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An Empirical Analysis of Child Care Demand in Switzerland

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Abstract

This paper analyses the demand of Swiss families for child care facilities. A choice experiment has been used to study the effects of the facilities' characteristics as well as socio-economic factors on the selected child care mode. The experimental data have been analysed using a discrete choice model with multinomial logit specification. The results suggest that the stated demand for extrafamilial child care is considerably higher than that observed from the actual choices, suggesting insufficient provision of affordable care. The child care choices depend significantly on price and quality attributes and certain families' characteristics such as income and education.

JEL classification code: C25, D10, J13

Keywords: Child care; Choice experiment; Discrete choice

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1. Introduction

Although child care services have been gaining importance in Switzerland, the provision of extrafamilial child care during the day has not been fully developed. Day care facilities are especially very limited in the countryside and small towns. The existing child care centres for children of pre-school age and the allocation offices for day care family homes have long waiting lists, especially for ages below two years as well as the subsidised providers. The private non subsidised facilities could alleviate but only partly, the insufficient provision, mostly because these facilities are not affordable for most families.¹

The lack of institutions supporting parents in the care of their children can have various negative social and economic consequences, for instance on the labour supply of women (Stebler 1999), on the fertility rate (Schröder 2005), and on the integration possibilities of disadvantaged children.² In order to improve the provision of child care centres and family day care homes, the Swiss government started an incentive programme for start-up financing of such services. This program is mainly aimed at increasing mothers' employment rate but in the long term could also attenuate the problems related to aging of the population by increasing fertility rates.

An effective promotion of child care facilities by policy makers needs detailed information about the parents' demand for child care centres and family day care homes. There is a great body of international literature³ analysing the demand for child care facilities (Johansen et al. 1996; Helburn and Howes 1996; Blau and Hagy 1998, Pungello and Kurtz-Costes 1999; Michalopoulos et al. 2000; Powel 2002; Del Boca et al. 2004), focussing mainly on the impact of characteristics of child care facilities on demand and on employment decisions of mothers. A large part of these analyses is based on data generated by national surveys. The samples are usually very large, consisting of thousands of representative households. The studies use cross sectional (Chaplin et al. 1996, Connelly and Kimmel 2000) as well as longitudinal data (Leibowitz et al. 1992, Anderson and Levine 1999). The analyses are based mostly on revealed preference data.

The general empirical results reported in those studies highlight the importance of several factors such as costs of care (Anderson and Levine 1999 and Chaplin et al. 1996), family income and child care tax credits (Hofferth and Wissoker 1992, Michalopoulos et al. 1992), age of children (Leibowitz et al. 1992), mother's working hours (Connelly and Kimmel 2000) as well as other socio-economic characteristics. Due to the great variation of the data used in these studies, comparison between the results of the studies is not always feasible.

From the econometric point of view, most of the papers employ a discrete choice analysis such as multinomial logit (Kreyenfeld and Hank 2000, Michalopoulos and Robins 2002, Del Boca et al. 2004) or probit (Anderson and Levine 1999, Chevalier and Viitanen 2002, Kimmel and Connelly 2003, Del Boca et al. 2004). Further, a combination of discrete and continuous models has been used when the objective was to estimate the demand quantities (for example, the demand for hours of child care), for a specific child care mode.

¹ The insufficient provision of affordable child care in the private sector could be explained by the market failure in valuing the positive externalities on women's labour participation and children's cognitive development.

² Stebler (1999) provides empirical evidence that the provision of child care facilities has a crucial impact on the working behavior of mothers in Switzerland. OECD (2004) reports that in Switzerland a relatively high share of working women work less than 30 hours a week (44.9% as opposed to the overall OECD average of 18.8%). Lanfranchi (2002) shows that schooling results of children of immigrants are highly related to their attendance of pre-school facilities.

³ For Switzerland, to the authors' knowledge, no study has been performed on this issue.

Another econometric issue analysed in various papers is how to consider the fact that the choice of a specific child care service is related to the mother's decision to work.. Some studies (for instance, Michalopoulos et al. 1992) have employed a structural model in which the decision of purchasing child care and that of the mother's employment are made simultaneously. Others have considered two-step sequential decisions. For instance, Connelly and Kimmel (2000) use a two-step procedure, estimating in a first step the choice among three employment states and a multinomial logit model of child care modes in the second step. Their model also includes the predicted probability of working full-time conditional on the probability of being employed. A further possibility consists in considering the employment decision as being exogenous to the child care decision (Hofferth and Wissoker 1992).

In this paper we consider the households' child care decisions in hypothetical situations conditional on their actual decisions about their working status. The goal of the paper is to analyse the potential demand of Swiss families for child care facilities. In particular the important factors influencing the demands for different alternatives shall be identified. We use a stated preferences approach⁴ and apply a discrete choice model in order to determine the "potential" demand of parents for child care facilities and the impact of various characteristics on this choice. The discrete choice model allows modelling the probability that a household chooses a particular mode of child care depending on the specified exogenous factors, such as the actually available child care possibilities and the family's socio-economic characteristics including their actual work status.

The main novelty of the paper consists in the use of experimental data. As far as we know, it is the first time that a choice experiment has been used in the context of child care analysis. The data have been collected for a sample of 600 families with at least one pre-school-aged child.

The paper continues with a description of the theoretical model of child care choice in Section 2. The experiment design and the survey procedures are presented in Section 3. Section 4 describes the collected data and the regression sample and Section 5 provides the estimation results. The paper ends with a summary of the results, an interpretation of the main results and some comments on their policy relevance.

2. Model description

With reference to the random utility theory⁵, the paper models the choice of child care services for families with children younger than 5 years (before kindergarten). The underlying assumption is that families evaluate the characteristics of different child care services and then choose the service, which maximizes their utility. It is assumed that households consider the tradeoffs between benefits gained from child care services based on care attributes and the incurred costs including service prices and other opportunity costs depending on the household characteristics. According to the random utility theory, the utility of a service or good is considered to depend on observable (deterministic) components, including the attributes of the services and individual characteristics, as well as on a stochastic element (cf. Louviere et al. 2000). We consider several child care attributes such as price, distance from home and quality of the service, and family characteristics including education, income and work status. Finally, the random component captures the influence of unobserved factors.

⁴ Because of limited availability and access to child care facilities, the revealed preferences approach does not seem to be adequate in the Switzerland's case.

⁵ For a description of the random utility theory see Louviere et al. (2000) or Ben-Akiva and Lerman (1985).

We represent the utility function of a child care mode j for family i as:

$$U_{ij} = X_{ij}\beta_j + Z_i\gamma_j + \varepsilon_{ij} \quad (1),$$

where X_{ij} is the vector of attributes of alternative j for household i ; Z_i is the vector of household characteristics; β_j and γ_j are the parameter vectors to be estimated; and ε_{ij} is an independently and identically distributed stochastic error term that represents the unobserved heterogeneity across households and alternatives. The adopted model in this paper is based on a multinomial logit model in which the error term ε_{ij} is assumed to follow a type I extreme value (Gumbel) distribution.⁶ In this model, the probability of choosing alternative j can be written as:

$$\Pr(Y_i = j) = \frac{e^{X_{ij}\beta_j + Z_i\gamma_j}}{\sum_{j=0}^J e^{X_{ij}\beta_j + Z_i\gamma_j}} \quad \text{for } j = 0, 1, 2, \dots, J \quad (2),$$

where $J+1$ is the number of alternatives and $Y_i = 0, 1, \dots, J$ is the individual i 's response. As the model in equation (2) is indeterminate, it requires a normalization assumption, which can be obtained by setting β_0 and γ_0 equal to zero. Thus, equation (2) can be written as:

$$\Pr(Y_i = j) = \frac{e^{X_{ij}\beta_j + Z_i\gamma_j}}{1 + \sum_{j=1}^J e^{X_{ij}\beta_j + Z_i\gamma_j}} \quad \text{for } j = 0, 1, 2, \dots, J, \beta_0 = \gamma_0 = 0 \quad (3),$$

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

It is worth noting that in this study the households are offered repeated choice situations and a more accurate presentation of the model should consider an index for the choice situation (card). Moreover, the number of alternatives is limited to three. The model in equation (3) can thus be written as:

$$P_{icj} \equiv \Pr(Y_{ic} = j) = \frac{e^{X_{icj}\beta_j + Z_i\gamma_j}}{1 + \sum_{j=1}^2 e^{X_{icj}\beta_j + Z_i\gamma_j}} \quad \text{for } j = 0, 1, 2, \beta_0 = \gamma_0 = 0 \quad (4),$$

where c is the choice-situation (card) number. Notice that the choice attributes vary across different cards, but the parameters are alternative-specific.

The marginal effects of the continuous explanatory variables are calculated as the partial derivative of the probability of outcome j , that is: P_j , with respect to the explanatory variable x , which is an element of the explanatory vector $[X, Z]$. The marginal effect and elasticity of a continuous variable x can thus be obtained respectively from:

$$\frac{\Delta P_j}{\Delta x} \cong \frac{\partial P_j}{\partial x} = P_j \left[\beta_j^x - \sum_{k=1}^2 P_k \beta_k^x \right] \quad \text{for } j = 0, 1, 2, \beta_0^x = 0 \quad (5),$$

$$\varepsilon_x = \frac{\partial P_j}{\partial x} \frac{x}{P_j} \quad (6),$$

⁶ For more details about the multinomial logit model see Greene (2003), chapter 21.

where the subscript β_k^x represents the coefficient of explanatory variable x , that is the corresponding element of the parameter vector $[\beta, \gamma]$. Similarly, the marginal effects for dummy variable x can be obtained from the following equation:

$$\frac{\Delta P_j}{\Delta x} = P_j(x=1) - P_j(x=0) \quad (7).$$

3. Experiment design

The data needed for the analysis of child care choices can be collected with two different methods: the revealed and the stated preference method. The first method is based on the observation of the actual choice decisions of households whereas the second method is based on the stated preferences of individuals when confronted with a hypothetical set of alternatives defined by the researcher.⁷

In this paper, the stated choice method has been preferred mainly because of the small share of families, who have actually the possibility of an affordable day care service. Moreover, it is generally difficult to collect data of the available choice set from which one alternative has been chosen.

The choice experiment approach has been initially developed by Louviere and Hensher (1983) and is one option in a family of empirical approaches known as stated choice modeling. This method consists of asking a number of respondents to choose one among several alternatives which are characterized by various attributes. Within the range of non-market valuation techniques, the choice experiment is most appropriate for capturing the the implicit values of child care attributes as well as that of the child care facility as a whole (Birol et al. 2005).

In our case, the choice experiment consists of four child care modes:

1. **Child care centre:** Child care provided by professional staff with several children during the day in a facility, other than private residence, which is specifically equipped for this purpose.
2. **Family day care home:** Day care provided by a mother or father who has one or more children of their own. The children are looked after in the private residence of the family who offers the care.
3. **Nanny:** Care provided by a private individual at home.
4. **Private care:** Include all other options such as care by the parents, relatives or friends.

The child care modes were characterised by the following attributes:

1. **Price for half a day care:** In order to simulate the real pricing policy in Switzerland the prices are selected from an interval proportional to the household's income. The price of the child care centre has been set between 0.3 and 0.6% of the family's income for a half-day care.⁸ The price of the family day care home was set slightly lower that is, between 0.2 and 0.5% of the family's income for a half-day care. Finally, the price for the nanny was fixed between 60 and 100 Swiss francs (CHF) per half a day, which is similar to the actual market rates.

⁷ For an overview of the advantages and drawbacks of the two methods see for example Verhoef and Franses (2002) or Louviere et al. (2000).

⁸ In some choice cards zero prices were introduced for day care centres in order to check the effect of free child care. These observations were however excluded from the final regression sample because our preliminary analyses showed that they might distort the estimation results in particular with respect to price elasticities.

2. **Distance from home:** The distance was set between 5 and 25 minutes without specifying the transport mode.⁹
3. **Opening hours:** For each alternative 5 different levels of opening hours were defined. Child care centres are usually open from Monday until Friday. For the family day care home and the nanny, some choice cards considered availability of care on Saturday and Sunday. The opening hours varied between 9 and 14 hours a day.
4. **Number of children per staff member:** This characteristic represents a quality aspect of the care. The number of children per care-giver varied between 3 and 7 children for the child care centre and between 3 and 6 for the family day care home. In the case of the nanny, the number of children corresponds to the number of children in the family.
5. **Flexibility:** This characteristic represents the scheduling flexibility. In the most restrictive form, the child care service is fixed to some days with the possibility to adapt these days only from month to month. In the most flexible form there is the possibility to use the care service in a short term and only for few hours.

Table 1 shows an example of a choice situation that has been presented to the families. Each family has been presented six different choice cards. Respondents were asked to imagine that the three offered alternatives to private care are available in their residence area and that can be obtained without the usually required registration in the waiting lists.

Table 1: Example of a choice card

SITUATION 1	Child care alternatives			
	ALTERNATIVE 1 Child care centre	ALTERNATIVE 2 Family day care	ALTERNATIVE 3 Nanny	ALTERNATIVE 4 Private care
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...)	

A full fractional design of all levels of all attributes would require a very high number of cards. Therefore, the different levels of the characteristics were combined using an orthogonal factorial design (Louviere et al. 2000, Champ et al. 2003). Using this approach redundant combinations of the levels of the characteristics are omitted. Thus it was possible to cover the whole space of attribute combinations with a limited number of alternatives. This allows

⁹ The families were asked to assume that they took their usually preferred transport mode. We wanted to avoid the possibility of refusal of an alternative only because of the suggested transport mode. The distance for the nanny alternative is naturally set to zero.

maximizing the information obtained by the choice experiment, without presenting all combination possibilities to the respondents.

In addition to the choice of the child care service, families were asked to specify how often they would like to use selected alternative, varying between one half-day to five full days a week. In the survey it has been stressed that every alternative was in addition to the care given by the parents.

The respondents were first contacted by phone and asked about their family composition and the age of the children. The families with any children of four years old or younger were asked further questions on their actual child care choices as well as some socio-economic characteristics, including income. In a second stage, the families were mailed six choice cards with the alternatives day care modes and the related instructions. In a third stage, they were contacted by phone and asked to reveal their choices. From the 694 households that participated at the first part of the survey 88% have completed the choice cards and participated at the second part of the survey. The average length of the interview was about 24 minutes. The survey was carried out between October 2003 and July 2004.

4. Data description

The original sample consists of 612 families living in Switzerland and covers households living in the German-speaking (58% of households) as well as in the French and Italian-speaking (42%) parts of Switzerland. Around 61% of the families in the sample reside in urban areas.

For the econometric estimations, we excluded some observations because of missing data or inconsistent responses. Further, in order to avoid a bias in price elasticities, observations with a child care centre price of zero were excluded.¹⁰ The final regression sample consists of 2972 choice situations from 597 households. Their actual choices indicate that 85% of these families do not use any external child-care; only about 10% use day care centres, and 5% use the services of family day care homes (Figure 1).

As mentioned, four alternatives have been considered in the experiment: Day care centre, family day care home, nanny and any private alternative. The distribution of hypothetical choices shows that the child care centre and family home alternatives have been chosen respectively in 28% and 23% of the cases. While the private care alternative has been selected in 45% of the cases, only in 4% of the hypothetical observations the baby-sitter alternative has been chosen. About 31% of the households have always chosen the private alternative. This suggests that these households have probably access to a private source of care and are not responsive to any changes in the attributes of other alternatives. On the other hand, about 69 percent of the households have chosen at least once, a non-private care. Only a small fraction of families (7%) have always chosen the same non-private alternative, suggesting that there is no strong preference for either of these choices.

¹⁰ As the multinomial logit model is a non-linear model, price elasticity of demand is not constant. Zero prices simulate a hypothetical situation in which the elasticities may be lower than the real-world situation. An additional regression controlling for a binary indicator for free prices suggested that such a variable cannot fully compensate for the potential biases.

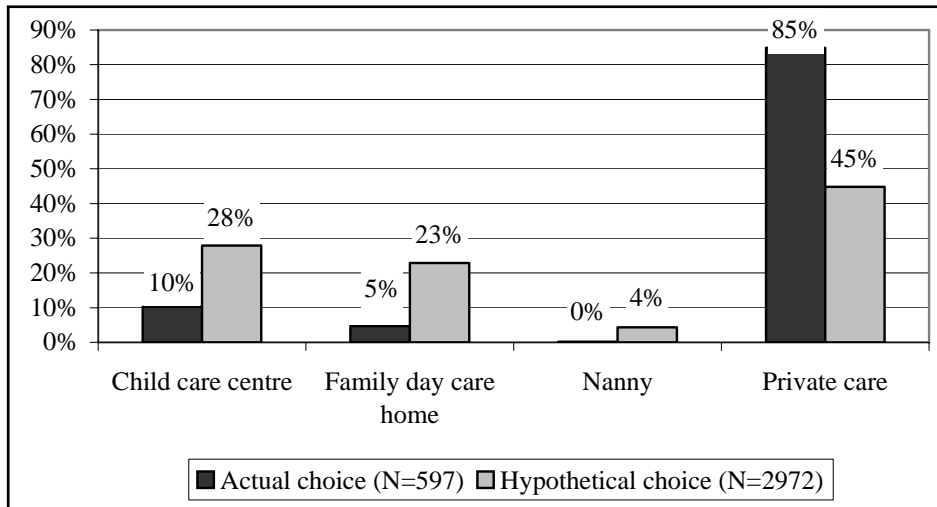


Figure 1: Comparison between actual and hypothetical child care choice

Given that in the experiment design the values of the choice attributes are simulated based on the real world, this considerable increase in demand can be probably explained by the current lack of supply. These results suggest that if families have a choice of child care with characteristics similar to the experiment, their demands for day care centres and family day care homes can substantially increase.

In order to avoid an excessive number of parameters in the model and given that this outcome concerns only a very small fraction of the sample, we decided to consider the nanny and private alternatives as a single category.¹¹

A descriptive summary of the final sample and the explanatory variables used in the econometric analysis are given in table 2 and 3.

¹¹ Preliminary multinomial logit analysis showed that the nanny attributes (like price and flexibility) do not have any significant effect on the probability of choosing other alternatives. Moreover, the results as far as the child care centre and family day care home alternatives are concerned, do not change significantly.

Table 2: Descriptive statistics of socioeconomic characteristics (N=597)

	Mean	Std. Dev.	Minimum	Maximum
Child is one-year old or younger	0.268	0.443	0	1
One parent's 1st nationality is not Swiss	0.206	0.405	0	1
Rural household	0.390	0.488	0	1
French/Italian speaking region	0.414	0.493	0	1
Additional child(ren) younger than 5	0.382	0.486	0	1
Additional child(ren) of age 5-12	0.405	0.491	0	1
Additional child(ren) of age 13-18	0.049	0.215	0	1
Mother's age	33.662	4.188	22	49
Mother has a university degree ^a	0.152	0.360	0	1
Mother works 50% or more	0.256	0.437	0	1
Household monthly income in CHF 1000 ^b	6.015	2.178	1	12
The respondent is the father ^c	0.095	0.294	0	1
Father's job is not a normal daily job ^d	0.186	0.389	0	1
Main child-care provided by parents	0.591	0.492	0	1
Main child-care by relatives/friends	0.258	0.438	0	1
Number of choice situations (cards)	4.978	0.960	2	6

^a University degree means an education level of University or professional University

^b Monthly income is available as a multiple of thousand francs (*e.g.* 3 means between 3000 and 4000).

^c In these households the responsibility of child-care arrangements is mainly with the father.

^d Includes cases in which father does not work.

Table 3: Descriptive statistics of the characteristics of the chosen alternatives (N=2972)

	Mean	Std. Dev.	Minimum	Maximum
Day Care Centre Price (CHF/half-day)	29.103	11.362	6	60
Family Home price (CHF/half-day)	23.093	10.307	3	50
Number of children per person (DCC)	5.041	1.399	3	7
Number of children per person (FH)	4.489	1.124	3	6
Distance from DCC (in 5 minutes)	3.002	1.418	1	5
Distance from FH (in 5 minutes)	3.029	1.397	1	5
FH is open at least 1 week-end day	0.401	0.490	0	1
DCC requires 1-month-ahead scheduling	0.397	0.489	0	1
FH requires 1-month-ahead scheduling	0.392	0.488	0	1

5. Estimation results

The regression sample used in the econometric analysis consists of 597 households and 2,972 observations. In the main analysis we consider three choices: Child care centre, family day care home and private care, the latter category including nannies and any non-official child care.

Using several preliminary regressions we have specified the variables, including choice attributes (X) and households' characteristics (Z), which have an important effect and excluded the variables that have a totally insignificant effect. Both t-ratios (with asymptotic normal distribution) and Wald tests (with Chi-square distribution) have been used to test the significance of the coefficients. While the t-ratios are used to see the significance in each outcome (alternative) separately, the Wald tests assess the hypothesis that the effects have an insignificant effect in all outcomes. Generally, the variables were excluded if their insignificance is suggested by both tests.

Since any additional variable in the model requires two more parameters, we tried to limit the number of parameters to a reasonable number. Therefore, many of the discrete variables in the data, which would have otherwise required several dummies, have been reduced to a single dummy.¹² It is reasonable to assume, as in any grouped data, that the errors can be correlated across the observations that belong to the same household. Here, the correlation within household groups is considered by using the robust standard errors with the cluster option in the Stata program.¹³ In this method the errors are only required to be independent across groups and can be correlated within groups. Consequently, the variations within groups contribute little to the estimation precision. The standard errors are therefore more realistic than those obtained with the independence assumption, which may be under-estimated.

Preliminary regressions showed that the child's age has no significant effect on the household's child care choice. Several alternative dummies were considered in these regressions.

¹² For instance, the mother's education is available in 13 categories, but after controlling for other variables only mothers with university degrees have shown significant difference from others.

¹³ See Moulton (1990) for more details about heteroscedasticity in grouped data, and Rogers (1993) for the clustering approach.

The only case with relatively significant effects was that families with children of one-year-old and younger could be slightly different from others in some of the adopted specifications. The measures related to opening hours of child-care centers did not appear to be significant. The scheduling flexibility, which has been defined in 5 categories, was shown to be significant only when one-month-ahead scheduling is required.

The estimation results are given in table 4. They show the effects of the explanatory variables on the probability of choosing child care centre and family day care home. The base category (comparison group) is the private care alternative. Many of the coefficients are statistically significant and the model shows a reasonable explanatory power as indicated by the value of pseudo R-square. The analysis of predicted probabilities also shows that the model correctly predicts the chosen outcome in 1,709 out of 2,972 cases, that is about 57.5% of the sample. Most of the coefficients have the expected sign and the main choice attributes such as price and distance are highly significant in both choices.

The hypothesis of independence of irrelevant alternatives (IIA) has been tested using a series of Hausman tests, which suggest evidence for independence. The marginal effects of each variable on the probabilities are also listed in the table. The first observation is that the marginal effects and the elasticities are not sensitive to whether they are estimated at the sample mean or are averaged over observations.

The results indicate that many of the household characteristics have a significant effect on choice probabilities. For instance immigrant families are on average about 10 percentage points more likely to choose child care centre. Residents of rural areas are on average slightly less likely to use child care centre. Compared to German-speaking households, families residing in French/Italian-speaking regions are about 5% more likely to use non-private child-care.

The above results are more or less consistent with the actual choice of these families. Among the 597 households in our sample, about 10% are actually using a child care centre, and about 5% a family day care house as their main child-care option. These numbers increase to about 15 and 10 percent (respectively for child care centre and family day care home) among the 123 immigrant families (with at least one foreign parent) in the sample. Similarly among the 233 rural households in the sample, only about 9% actually use a non-private child-care (child care centre and family day care home). As for the actual choice among the 233 'Latin' families in the sample, the distribution changes to about 15% for the child care centre and 8% for the family day care home alternative.

The presence of a sibling has a significant effect only if they are older than five years old. The estimation results suggest that the households with additional children older than 5 are less likely to use a non-private care option. However, the effect depends on the age category of the sibling(s): Households with teenage children are on average 14% less likely to choose a child care centre whereas the presence of children between 5 and 12 decreases the family day care home choice probability by 0.09 on average.

Older mothers are significantly more likely to choose a non-private child-care. As suggested by an elasticity of approximately 1.2 and 0.5, the probability of child care centre and family day care home choice rises by about 12% and 5% if the mother's age increases by 10%. Mothers with university degrees are on average 9% more likely to use child care centre. The results also suggest that the demand for child care centre increases with family income. Namely, other factors held constant, households with higher incomes are significantly more likely to choose child care centers, with an average elasticity of 0.52.

Table 4: Regression results

	Child care centre		Family day care home	
	Coefficient	Robust std.error	Coefficient	Robust std.error
Child is one-year old or younger	-0.008	0.162	-0.322	0.177
One parent's nationality is not Swiss	0.585***	0.205	0.299	0.224
Household living in rural area	-0.265	0.164	0.024	0.173
French/Italian speaking region	0.382**	0.166	0.419**	0.177
Additional child(ren) younger than 5	0.033	0.174	0.175	0.182
Additional child(ren) of age 5-12	-0.518***	0.193	-0.151	0.194
Additional child(ren) of age 13-18	-0.513	0.366	-1.303***	0.499
Mother's age	0.064***	0.022	0.044**	0.022
Mother has a university degree	0.499**	0.245	0.219	0.250
Mother works 50% or more	0.068	0.210	-0.137	0.214
Monthly income in 1000 CHF	0.144***	0.054	0.066	0.055
Respondent is the father	-0.748**	0.295	-0.751**	0.318
Father has not a normal daily job	-0.521**	0.240	-0.295	0.276
Main child-care by parents	-1.129***	0.224	-1.262***	0.268
Main child-care by relatives/friends	-1.142***	0.236	-0.916***	0.271
Price (CC)	-0.052***	0.007	0.015**	0.007
Price (FH)	0.012***	0.007	-0.051***	0.007
Number of children per person (CC)	-0.163***	0.035	-0.014	0.034
Number of children per person (FH)	-0.031	0.041	-0.111**	0.046
Distance from CC (in 5 minutes)	-0.321***	0.037	0.073**	0.034
Distance from FH (in 5 minutes)	0.087**	0.035	-0.370***	0.037
FH is open at least 1 week-end-day	-0.149	0.094	0.289***	0.098
CC requires 1-month-ahead scheduling	-0.147	0.094	-0.045	0.098
FH requires 1-month-ahead scheduling	0.135	0.096	-0.187	0.106
Constant	0.258	0.803	0.438	0.826

597 households, 2972 observations, 3 alternatives: Child care centre (CC); family day care home (FH); Private/Nanny (comparison group)

* significant at .1, ** significant at .05, and *** significant at .01;

Pseudo R² = 0.143, logL = -2655.0, Correct prediction: 57.5%

In about 9.5% of the households in the sample the father has responded to the survey (see table 2). These cases generally correspond to the households in which the responsibility of child care is mainly with the father. The estimations indicate that such households are significantly less likely (by about 10 percentage points) to choose a child care centre. Our data on the couples' working status show that in these households, it is relatively likely that the father does not work and the mother has a full-time job. This suggests that the father-responder dummy might capture some of the effects of the couple's working status. However, our preliminary regressions indicate that if this dummy is replaced with the father's working status variables such as percentage of working hours or full-time job dummies, their effects are not significant. Therefore this dummy appears to capture some other household characteristics as well. It also turns out that the probability of choosing a child care centre falls by about 8% if the father's job is not a normal daily job with fixed hours.

The last two household characteristics in the model measure the access to a private care. As expected, households that have access to parental care (main child care provided by one or both parents) are about 15% less likely to choose a child care centre or a family day care home. Similarly, the households with access to child care provided by relatives or friends are less likely to choose a non-private care. However, the effect is much higher with respect to the child care centre, suggesting that families with access to a private child-care are relatively more willing to substitute a non-parental care for a family day care home rather than a child care centre.

Our additional regressions indicate if the nine choice attributes are excluded from the model, the pseudo R-square's value falls to .056, suggesting that the choice attributes explain a large fraction of the variation in choice probabilities. The most important attribute is price. Table 5 shows that the own price elasticity of both care types is about -1.0 to -1.2. The own price coefficients are not significantly different. This suggests that a price increase of 10% will reduce the demand by about 10 to 12 percent. The cross price elasticities are however, slightly but not significantly, different. According to the estimations, the demand for child care canter and family day care homes respectively increase by about 4% and 7% if the alternative care price increases by 10%. This suggests that facing a price change, the households are probably more willing to substitute child care centre by family day care home than vice versa.

Table 5: Marginal effects and elasticities (at the sample mean) of significant variables

	Child care centre		Family day care home	
	Marginal effect	Elasticity	Marginal effect	Elasticity
One parent's nationality is not Swiss	0.10			
French/Italian speaking region	0.05		0.05	
Additional child(ren) of age 5-12	-0.09			
Additional child(ren) of age 13-18			-0.14	
Mother's age	0.01	1.28	0.00	0.61
Mother has a university degree	0.09			
Monthly income in 1000 CHF	0.02	0.56		
Respondent is the father	-0.10		-0.08	
Father has not a normal daily job	-0.08			
Main child-care by parents	-0.14		-0.15	
Main child-care by relatives/friends	-0.16		-0.09	
Price (CC)	-0.01	-1.20	0.005	0.73
Price (FH)	0.005	0.45	-0.01	-1.00
Number of children per person (CC)	-0.03	-0.59		
Number of children per person (FH)			-0.02	-0.36
Distance from CC (in 5 minutes)	-0.06	-0.74	0.03	0.41
Distance from FH (in 5 min.)	0.04	0.43	-0.07	-0.95
FH is open at least 1 week-end-day			0.06	

Child care centre (CC); family day care home (FH)

The ratio of children per care-person does not have a significant 'cross' effect, that is changing this factor in one alternative does not change the demand for the other alternative. Here again the own elasticities are slightly but not significantly different across alternatives (Chi-square of 0.85, $p=0.36$). The results suggest that the probabilities decrease with less staff, the respective elasticities being 0.58 and 0.35 for the alternatives child care centre and family day care home. The distance to the child care provider significantly affects the probabilities. The own distance elasticity is respectively -0.8 and -1.0 for child care centre and family day care home choices and the cross distance elasticities are both about 0.4. The distance elasticities are not significantly different across the two alternatives.

If families day care homes function during the weekend, their demand will increase by about 6% on average, but it does not affect the child care centre demand. The scheduling flexibility has no significant effect. However, if the family day care homes require one-month-ahead scheduling, their demand may slightly fall, while the demand for child care centers can rise by almost the same amount. This may suggest that families are willing to plan their child-care demand with a centre but not with a family home.

6. Summary and conclusions

Although extrafamilial child care services have gained importance in Switzerland, the provision of day care facilities has not been fully developed. In order to improve the provision of child care centres and family day care homes, the government has initiated an incentive programme for start-up financing of child care services. An effective promotion of child care facilities by policy makers requires detailed information about the conditions under which parents are willing to use such services.

We have used a stated preferences approach in order to elicit the preferences of households regarding the type of care provided to their children. By applying a choice experiment it was possible to identify the importance of the characteristics of child care facilities for their choice. The choice experiment considered four modes of child care provision: the child care centre, the day care family home, the nanny and the private solution. The characteristics considered in the choice experiment were the price, the distance from home, the number of children per staff member, the opening hours and the flexibility to adapt the time of care to different needs.

The sample consists of 612 families living in Switzerland and covers households living in all parts of Switzerland. The comparison of the actual choices and the hypothetical choices shows a considerable increase in demand for child care centres and family day care homes. This can be probably explained by the current lack of supply. These results suggest that if families have a choice of child care with characteristics similar to the experiment, their demands for day care centres and family day care homes can substantially increase.

The results of a multinomial logit regression model indicate that many of the household characteristics have a significant effect on choice probabilities. For instance, the mother's age has a significant effect on the choice of non-private care. As suggested by an elasticity of approximately 1.2, the probability of child care centre choice rises by about 12% (5% for family day homes) if the mother's age increases by 10%. Mothers with university degrees are on average 9% more likely to use child care centre. The results also suggest that the demand for child care centre increases with family income (average elasticity of 0.52). Households that have access to parental care are about 15% less likely to choose a child care centre or a family day care home. Similarly, the households with access to child care provided by relatives or friends are less likely to choose a non-private care.

In addition to the socio-demographic variables, the choice attributes explain a large fraction of the variation in choice probabilities. The most important attribute is price. The own price elasticity of child care centre and family day care home is about -1.0 to -1.2. This suggests that a price increase of 10% will reduce the demand by about 10 to 12 percent. The distance to the day care provider significantly affects the probabilities. The own distance elasticity is respectively -0.8 and -1.0 for child care centre and family day care home choices. The elasticity of the ratio of children per care-person suggest that the probabilities decrease with less staff, the respective elasticities being 0.58 and 0.35 for the alternatives child care centre and family day care home.

The results suggest that there is an important need for non-parental care facilities in Switzerland. The demand for these institutions depends mainly on their characteristics with the price and the distance being very important. The final demand depends also on the families' characteristics: income and education appear to increase the probability of choosing child care center and family day care homes. Also the family's cultural background appears to play a role in their choice, since families living in the French or Italian-speaking parts of Switzerland are

more likely to choose certain forms of institutional care. However, we can observe that overall there are no strong preferences for one specific child care mode. As a consequence, the government should promote different child care alternatives. For instance, family day care homes are an interesting complementary alternative to child care centres, in particular in those (rural) regions where the number of children is not high enough to justify the creation of a care centre. Given the high price elasticity, the State should consider subsidies in prices otherwise a promotion of extra-familial child care wouldn't be effective. An alternative that should be considered due to the observed weak preferences for a specific type of child care is the subsidization of families using extrafamilial child care modes, instead of the subsidization of specific institutions. This allows a free choice for families enabling them to choose the best alternative to them.

8. References

- Anderson PM, Levine, PB (1999) *Child Care and Mothers' Employment Decisions*. National Bureau of Economic Research, Cambridge MA.
- Andrén T (2002) *A Structural Model of Childcare, Welfare, and the Labor Supply of single Mothers*. Working Papers in Economics 82, Göteborg University, Department of Economics.
- Ben-Akiva M, Lerman, SR (1985) *Discrete Choice Analysis: Theory and Application to Travel Demand*, The MIT Press, Cambridge Massachusetts, London, England.
- Birol E, Karousakis K, Koundouri P (2005) *Using a choice experiment to estimate the non-use values of wetlands: the case of Cheimaditida wetland in Greece*. Environmental Economy and Policy Research, Discussion Paper Series, No. 08.2005, University of Cambridge.
- Blau DM (2000) *Child Care Subsidy Programs*. NBER Working Paper 7806, NBER volume edited by Robert Moffitt.
- Blau DM, Hagy AP (1998) *The Demand for Quality in Child Care*. Journal of Political Economy 106 (1), February: 104-146.
- Champ PA, Boyle KJ, Brown TC (2003) *A Primer on Nonmarket Valuation, The Economics of Non-Market Goods and Resources*. Ed. Bateman I.J., Kluwe Academic Publishers, Dordrecht, The Netherlands.
- Chaplin DD, Robins PK, Hofferth SL, Wissoker DA, Fronstin P (1996) *The Price Elasticity of Child Care Demand: A Sensitivity Analysis*. Unpublished manuscript.
- Chevalier A, Viitanen TK (2002) *The Supply of Childcare in Britain: Do Mothers Queue for Childcare?*. Unpublished paper, Institute for the Study of Social Change, University college Dublin.
- Connelly R, Kimmel J (2000) *Marital Status and Full-Time/Part-Time Work Status in Child Care Choices*. Unpublished revision of W.E. Upjohn Institute for Employment Research working paper no. 99-058, October 1999, Kalamazoo, Michigan.
- Del Boca D, Locatelli M, Vuri D (2004) *Child Care Choices by Italian Households*. Discussion Paper Series, Institute for the Study of Labor, IZA DP No. 983.
- Greene WH (2003) *Econometric Analysis*. 5th edition, Prentice Hall, Upper Saddle River, New Jersey.

- Helburn SW, Howes C (1996) Child Care Cost and Quality, *The Future of Children – Financing Child Care*. Vol. 6, No. 2: 62-82.
- Hofferth SL, Wissoker DA (1992) Price, Quality, and Income in child Care Choice. *The Journal of Human Resources*, 27, 1: 70-111.
- Kimmel J (1998) Child Care Costs as a Barrier to Employment for Single and Married, Mothers- *Review of Economics and Statistics* 80 (2), May: 287-299.
- Krayenfeld M, Hank K (2000) Does the availability of child care influence the employment of mothers? Findings from western Germany. *Population Research and Policy Review* 19: 317-337.
- Johansen AS, Leibowitz A, Waite LJ (1996) The Importance of Child-Care Characteristics to Choice of Care. *Journal of Marriage and the Family* 58: 759-772.
- Lanfranchi A (2002) Schulerfolg von Migrationskindern. Die Bedeutung familienergänzender Betreuung im Vorschulalter. Opladen: Leske + Budrich, Reihe Familie und Gesellschaft, Band 28.
- Leibowitz A, Klerman JA, Waite LJ (1992) Employment of New Mothers and Child Care Choice – Differences by Children's Age. *The Journal of Human Resources*, Vol. 27, No. 1, Winter: 112-133.
- Louviere JJ, Hensher DA, Swait JD (2000) *Stated Choice Methods – Analysis and Application*. Cambridge University Press, Cambridge.
- Louviere JJ, Hensher DA (1983) Using discrete choice models with experimental design data to forecast consumer demand for a unique cultural event. *Journal of Consumer research* 10(3): 348-61.
- Maddala GS (1999) *Limited-dependent and qualitative variables in econometrics*. Econometric Society Monographs, Cambridge University Press, Cambridge.
- Michalopoulos C, Robins PK, Garfinkel I (1992) A Structural Model of Labor Supply and Child Care Demand. *The Journal of Human Resources*, Vol. 27, No. 1, Winter: 166-203.
- Michalopoulos C, Robins PK (2002) Employment and child-care choices of single-parent families in Canada and the United States. *Journal of population Economics* 15 : 465-493.
- Moulton BR (1990) Random group effects and the precision of regression estimates. *Journal of Econometrics*, 32: 385-397.
- Powel LM (2002) Joint Labor Supply and Childcare Choice Decisions of Married Mothers. *The Journal of Human Resources*, 37, 1: 106-128.
- Pungello EP, Kurtz-Costes B (1999) Why and How Working Women Choose Child Care: A Review with a Focus on Infancy. *Developmental Review* 19: 31-96.
- Rogers WH (1993) Regression standard errors in clustered samples. *Stata Technical Bulletin*, 13: 19-23 (reprinted in *Stata Technical Bulletin Reprints*, Vol.3, 88-94).
- Schröder J (2005) Der Zusammenhang zwischen Erwerbstätigkeit und Fertilität: Ein Überblick über den Forschungsstand. Working Paper, Mannheimer Zentrum für Europäische Sozialforschung, Universität Mannheim.
- Stebler S (1999) Erwerbsverhalten und Familienpolitik in der Schweiz. Dissertation der Wirtschaftswissenschaftlichen Fakultät der Universität Zürich, Zürich.

- Stern S, Banfi S, Tassinari S (editors) (2006) Nachfrage für Krippen und Tagesfamilien in der Schweiz - Aktuelle und zukünftige Potenziale. Haupt, Bern.
- Verhoef PC, Franses PH (2002) On combining revealed and stated preferences to forecast customer behavior: three case studies. Econometric Institute Report, 2002-04, Erasmus University Rotterdam.

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