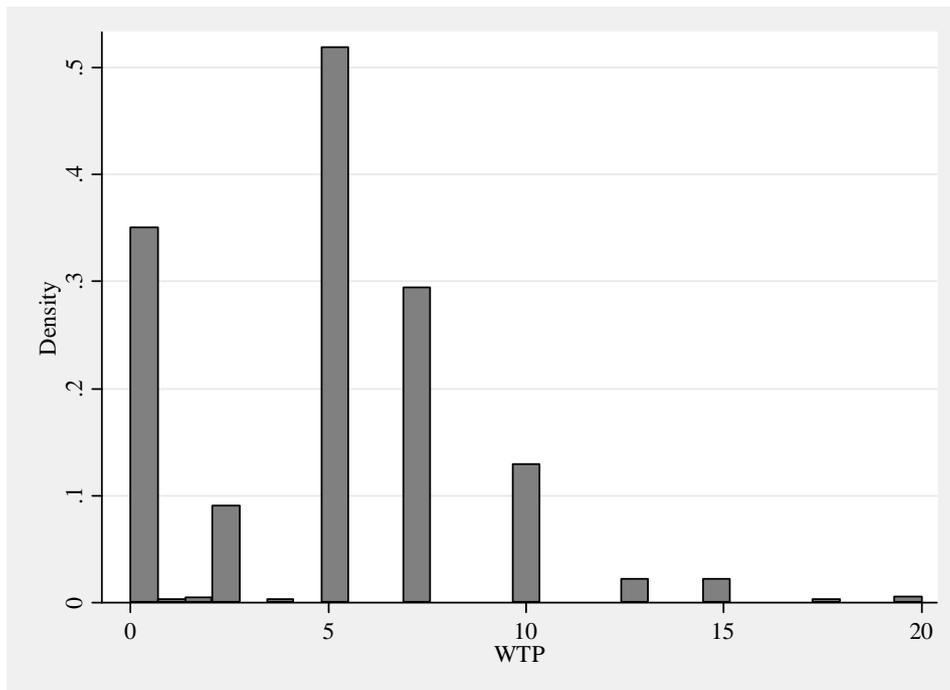


Figure 1: Willingness to pay for school-meal service (N=906).

Similarly to the meal service, we can identify three sub-groups of parents for the after-school service: those already using the service (7.62% of the sample), those not yet using the service but interested in it (46.58%), and

parents not interested in the service (45.80%). About 85% of parents already using the service are satisfied with the current organization. The average daily willingness to pay is 5.31 Swiss francs.

Currently, parents not yet using the service organize the after-school care of children by themselves or are helped by grandparents or baby-sitters. In about 84% of the cases, the lack of after-school service is not perceived as a problem. The average willingness to pay for those parents interested in the service is 5.80 Swiss francs.

As for the school-meal service, the mean willingness to pay for after-school service of the whole sample is computed by considering a zero WTP for those parents who are not interested in the service. The average willingness to pay for the after-school service is 3.11 Swiss francs. Figure 2 shows a detailed distribution of the willingness to pay for the after-school service of the whole sample.

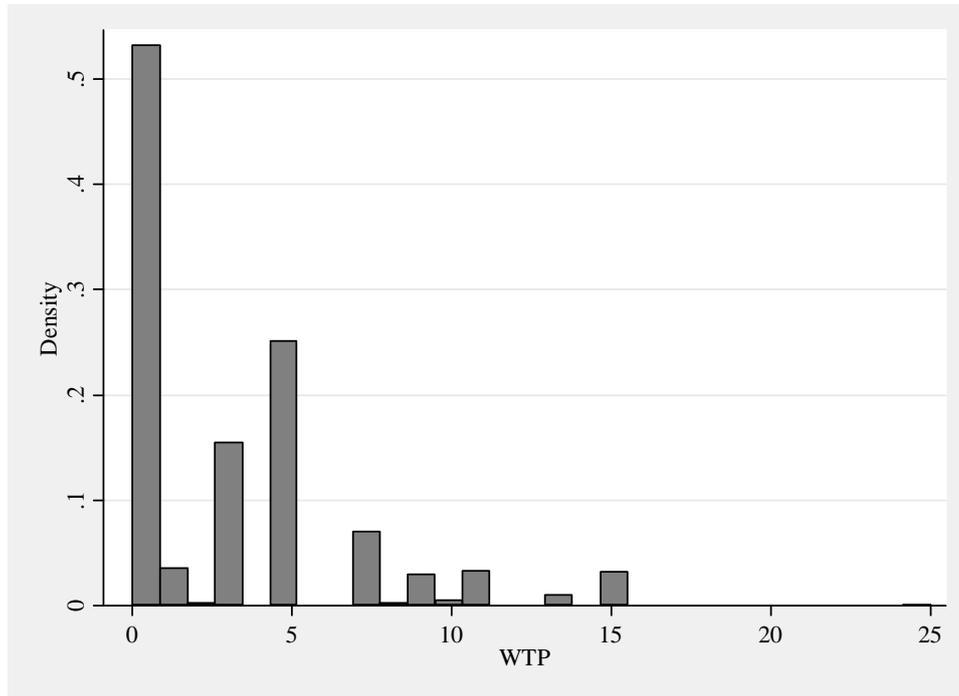


Figure 2: Willingness to pay for the after-school service (N=906).

Surprisingly, we observe that parents already using some service (school-meal service or after-school service) have a lower willingness to pay than parents currently not yet using the service. Among possible explanations we suggest the protest bid or the neighborhood effect. Protest bid occurs whenever individuals who oppose or do not approve the survey fail to respond and give invalid but positive bids: extremely high or low responses to WTP questions. The neighborhood effect is the tendency for an individual to be influenced by exposure to the behavior of his or her peers (Baerenklau 2005).

Another possible explanation is the income effect since access to these services in the City of Lugano is limited for households with an income above 130'000 Swiss francs per year. This limitation represents a sort of demand rationing. Consequently, a certain number of households with a

relatively high income are excluded from the services. These households may have higher willingness to pay as compared to parents already using the service. Although they are willing to enter the market at higher prices, they are currently excluded.

4. Data

The variables used as explanatory variables to estimate the models presented in Section 2 are described and summarized in Table 1.

The final number of observations in our regression models is 607. We lose 299 observations because some respondents did not answer to all the questions.

In Table 2 we present the two services considered in our regressions with respect to some important factors affecting the decision to use the service and the willingness to pay for school-meal service and for after-school service. We did not consider the before-school service due to the low number of valid observations.

The sample considers 89 (14.66%) respondents that already use the school-meal service, 393 (64.74%) that are not using the service but would be interested to use it, and 125 (20.60%) that are not interested in lunch services for their children. The average willingness to pay for a meal is about 6 Swiss francs for parents already using the service and 6.74 Swiss francs for respondents interested in the service. Obviously, people not interested have a zero willingness to pay. The average household income for parents interested in the service is higher than parents that already use the service (about 91'500 and 82'000, respectively). At least one parent has a university degree in about 21% of the respondents that already use the service and in about 36% of parents that are interested in the service. The average number of children in the household is 1.74 for parents that use the service and 2.19 for parents that are interested in the service. The mother is a housewife in 43.51% of the households interested in the service and in about 4.5% of the households that use the service.

Variable	Description	Obs.	Mean	Std. Dev.	Min	Max
WTP Lunch	Willingness to pay for a school-meal service (in CHF)	906	4.93	3.71	0	20
WTP After	Willingness to pay for after-school service (in CHF)	906	3.11	3.81	0	25
Children	Parents have two or more children (yes=1, no=0)	906	0.74	0.44	0	1
University Education	At least a parent has a university degree (yes=1, no=0)	770	0.33	0.47	0	1
High Education	At least a parent has a high school degree (yes=1, no=0)	770	0.68	0.47	0	1
Income	Households yearly income, in 10'000 CHF	746	80.63	36.50	0	200
Low income	Household yearly income < 50'000 CHF (yes=1, no=0)	746	0.20	0.40	0	1
Medium income	Household yearly income between 50'000 and 100'000 CHF (yes=1, no=0)	746	0.61	0.49	0	1
High income	Household yearly income > 100'000 CHF (yes=1, no=0)	746	0.20	0.40	0	1
Lunch RP	Parents already using the school-meal service (yes=1, no=0)	906	0.18	0.39	0	1
Lunch SP	Parents interested in the school-meal service (yes=1, no=0)	906	0.57	0.49	0	1
After RP	Parents already using the after-school service (yes=1, no=0)	906	0.08	0.27	0	1
After SP	Parents interested in the after-school service (yes=1, no=0)	906	0.47	0.50	0	1
Housewife	Mother is housewife (yes=1, no=0)	853	0.34	0.47	0	1

Table 1: Descriptive statistics for the whole sample.

Service	Obs. (N=607)	%	WTP (in CHF)	Income (in 10'000 CHF)	University degree	Number of children	Housewife
Lunch service							
Already using it	89	14.66	6.02	82.02	21.35%	1.74	4.49%
Interested	393	64.74	6.74	91.53	36.13%	2.19	43.51%
Not interested	125	20.60	0.00	79.64	24.00%	2.18	40.80%
After-school service							
Already using it	31	5.11	5.69	78.39	19.35%	1.57	9.68%
Interested	315	51.89	5.58	88.78	34.29%	2.20	40.00%
Not interested	261	43.00	0.00	87.47	29.50%	2.10	37.16%

Table 2: Summary statistics for the sub-sample of households used in regression models.

We can note that households interested in the school-meal service are more willing to pay, they have a higher household income, the percentage of parents with a university degree is greater, on average they have more children, and the mother is often a housewife.

Considering the after-school service, the sample is composed by 31 (5.11%) parents that already use it, 315 (51.89%) that are not yet using the service and would be interested to use it and 261 (43%) respondents that are not interested in this kind of service. The average willingness to pay is about 5.69 Swiss francs for parents already using the service and 5.58 Swiss francs for respondents interested in the service. People not interested have a zero willingness to pay. The average household income for parents interested in the service is higher than parents that already use the service (about 88'800 and 78'400, respectively). At least one parent has a university degree in about 19.35% of the respondents that already use the service and in about 34.3% of parents that are interested in the service. The average number of children in the household is 1.57 for households that use the service and 2.20 for households that are interested in the service. The mother is housewife in 40% of the households interested and in about 9.7% of the households that use the service.

As for the school-meal service, we can take the same considerations about parents interested in the after-school service, but in this case the difference is that the willingness is slightly lower than for parents that already use the service.

In both services, housewives are more likely to be present in households that are interested in the services. This can be explained by the need of mothers to work and for this reason they cannot organize the care of children and demand both the two services.

Generally, for parents that already use the service and for parents that are interested in the service, we can affirm that the willingness to pay for the school-meal service is higher than the willingness to pay for the after-school service. It seems that for parents service during lunch is more important than the after school. A possible explanation could be that during the lunch break parents, due to the fact that they work or are involved in other activities, cannot organize care of their children. Instead, the organization of care after school would be easier. The opportunity cost of time is greater for the school-meal service than for after-school service.

5. Regression results

The estimation results of the three econometric approaches used to investigate the willingness to pay for school-meals and after-school services are summarized in Table 3 and 4. Due to the low number of observations, we do not apply these models to the before-school service.

For comparison purposes we run OLS regressions. These results are clearly biased, due to the fact that some observations have zero willingness to pay. These are from parents not interested in the use of school-meal or after-school services. For the school-meal service we have 125 observations with zero willingness to pay (20.60%) and for the after-school service there are 261 observations (43%) with zero willingness to pay.

As for the school-meal service (Table 3), the regression coefficients generally show the expected sign and are significant in the OLS model. The R^2 is 0.395 and the pseudo R^2 in the Tobit regression is 0.117. The number of children has a negative impact on the willingness to pay for the service, whereas education, income, the interest of parents with the school-meal service, and the experience of parents with the after-school service have a positive effect on the willingness to pay. The coefficient of being a housewife has a significant and negative impact, as expected, in the OLS and the Tobit regressions.

The presence of brothers and sisters in the household significantly reduces the amount that parents are willing to pay for the school-meal service. A possible explanation is that the preparation of lunches within the household is characterized by some economies of scale. Also, households with more than one child may have lower opportunity cost of time. Households where at least one parent has a university degree are more willing to pay for the school-meal service. Also, a higher household income is significantly

associated with a higher willingness to pay. Households with a housewife have a significantly lower willingness to pay. This suggests that the mother has some preferences on directly looking after her children. Parents already using another service (the after-school service) are also willing to pay more for the school-meal service. This could be interpreted as experience.

In terms of sign and significance of coefficients, Tobit regression gives results that are similar to OLS regression. However, income is less significant, whereas the presence of a housewife is more significantly related to the willingness to pay for a school-meal.

The results of the Heckman and the Cragg models can be separately analyzed for two steps of the decision: to use or not to use the school-meal service and how much households are willing to pay.

The first step gives similar results in both models. Experience with the after-school service as household income significantly increases the probability of using the meal service.

The second step produces results for the two models. The coefficients of Cragg model are relatively more significant. However, interest to use the school-meal service is not significant in the Cragg model. In both models, the presence of a housewife is not significant, unlike the previous findings with OLS and Tobit regressions.

Variable	OLS		Tobit		Heckman		Cragg	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Selection equation								
Constant	-	-	-	-	0.392 *	0.205	0.392 *	0.205
Children	-	-	-	-	-0.097	0.146	-0.097	0.146
University Education	-	-	-	-	0.193	0.137	0.193	0.137
Income	-	-	-	-	0.005 **	0.002	0.005 **	0.002
After RP	-	-	-	-	1.080 **	0.438	1.080 **	0.438
Housewife	-	-	-	-	0.024	0.129	0.024	0.129
Willingness to pay								
Constant	1.692 ***	0.423	0.157	0.534	6.091 ***	0.995	4.850 ***	0.487
Children	-0.717 **	0.281	-0.809 **	0.344	-0.634 *	0.342	-0.834 ***	0.306
University Education	0.758 ***	0.263	0.825 ***	0.321	0.673 **	0.336	0.912 ***	0.286
Income	0.011 ***	0.004	0.011 **	0.004	0.011 **	0.006	0.017 ***	0.004
Lunch SP	4.488 ***	0.256	6.208 ***	0.342	0.684 *	0.358	0.539	0.362
After RP	3.319 ***	0.547	4.530 ***	0.660	-	-	-	-
Housewife	-0.546 **	0.264	-0.937 ***	0.328	0.148	0.312	0.186	0.303
mills ratio	-	-	-	-	-2.483	1.954	-	-
Pseudo R ²	-	-	0.117	-	-	-	-	-
R ²	0.395	-	-	-	-	-	-	-
Log-Likelihood	-	-	-1'360.794	-	-	-	-1'446.216	-
Number of obs. (N)	607	607	607	607	607	607	607	607

Note: *, ** and *** denote statistical significance at 10%, 5% and 1% levels, respectively.

Table 3: Estimation results of the regression models for the school-meal service.

In Table 4, we report the results of models for the after-school service. Generally, all the estimated coefficients show the expected sign. Among significant factors affecting the willingness to pay for the after-school service are level of education and income. The level of education has a positive and significant impact on the willingness to pay for the service in all the regressions. Income is highly significant in the second stage (willingness to pay) of the Cragg and the Heckman models. Respondents who are not using the after-school service yet, are significantly more willing to pay than parents that already use the service in the OLS and the Tobit regressions. However, this is not confirmed by the Heckman and the Cragg models. As expected, households with more than one child are less willing to pay for the after-school service than households with a single child. The reason could be that these households are more likely to consider alternative solutions, possibly less expensive, to care their children after school. Also,

experience with the school-meal service significantly affects willingness to pay in the OLS and Tobit models and the decision to use or not to use the after-school service in the Heckman and the Cragg models. The presence of a housewife is never significant.

The R^2 in OLS regression is 0.491 and the pseudo R^2 in the Tobit regression is 0.221. The goodness of fit is generally lower for the school-meal service as compared to the after-school service.

Variable	OLS		Tobit		Heckman		Cragg	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Selection equation								
Constant	-	-	-	-	0.015	0.188	0.015	0.188
Children	-	-	-	-	0.032	0.124	0.032	0.124
University Education	-	-	-	-	0.114	0.117	0.114	0.117
Income	-	-	-	-	0.000	0.002	0.000	0.002
Lunch RP	-	-	-	-	0.368 **	0.157	0.368 **	0.157
Housewife	-	-	-	-	0.067	0.119	0.067	0.119
Willingness to pay								
Constant	0.024	0.402	-4.751 ***	0.748	3.533 **	1.719	3.458 ***	0.975
Children	-0.538 **	0.257	-1.072 **	0.429	-0.382	0.421	-0.531	0.542
University Education	0.627 ***	0.242	0.807 **	0.396	1.177 ***	0.413	1.404 ***	0.482
Income	0.006 *	0.003	0.008	0.006	0.015 ***	0.006	0.020 ***	0.007
Lunch RP	1.189 ***	0.319	2.981 ***	0.520	-	-	-	-
After SP	5.038 ***	0.215	9.782 ***	0.470	-0.573	0.678	-0.535	0.810
Housewife	0.055	0.247	0.110	0.415	0.301	0.382	0.423	0.501
mills ratio	-	-	-	-	1.537	2.577	-	-
Pseudo R^2	-	-	0.221	-	-	-	-	-
R^2	0.491	-	-	-	-	-	-	-
Log-Likelihood	-	-	-1'015.732	-	-	-	-1'269.490	-
Number of obs. (N)	607	-	607	-	607	-	607	-

Note: *, ** and *** denote statistical significance at 10%, 5% and 1% levels, respectively.

Table 4: Estimation results of the regression models for the after-school service.

The second step of the Heckman and Cragg models produces results that are similar in terms of sign and significance of coefficients. The level of education has a positive sign and highly significant impact on the willingness to pay for the after-school service, as well as income. As expected, the number of children has a negative impact on the willingness to

pay for the after-school service, but the coefficient is not significant. The interest to use the after-school service and the presence of a housewife are never significant.

Regarding the sample selection problem, the inverse Mills ratio coefficient in the Heckman model is not significant for both types of services. This suggests no evidence of sample selection.

The Tobit model has a limitation: the probability to use or not to use a service and the willingness to pay for the service are determined by the same parameters. The Cragg model is a more flexible alternative, which allows the use of two separate set of parameters.

We considered an alternative model specification with the level of education measured in high school attendance and categorical variables for income (low, medium and high). The results are not markedly different from those presented above.

6. Conclusions

Many local governments are currently running deficits for the provision of school-meal services and after-school services in primary schools. Moreover, supply of these services is low and parents must often reduce time at work or pay for private solutions. In the City of Lugano, school-meal service and after-school service are not available in all of the schools. Moreover, access to these services is restricted for households with a relatively high yearly income (above 130'000 Swiss francs). To improve the provision of these services, a new pricing policy must be considered, which requires detailed information on factors affecting use and willingness to pay for meal and after-school services.

Using revealed and stated preferences, we analyzed household choices concerning the school-meal service and the after-school service for children attending primary schools in the City of Lugano. One critical aspect of the investigation is the sample selection problem: if respondents that are not willing to pay for the services are included in the analysis, we could obtain biased estimates. We considered this aspect in the econometric approach.

Our results confirm that the willingness to pay for school-meal and after-school services depend on household income. We found evidence that 17.7% of households would be interested in using the school-meal service and 13.7% in using the after-school service, but are currently excluded because of high income. In general, households are willing to pay 4.93 Swiss francs for the school-meal service and 3.11 Swiss francs for the after-school service. These amounts are significantly lower than the estimated costs for the provision of these services. Nevertheless, households with high income interested in using these services have significantly higher willingness to pay, around 7.03 Swiss francs for school-meal service and 6.66 Swiss francs for the after-school service.

Among the most important factors related to the decision to purchase school-meals and after-school services, we found: parents' level of education, number of children in the household, and household income. The decision to use or not to use these services is affected by experience with other school services.

These results may help public authorities to disentangle the needs of specific groups of households to improve the supply of school-meals services and after-school services. A refined pricing policy could extract higher willingness to pay of some groups of households, for instance high-income households, to reduce the deficit of local governments and to improve the supply of school-meal and after-school services.

There will be scope for some price discriminating policy based on expected benefits from services and household income.

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