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The Excess Demand for Subsidized Child Care in Germany

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Abstract: The extension of subsidized child care is currently on the top of the political agenda in Germany. In this paper the excess demand for subsidized child care slots is estimated using a partial observability model in the style of Abowd and Farber (1982). The results show that more than 50 percent of children aged 0-3 are queuing for child care slots, whereas only 10 percent of children aged 4-6 years are queuing. For children in the younger age group about 255,000 child care slots are missing. This number comes close to the government's plan to expand subsidized child care by 230,000 slots.

Keywords: child care, excess demand, partial observability model

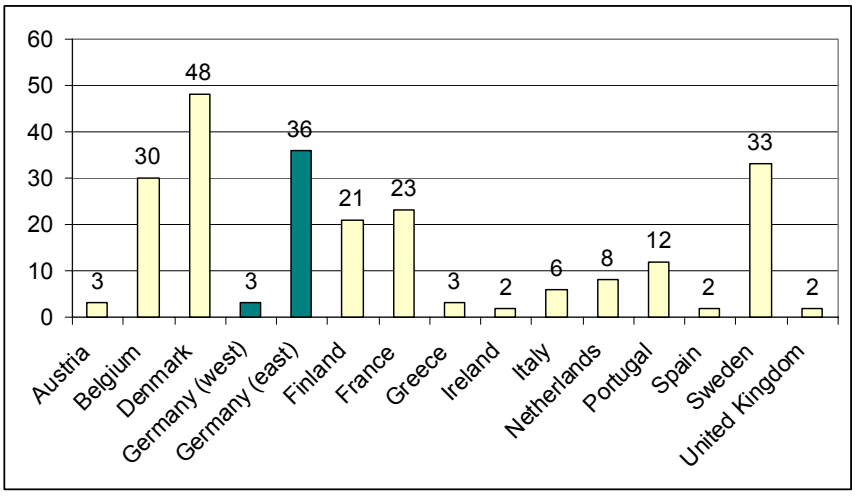
JEL classification: J13, C35, D12

1 Introduction

The extension of the provision of subsidized child care for preschool children is currently on the top of the political agenda in Germany. The "demand-oriented" extension of child care is an announced goal by the German government, although the exact amount of the demand for child care is not known. This paper tries to give an answer to the question on how many parents demand subsidized child care for their children, and in particular, to what extent this demand is not met by the child care facilities already available.

As can be seen in Figure 1, the availability of child care facilities for preschool children is limited, especially for children under the age of three living in west Germany. This is an often cited reason for both, the low fertility rates and the low employment rates of mothers in Germany. Also, the positive effects of child care utilization on future educational outcomes is an argument for the extension of subsidized child care. For these reasons, it is the explicit goal of the federal government to reach the standards of comparable countries in the fields of child care until the year 2010.

Figure 1: Publicly financed/subsidized child care slots for children under three years per hundred children in selected countries of the European Union



Source: BMFSFJ (2003) and DJI (2002).

Comparing the German availability ratios to those of other European countries, such as France or Denmark, for example, might lead to the conclusion that excess demand for child care in west Germany is extremely large, in particular for children in the younger age group.

However, without knowledge of the demand for child care, it is not possible to report the amount of excess demand. Although the problem of excess demand is widely recognized (see e.g. Büchel and Spieß 2003), to my knowledge there is no data set available that would allow to observe the demand for child care[1]. Some surveys provide representative evidence on the attitudes towards child care provisions. For example, in the German Socio-Economic Panel (GSOEP), all parents of preschool-aged children are asked about their satisfaction with the child care available. Answers have to be given on a scale between 0 ("totally unhappy") and 10 ("totally happy"). For all parents of this group, only 5 percent report values between 0 and 2 ("totally unhappy"), whereas 48 percent report values between 8 and 10 ("totally happy"). Interestingly, these results do not differ when only parents with children under the age of three are considered. In this group, 6 percent report to be "totally unhappy", whereas 45 percent report to be "totally happy". This result is remarkable, given that availability of child care slots for children under the age of three is extremely low. On the other hand, there is some empirical evidence that rationing of child care slots is an issue for parents. In a survey undertaken by the Forsa Institute in 2004[2], parents with children aged up to 13 years were asked questions on different issues concerning family-work life balance. About 30 percent of all respondents stated that is is/was "very hard" to find a child care slot.

Data on the above cited evidence from attitude questions only provide a very rough hint on the amount of the demand for formal child care. However, since the extension of the provision of child care is on the top of the political agenda at the moment, it is of great importance to learn something about the amount of the excess demand for subsidized child care in Germany. The aim of this paper is to estimate the demand for child care on the basis of a partial observability model. Under certain assumptions, the demand for and supply of child care can be estimated even when only the joint outcome of these two variables, namely child care utilization, is observed. I will use the model introduced by Abowd and Farber (1982), in which identification of the demand and supply equations is not only based on exclusion restrictions, but also on the fact that some children are not restricted in their access to subsidized child care. The results show that for children up to three years excess demand is very large, especially in west Germany. About 45 percent of all children in this age group are queuing for a child care slot while only about 10 percent actually attend a child care facility.

The reminder of the paper is organized as follows: The next section provides a short sketch on the organizational structure of child care in Germany. Section 3 outlines the previous literature on the demand for child care. In section 4, the details of the econometric model

[1] In some surveys, parents are asked if their child is in a child care facility. However, in order to calculate the demand for child care, this question should be splitted in two: 1. Is your child in a child care facility? 2. If not: Did you apply for a slot in a facility?

[2] See Media-Forschung und –Service (2004)

are shown, while section 5 provides a description of the data. In Section 6, the estimation results are presented and commented against the background of the current political debate and section 7 summarizes and concludes.

2 Organization of child care in Germany

In Germany, the organization of the provision of child care is the responsibility of the communities and the federal states. According to the *Kinder- und Jugendhilfegesetz* (*Achtes Buch Sozialgesetzbuch*), they have to work towards a sufficient provision of child care slots. This rather vague mandat of "sufficient provision" is concretized only for children in the age group above 3 years: According to this federal law, all children between three years and school age have a legal claim for a part-time child care slot. In 2004, a federal law[3] has been passed, which requires the communities to provide child care slots for all children up to three years in the case that both parents are working or wish to work.

Carriers of child care facilities are either the communities themselves or so-called "free carriers" ("freie Träger"), such as churches, non-profit organizations or parents' initiatives. These private carriers are highly subsidized: according to the *Statistisches Bundesamt*, total subsidies of child care facilities were as high as 10.4 billion Euro in the year 2001. Public funding goes to the vast majority of child care institutions, also to the private (non-profit) carriers. For-profit institutions, which are not eligible for subsidies, make up only a very small proportion of all carriers. Due to these subsidies, the parents' fees in both, public and private child care facilities lie only in the range of 0 to 30 percent of the total costs of a child care slot (DJI 2002). It should also be mentioned that parents' fees are charged according to the parents' income in the majority of the facilities. In most regions, income-dependent fee schemes are even mandatory.

In addition to subsidized public or private child care facilities, child care by nannies or childminders ("Tagespflege") is also used, especially for children under the age of three years. This sector is almost exclusively privately organized, and statistics about the amount of utilization of child minding in terms of children or hours, as well as on the cost structure, are not available. Estimations based on surveys give utilization of child minders between 3% (Family Survey) and 4% (GSOEP) of all children under the age of three. Child minding is more widely used in urban than in rural areas and more in west than in east Germany. The costs of child care by a childminder are much higher than in a child care facility, and amount to about 690 Euro per month (Jurczyk et al. 2004). In contrast to that, parents' fees for a full-time slot

[3] See *Gesetz zum qualitätsorientierten und bedarfsgerechten Ausbau der Tagesbetreuung und zur Weiterentwicklung der Kinder- und Jugendhilfe (Tagesbetreuungsausbaugesetz - TAG),* downloadable from http://www.bmfsfj.de/RedaktionBMFSFJ/Abteilung5/Pdf-Anlagen/gesetz-tag,property=pdf.pdf (24/01/05)

in a subsidized child care facility only amount to 110 Euro on average. The highest fee reported by parents in the GSOEP wave 2002 amounts to 400 Euro per month.

Given that this private market for child care exists, excess demand for child care in Germany really means excess demand for child care at the subsidized price, i.e. in subsidized child care facilities. Considering the large difference between the market price for child care and the parents' fees for a subsidized child care slot, it is not surprising that parents prefer to queue for a subsidized child care slot instead of buying private child care on the market, since the private costs might exceed the mother's (or father's) market wage[4]. Therefore, it is important to keep in mind throughout the paper that whenever excess demand for child care is mentioned, what is really meant is the excess demand for child care in subsidized institutions.

3 Literature Overview

The demand for child care has already been the subject of numerous international studies. There exists a large literature on the demand for child care in the United States and Canada (for a survey of this literature, see e.g. Joesch and Hiedemann 2002), however in the past years, also studies for other countries have been published (see e.g. Choné et al. 2003 for France, Del Boca et al. 2004 for Italy, Kornstad and Thorensen 2002 for Norway, Lokshin 2004 for Russia). In most of these studies, demand for child care and labor supply decisions of mothers are estimated simultaneously. However, some studies focus on special characteristics of the demand for child care. Joesch and Hiedemann (2002) estimate the demand for child care using a double-hurdle model in order to separate different reasons for zero child care consumption in the US. While they differentiate between zero consumption due to high costs and zero consumption because parents are not interested in non-relative child care regardless of the cost, access restrictions to child care are not modelled as a reason for zero comsumption. Access restricitions are explicitly modelled by Chevalier and Viitanen (2004) in a study on the demand for child care in the UK. The authors use a partial observability model in the style of Porier (1980) in order to separate demand and supply of child care. They find evidence for a considerable excess demand for child care in the UK.

In contrast to the literature on the US and Canada, estimates on the demand for child care in Germany is rather limited[5]. An early study by Merkle (1994), who uses data from the GSOEP, estimates price elasticities for child care demand. Ondrich and Spieß (1998) analyze the determinants of the transition from home to institutional child care in Germany. The focus of a study by Spieß (1998) is to estimate the effects of public regulations in the child care

[4] There might of course be also other reasons why parents prefer institutional child care over the private sector, for example if they expect the child care quality to be higher in the institutional sector. However, due to lack of data, quality issues are not taken into account in my analysis.

[5] A detailed literature survey on German studies can be found in Büchel and Spieß (2002).

"market" on the demand for child care. Büchel and Spieß (2002) estimate the effects of socio-economic variables such as education and income as well as ethnicity of the parents on the utilization of child care. Although e.g. Merkle (1994) and Ondrich and Spieß (1998) "control" for rationing of child care slots in the demand estimation by introducing a variable indicating child care slots per hundred children on a regional level, all studies are either based on the assumption that observed child care utilization can be interpreted as demand for child care or explicitly state that effects on child care utilization are estimated. In the latter case, implications concerning the demand for child care are not possible.

In addition to the studies on the demand or the utilization of child care, there are several studies that analyze the effect of local child care availability on mother's employment rates. Kreyenfeld and Hank (2000) argue that in the German context of low availability and low prices of child care, the availability of child care rather than its price should have an impact on women's employment rates. In contrast to Kreyenfeld and Hank (2000), who do not find a significant effect of local child care availability on mother's employment, Spieß and Büchel (2003) do find a significant effect of the availability of full-time child care slots on mother's employment in west Germany.

The aim of this paper is to explicitly model the possibility of access restrictions to subsidized child care slots in the estimation of child care demand for Germany. Similar to the study by Chevalier and Viitanen (2004), I will use a partial observability model in order to separate the demand and supply for child care slots. However, as will be outlined in the next section, in contrast to Chevalier and Viitanen I will follow the partial observability model introduced by Abowd and Farber (1982).

4 Econometric Model

The data set I will use for estimation contains information about the child care status of the child, i.e. it is known if a child is in a child care facility or not. If a child is not in a child care facility, this can be the case because (1) the parents do not want the child to be in a child care facility, or (2) because the parents applied for a child care slot but were not chosen from the queue. This implies that the observed variable "child care status" is in fact the product of two unobserved variables, namely the demand for child care and the supply of a child care slot. In order to calculate the size of the queue for subsidized child care, a model has to be estimated that allows to predict the probability that a child is not given a child care slot (supply = 0), while the parents want the child to be cared for in a facility (demand = 1). On the basis of partial observability models, demand and supply for a restricted good can be estimated, even if only the joint outcome of the two unobserved variables demand and supply is given. In this paper, I will follow the approach introduced by Abowd and Farber (1982). The idea of their model is to make use of the fact that not all observations are constrained in their access to

child care. The advantage of this model compared to the model introduced by Poirier (1980) and used by Chevalier and Viitanen (2004) is that identification is based not only on exclusion restrictions but also on the fact that for the observations who are not constrained, child care utilization can be explained by demand side variables only.

Formally, the model can be stated as follows: The latent variable demand for child care D* depends on child and household characteristics X_D and a stochastic part ε_D,

$$D^* = x_D\beta_D + \varepsilon_D \quad (1),$$

where β_D is the vector of the coefficients. It will be assumed that parents will have observed demand if D^* is above a certain threshold, which is set to zero for convenience,

$$D = 1 \text{ if } D^* > 0 \quad (2).$$

Therefore, the probability that parents demand paid child care can be stated as

$$\Pr(D = 1) = \Pr(\varepsilon_D > -x_D\beta_D) \quad (3).$$

Further, it is assumed that parents who demand child care slots in child care facilities at the subsidized price are selected from the queue according to some household, child characteristics and regional characteristics X_S, a vector of coefficients β_S and a stochastic error term ε_S, formally

$$S^* = x_s\beta_s + \varepsilon_s \quad (4).$$

As in the case of the observed demand, an offer (supply) of a child care slot will be observed if S^* is above zero,

$$S = 1 \text{ if } S^* > 0 \quad (5).$$

Accordingly, the probability of being offered a child care slot is

$$\Pr(S = 1) = \Pr(\varepsilon_S > -x_S\beta_S) \quad (6).$$

As already mentioned above, only the joint outcome of the two variables D and S, namely child care utilization C is observed. If it is assumed that the error terms ε_S and ε_D are independently[6] and normally distributed, the probability that child care is used can be stated as

$$\Pr(C=1) = \Pr(S=1 \,\&\, D=1) = \Pr(D=1) \cdot \Pr(S=1 \mid D=1) \qquad (7).$$

Since independency of the error terms is assumed, it follows that (7) can be simplified to

$$\begin{aligned} &\Pr(C=1) = \Pr(S=1 \,\&\, D=1) = \Pr(D=1) \cdot \Pr(S=1) = \\ &\Pr(\varepsilon_D > -x_D\beta_D) \cdot \Pr(\varepsilon_S > -x_S\beta_S) \end{aligned} \qquad (8).$$

The probability that child care utilization is not observed is the sum of the probability that parents did not demand child care and the probability that they demanded child care but were not offered a slot, namely

$$\begin{aligned} &\Pr(C=0) = 1 - \Pr(C=1) = \\ &\{1 - \Pr(D=1)\} + \Pr(D=1) \cdot \{1 - \Pr(S=1 \mid D=1)\} = \\ &\{\Pr(\varepsilon_D < -x_D\beta_D)\} + \Pr(\varepsilon_D > -x_D\beta_D) \cdot \{1 - \Pr(\varepsilon_S > -x_S\beta_S) \cdot \Pr(\varepsilon_D > -x_D\beta_D)\} \end{aligned} \qquad (9).$$

As stated above, identification of the model is based on the assumption that some children are not restricted in their access to subsidized child care slots. This group consist of children who have already been in a child care facility the year before[7], or who live in a county where availability of child care slots is near to hundred percent[8]. For these children, the child care status of the current year can be explained by demand-side variables only. The likelihood function to be maximized therefore consists of two parts, where the first product is over all observations who are not constrained (NC = 1), and the second product is over those who might be constrained (NC = 0), formally[9]

[6] I tested the assumption of the independency of the error terms ε_D and ε_S by estimating a bivariate model. The correlation coefficient in this estimation was not statistically significant. (Estimation results and the likelihood function of the bivariate model are available from the author upon request.) Drawing from this result I prefer the simpler model assuming independent error terms since there is no efficiency gain of estimating the bivariate model.

[7] The assumption that children who have been in a child care facility the year before do not have to queue for a child care slot in the current year is in line with general practice in German child care facilities.

[8] There are 440 counties in Germany. It is assumed that children are not restricted in their access to child care slots if there are more or equal to 99 slots per hundred children in the county.

[9] See also Maddala (1983).

$$L = \prod_{NC=1} \Phi\left(X_D\beta_D\right)^C \left[1-\Phi\left(X_D\beta_D\right)\right]^{1-C} \cdot \prod_{NC=0} \left[\Phi\left(X_D\beta_D\right)\Phi\left(X_S\beta_S\right)\right]^C \cdot \left\{1-\left[\Phi\left(X_D\beta_D\right)\Phi\left(X_S\beta_S\right)\right]\right\}^{1-C} \quad (10).$$

In both equations, the age of the child and the mother's marital status[10], number of siblings in child care facilities, as well as regional variables are used as explanatory variables. In the demand equation, characteristics of the mother such as her education, age and nationality are added. The mother's wage is included as a measure for the opportunity cost of maternal child care. For non-working mothers, I use predicted wages from a wage estimation based on a Heckman-type selection model[11]. Further, a hypothetical net household income for mother's working hours equal to zero is added. This income is calculated on the basis of the tax-benefit simulation model STSM (see Haan et al. 2005) and contains public transfers such as social assistance if the household is eligible. Additionally, the number of siblings by age groups and number of siblings in child care are included. In order to capture attitude variables that could influence the parent's child care demand, a dummy variable indicating frequent church attendance is used as well as the share of housework done by the father. This latter variable is intended to reflect attitudes towards gender roles and might influence the propensity to use non-maternal child care. A dummy variable indicating the presence of another adult household member apart from the parents is included in order to capture the availability of informal child care. In the supply equation, child care slots per child available ("Versorgungsquote") at the county level and for two different age groups is used as additional explanatory variable.

Chevalier and Viitanen (2004) also use the average price for a child care facility at the regional level for identification of the demand equation. For the case of Germany, this variable cannot be used. Official data on prices at the regional level do not exist since facilities are not required to report the prices they charge. Also, most child care facilities charge parents according to their income, so that the variation in prices is higher among income groups than among regions.

On the basis of this model, it is possible to predict the probability that a child is not in a child care facility because it was not offered a child care slot, although the parents applied for one, i.e.

$$\Pr(S=0 \,\&\, D=1) = \Pr(S=0)\cdot\Pr(D=1) \quad (11).$$

This probability is essential to the question of this paper, since it will allow us to draw conclusions about the amount of excess demand for child care.

[10] In Germany, many facilities favor children living with lone mothers.

[11] Estimation results are available from the author upon request.

5 Description of the data

The model described in the section above will be estimated on the basis of data from the German Socio-Economic Panel (GSOEP) from the year 2002. The GSOEP is a representative panel study of private households living in Germany[12]. While in all waves of the GSOEP there is only basic information on child care utilization, the 2002 wave provides detailed information on child care utilization, type of facility, child care hours, expenditures and informal care arrangements.

As already mentioned in the section above, for estimation of the model, regional information on the county level is matched to the individual data. Special permission was needed by DIW Berlin to use the regional code number on the county level ("Kreiskennziffer")[13]. Child care availability ratios (child care slots per child in each county) for two different age groups are matched to the individual child information from the GSOEP. This data was provided by the Deutsches Jugendinstitut in Munich[14]. Additionally, data on the spatial structure of the counties is matched to the individual data using variables from the INKAR data set provided by the Bundesamt für Bauen und Raumordnung[15]. In this data set, all 440 German counties are classified into 1 out of 9 spatial structure types, depending on population density and distance to the next urban center. This spatial structure type variable is also used in the estimation of the model (see Appendix 1 for an exact definition of this variable). Tables 1 and 2 provide detailed information on sample size, definitions and descriptives statistics on the variables used in the estimated model.

Table 1: Sample description

Number of children in GSOEP wave 2002, aged 0 – 6 and not yet enrolled in school (… these children live in 1426 households)	**1857**
Observations lost due to missing values in the variable on local availability of child care facilties	27
Observations lost due to missing values in the hypothetical net household income variable*	32
Sample Size used for estimation	**1798**
… therof children who are not constrained in their access to childcare	907
… children who might be constrained	891

* In these cases, there were missing values on variables needed for the calculation of net household income, such as missing information on the income of other household members.

[12] For more information on the GSOEP, see http://www.diw.de/english/sop/.

[13] I would like to thank C. Katharina Spiess from DIW Berlin for her support considering the provision of this data.

[14] I would like to thank Hiltrud Bayer from the Deutsches Jugendinstitut in Munich for the provision of this data.

Table 2: Variable description

Variable Name	*Description*	*Mean*	*Standard Deviation*
Dependent variable			
inchildcare	Dependent variable: 1 if child is in child care facility; the variable is not coded as 1 if parents report the child being cared for by a childminder ("Tagesmutter").	0.54	--
	…mean in the "not constrained" part of the sample	0.92	--
	…mean in the "might be constrained" part of the sample	0.17	--
Explanatory variables used in both equations			
age01	Dummy variable: 1 if child is aged 0 or 1*	0.26	--
age2	Dummy variable: 1 if child is aged 2*	0.16	--
age3	Dummy variable: 1 if child is aged 3*	0.16	--
	→ Base category of age dummies are children aged 4, 5 or 6 and not yet enrolled in school		
dadyes	Dummy variable: 1 if mother is married or cohabiting	0.91	--
numsiblcc_03	Number of siblings aged 0-3 in child care facility	0.08	0.32
numsiblcc_46	Number of siblings aged 4-6 in child care facility	0.18	0.44
Explanatory variables used in the demand equation			
schooling_mother	Mother's years of schooling	11.80	2.95
german_mother	Dummy-Variable: 1 if mother has German nationality	0.84	--
age_mother	Age of mother in years	33.02	5.22
wage	Mother's wage in Euro per hour	10.59	4.22
otheradult	Dummy-Variable: 1 if there is an adult living in the household apart from father and mother	0.06	--
hyp_netincome	hypothetical net household income if mother's working hours are zero, divided by 1,000	2.63	1.29
sibls03	Number of siblings between 0 and 3 years	0.21	0.42
sibls46	Number of siblings between 4 and 6 years	0.20	0.41
sibls610	Number of siblings between 6 and 10 years	0.26	0.47
sisters1016	Number of sisters between 10 and 16 years	0.08	0.27
church	Dummy-Variable: 1 if mother reports to attend church or other religious events every week or every month	0.20	--
housework_dad	Share of housework done by the father, if present	0.12	0.18
Explanatory variables used in the supply equation			
availability	Availability ratios of child care slots by age group on the local level: Number of child care slots per child	0.66	0.50
Regional and spatial structure variables, used in both equations			
region1	Dummy: 1 if child lives in Schleswig-Holstein, Lower Saxony, Hamburg or Bremen	0.15	--
region2	Dummy: 1 if child lives in Hesse, Rhineland-Palatinate or Saarland	0.17	--
region3	Dummy: 1 if child lives in Nordrhine-Westfalia	0.22	--
region4	Dummy: 1 if child lives in Baden-Wuerttemberg	0.15	--
region5	Dummy: 1 if child lives in Bavaria	0.14	--
	→ Base Category of the regional variables are the regions Berlin, Mecklenburg-Western Pomerania, Brandenburg, Saxony-Anhalt, Saxony and Thuringia		

[15] For more information on this data set, see Bundesamt für Bauwesen und Raumordnung (2002).

Table 2 continued

spat. str. type 2	Dummy: 1 if county is of spatial structure type 2**	0.19	--
spat. str. type 3	Dummy: 1 if county is of spatial structure type 3**	0.10	--
spat. str. type 4	Dummy: 1 if county is of spatial structure type 4**	0.04	--
spat. str. type 5	Dummy: 1 if county is of spatial structure type 5**	0.05	--
spat. str. type 6	Dummy: 1 if county is of spatial structure type 6**	0.21	--
spat. str. type 7	Dummy: 1 if county is of spatial structure type 7**	0.10	--
spat. str. type89	Dummy: 1 if county is of spatial structure type 8 or 9**	0.12	--
	→ Base Category of the spatial structure type variables is type 1**		

* The exact age of each child at the time of the interview is calculated by using information on the month of birth and the month of the interview.
** For a description of the spatial structure types see Appendix.

6 Estimation Results

Table 3 presents the coefficients of the estimated model as stated in section 4. The age of the child significantly affects the probability that child care is demanded. In contrast to this, none of the variables capturing mother's characteristics, such as her age, years of schooling, nationality or her wage are statistically significant. The hypothetical net household income at mother's working hours of zero has a significantly positive effect, whereas the number of siblings in all age groups, as well as the number of sisters aged 10-16 have a negative effect on the probability that child care is demanded. The number of siblings who are in a child care facility, however, is positive and significant. Among the variables that shall capture attitudes towards non-maternal child care, the variable indicating frequent church attendance has a negative influence on the probability of demanding formal child care. However, the share of housework done by the father is not statistically significant. As expected, the presence of another adult household member apart from the parents decreases the probability to demand formal child care. Among the regional variables, all regions except for region 4 ("Baden-Wuerttemberg") have a statistically significant negative sign, indicating that demand for child care in these regions is lower than in the base category, which are all Laender in east Germany, including Berlin. Interestingly, none of the spatial structure type dummy variables (see Appendix) are statistically significant, which leads to the conclusion that demand for child care does not vary between urban and rural areas.

In the supply equation, the availability of child care slots on the county level has a positive influence on the individual probability to be offered a child care slot. Also, the regional variables except for region 1 (Schleswig-Holstein, Lower Saxony, Hamburg or Bremen) are statistically significant. The negative sign might indicate the fact that in the regions of the base category, for a given number of child care slots, facilities are willing to take more than one child per slot.

Table 3: Estimation Results

	Demand Equation		Supply Equation	
Variable	**Coefficient**	**Standard Error***	**Coefficient**	**Standard Error***
age01	-1.48	0.56	-1.77	0.69
age2	-1.73	0.39	-0.71	0.70
age3	-1.25	0.19	-0.73	0.40
dadyes	-0.04	0.25	0.03	0.39
numbersiblscc_03	5.33	0.35	0.09	0.29
numbersiblscc_46	0.75	0.37	0.01	0.15
schooling_mother	0.02	0.02	--	--
age_mother	0.01	0.02	--	--
german_mother	0.04	0.19	--	--
wage	0.002	0.02	--	--
hyp_netincome	0.20	0.07	--	--
otheradult	-0.41	0.23	--	--
siblings03	-0.63	0.16	--	--
siblings46	-0.87	0.30	--	--
siblings610	-0.44	0.12	--	--
sisters1016	-0.65	0.22	--	--
church	-0.29	0.15	--	--
housework_dad	0.34	0.38	--	--
availability	--	--	1.80	0.73
region1	-1.09	0.30	-0.61	0.46
region2	-0.51	0.31	-0.74	0.41
region3	-0.61	0.36	-0.72	0.36
region4	-0.42	0.31	-0.73	0.40
region5	-0.72	0.30	-0.87	0.37
spatial structure type 2	-0.06	0.24	0.30	0.30
spatial structure type 3	0.08	0.29	-0.13	0.31
spatial structure type 4	0.01	0.35	0.31	0.53
spatial structure type 5	-0.25	0.33	0.12	0.42
spatial structure type 6	-0.04	0.22	-0.15	0.28
spatial structure type 7	0.14	0.30	-0.07	0.36
spatial structure type 8 and 9	-0.11	0.24	0.33	0.30
constant	1.76	0.57	0.14	0.97
Number of observations: 1798				
Log likelihood: -449.77799				
Wald chi2 (30): 773.43				

* Robust standard errors, allowing correlation of the error terms within the household (cluster option).

In order to give a measure for the predictive quality of the estimated model, actual and predicted values of child care utilization are presented in Table 4. The predicted value is coded as 1 if the predicted probability is higher than 0.5. The model performs well in predicting the joint outcome of child care demand and supply. As Table 4 shows, about 89 percent of all observations are predicted correctly according to this rule. As a comparison, a model that explains the left-hand side variable by a constant only would predict 54 percent of all cases correctly.

Table 4: Percent correctly predicted

		Actual	
		0	*1*
Predicted	*0*	724 (40%)	90 (5%)
	1	107 (6%)	877 (49%)

The partial observability model also allows to predict the marginal probabilities of demand for and supply of child care slots. Table 5 shows these marginal probabilities by regions and age groups. For children in the younger age group, the marginal probabilities of demand for a child care slot are lower in west than in east Germany. This can be explained by the differences in attitudes towards early stage child care and female employment.

The marginal supply probabilities lie above the official availability ratios in most Laender of west Germany for children in the younger age group. This might be explained by the fact that child care facilities are willing to take more than one child per slot. For children in the older age group, the marginal supply probabilities are below the official availability ratios, which might be evidence for regional mismatch. In addition, it has to be considered that the standard errors of the estimates might lead to confidence intervals that overlap with the official availability ratios.

Table 5: Marginal probabilities of demand for and offer of child care slots

"Bundesländer"	*Age group 0 - <3*			*Age group 3-6*		
	P(Demand=1)	**P(Offer=1)**	***availability ratio****	**P(Demand=1)**	**P(Offer=1)**	***availability ratio****
Berlin	0.84	0.34	*0,36*	0.94	0.94	*0,94*
Schleswig-Holstein	0.51	0.09	*0,03*	0.79	0.87	*0,96*
Lower Saxony	0.45	0.07	*0,02*	0.76	0.85	*0,94*
Hamburg, Bremen	0.43	0.09	*0,13*	0.78	0.78	*0,82*
Northrhine-Westfalia	0.68	0.05	*0,02*	0.88	0.82	*0,91*
Rhineland-Palatinate, Hesse, Saarland	0.68	0.06	*0,03*	0.90	0.90	*1,16*
Baden-Wuerttemberg	0.73	0.06	*0,02*	0.92	0.92	*1,06*
Bavaria	0.63	0.04	*0,03*	0.87	0.83	*1,02*
Mecklenburg-Western Pomerania, Brandenburg	0.85	0.40	*0,32*	0.94	0.98	*1,10*
Saxony	0.86	0.27	*0,29*	0.96	0.97	*1,20*
Saxony-Anhalt, Thuringia	0.83	0.33	*0,35*	0.96	0.98	*1,36*

* Availability ratio: Official number of child care slots per child as reported by Deutsches Jugendinstitut.

The joint probability that parents demand child care for a child but are not offered a slot gives the individual probability of being rationed. These probabilities are presented in Table 6 by age group and region. In the younger age group, for those who are demanding a child care slot, the probability that they will not be offered one, is high in all regions. Comparing these results to the results presented in Table 5 above, it becomes evident that in the Laender of east Germany, excess demand is high since demand is well above the national average, whereas in west Germany, excess demand is high because the supply probabilities are very low. The probability of being rationed is much lower for children in the older age group. Considerable excess demand in this age group seems to be existent only in a few regions like Hamburg and Bremen, Northrhine-Westfalia and Bavaria. While for Hamburg and Bremen, this result can be explained by the below-average availability of slots (see Table 5), the result is more surprising for Bavaria and Northrhine-Westfalia. However, it might be explained by regional mismatch of demand and supply of subsidized child care slots.

Table 6: Probability of being rationed, by age group and regions as well as working status of the mother

"Bundesländer"	*Age group 0 - <3*	*Age group 3-6*
Berlin	0.58	0.06
Schleswig-Holstein	0.49	0.09
Lower Saxony	0.45	0.10
Hamburg, Bremen	0.45	0.16
Nordrhine-Westfalia	0.62	0.15
Rhineland-Palatinate, Hesse, Saarland	0.65	0.08
Baden-Wuerttemberg	0.67	0.07
Bavaria	0.62	0.14
Mecklenburg-Western Pomerania, Brandenburg	0.51	0.02
Saxony	0.63	0.03
Saxony-Anhalt, Thuringia	0.56	0.01
Children with full-time or part-time working mothers		
east Germany	0.49	0.02
west Germany	0.64	0.11
Children with non-working mothers		
east Germany	0.61	0.03
west Germany	0.60	0.11

Table 6 also shows the probabilities of being rationed by employment status of the mother. This might be an interesting information for the current political debate in Germany, since the government plans to draft a law that would require the communities to provide child care slots for all children with working parents or parents who wish to work (see section 1). For chil-

dren in the younger age group, excess demand for child care is large – up to 64 percent – even when only the sample of children with working mothers is considered. In east Germany, this number is lower (49 percent), which is due to the higher availability of child care facilities. However, these numbers have to be seen as an upper bound for the excess demand for subsidized child care of children with working mothers, because in Germany, facilities usually favor children with working mothers. However, since the decision about child care and labor supply is made simultaneously, working hours of the mother cannot be used as an explanatory variable in an estimation of child care demand. Rather, a model that jointly estimates child care and labor supply choices would be needed. This is left for future research.

The total size of the queue for child care slots in numbers of children can be calculated using the GSOEP weighting factors. As can be seen in Table 7, in total parents of more than 1.2 million children up to the age of three years demand subsidizec child care but are not offered a slot. This means that for more than half of all children in this age group (about 2.1 million according to the GSOEP), there is no child care slot although parents would demand one. On first sight, this seems to be a large number, compared to the figures on attitudes towards child care and maternal employment presented in section 1. However, the demand for child care estimated in this paper includes part-time as well as full-time child care. It might be plausible that a large number of the parents queuing for child care slots only wish to have their child in part-time care.

Among the children in the older age group, excess demand is much lower. In all regions of Germany, less than 300 thousand children aged 3 to 6 are queuing for a child care slot. In both age groups the majority of children who are not offered a child care slot live in west Germany.

Table 7: Number of children queuing for child care

"Bundesländer"	*Age group 0 - <3*	*Age group 3-6*
Berlin	36,000	5,0
Schleswig-Holstein	24,000	8,0
Lower Saxony	130,000	28,00
Hamburg, Bremen	22,000	9,0
Nordrhine-Westfalia	277,000	86,00
Rhineland-Palatinate, Hesse, Saarland	207,000	45,00
Baden-Wuerttemberg	208,000	28,00
Bavaria	180,000	64,00
Mecklenburg-Western Pomerania, Brandenburg	38,000	2,0
Saxony	67,000	3,0
Saxony-Anhalt, Thuringia	69,000	1,0
Sum	**1 260,000**	**279,00**

As already mentioned in the introduction, the German government is currently proposing a draft law on the expansion of subsidized child care for children up to the age of three. The idea is to provide sufficient child care slots for all children whose parents are both working or wish to work. The draft law states that until the year 2010, additional 230,000 child care slots shall be provided[16]. As shown in Table 8, the estimation results of my analysis show that about 255,000 children up to three years with working mothers are queuing for a child care slot.

In order to calculate the total amount of additional places required to fulfill the claim of the law, the number of children whose mothers are currently not employed but wish to work, must be added. This number can be obtained by combining the estimation results presented above with information on employment intentions from the GSOEP[17]. Table 8 also lists the number of children queuing for a child care slot, whose mothers are not working but wish to work in the near future. For the group of children whose mothers state that they intend to start working "as soon as possible", about 35,000 children are queuing for slots. Adding the number of this definition to the 255,000 children with working mothers queuing for slots, this estimated number is higher than the "educated guess" by governmental experts of 230,000 additional child care slots. Further, it is unclear if the draft law also intends to provide child care slots for mothers who are engaged in marginal employment. If this were the case, another 128,000 child care slots would be needed.

Table 8: Number of children under 3 years queuing for subsidized child care, by employment status / intention of the mother (rounded to the nearest thousand)

	east Germany	*west Germany*
Mother working full-time or part-time	61,000	194,000
Mother in marginal employment	6,000	122,000
Mother intends to start working "as soon as possible" *	6,000	29,000
Mother intends to start working "next year" *	53,000	122,000
Mother in none of the above categories	84,000	583,000

* Only those mothers were considered who answerd *"Yes, definitely"* to the question *"Do you intend to engage in paid employment (again) in the future?"*

[16] See *Gesetz zum qualitätsorientierten und bedarfsgerechten Ausbau der Tagesbetreuung und zur Weiterentwicklung der Kinder- und Jugendhilfe – (Tagesbetreuungsausbaugesetz TAG)* .Source: see footnote 3, page 3.

[17] In the GSOEP questionnaire, non-working persons are asked *"Do you intend to engage in paid employment (again) in the future?"*. The possible answer categories to this questions are *"No, definitely not", "Probably not", "Probably"* and *"Yes, definitely"*. After that, people are asked "*When, approximately, would you like to start with paid employment?"*, and the possible answers are *"As soon as possible", "Next year", "In the next two to five years"* and *"In the distant future, in more than five years"*.

It should be mentioned, however, that it is difficult to interpret the numbers resulting from these GSOEP questions on future work intentions appropriately. Since these questions do not explicitly ask employment intentions in the case that access to subsidized child care is guaranteed, it may be the case that women report that they do not wish to start employment as soon as possible because they know that subsidized child care is not available for them. These numbers have therefore to be seen as a lower bound for the number of mothers who wish to work in case that child care would be provided at the subsidized fee. In order to estimate the labor supply responses that would result from a policy reform of a substantial expansion of subsidized child care slots, a microsimulation model as in Wrohlich (2004) can be used. For the moment, this question is left for future research.

7 Summary and Conclusion

In this paper, I estimated the excess demand for public child care on the basis of a partial observability model as introduced by Abowd and Farber (1982). Estimation results show that among children aged up to three years, more than 50 percent are queuing for child care, i.e. their parents demand a child care slot but they are not chosen from the queue. This problem is relevant in both west than east Germany. Availability of child care is much higher in east Germany, however, also the demand for child care is higher in these regions. For children above three and under seven years, excess demand for child care is far less of a problem than for children of the younger age group. Still, about 300 thousand children in this age group are not offered a child care slot although their parents would want them to be in child care.

These results are relevant to the current political debate, since the federal government recently presented a draft law that intends to expand subsidized child care for all children up to three years in the case that both parents are working or wish to work. The government stated that for the implementation of this law, about 230,000 additional child care slots are needed. As the results of my estimation show, about 255,000 children in the queue have working mothers. Another 35,000 children have mothers who are not yet employed but wish to work as soon as possible. This implies that the number of additional child care slots that are planned to be subsidized until the year 2010 comes close to the needs calculated on the basis of the estimations in this analysis, as long as children with working mothers are considered. If also child care slots for children with mothers who wish to work in the near future shall be subsidized, the number of additional child care slots would have to be increased by another 35,000 slots.

References

ABOWD, John M. and Henry S. FARBER (1982): Job Queues and the Union Status of Workers, *Industrial and Labor Relations Review* Vol. 35/3: 354-367.

BMFSFJ (German Ministry for Families, Seniors, Women and Youth) (ed.) (2003): *Die Familie im Spiegel der amtlichen Statistik*. Berlin.

BÜCHEL, Felix and C. Katharina SPIEß (2002): Form der Kinderbetreuung und Arbeitsmarktverhalten von Müttern in West- und Ostdeutschland. *Schriftenreihe des BMFSFJ, Vol. 220.* Kohlhammer: Stuttgart.

BUNDESAMT FÜR BAUWESEN UND RAUMORDNUNG (2002): *Aktuelle Daten zur Entwicklung der Städte, Kreise und Gemeinden.* Bonn.

CHEVALIER, Arnaud and Tarja VIITANEN (2004): The Supply of Childcare in Britain: Do Mothers Queue for Childcare? *Mimeo*.

CHONÉ, Philippe, David LE BLANC and Isabelle ROBERT-BOBÉE (2003): Female Labor Supply and Child Care in France. CESifo Working Paper No. 1059.

DEL BOCA, Daniela, Marilena LOCATELLI and Daniela VURI (2004): Child Care Choices by Italian Households, IZA Discussion Paper No. 983.

DJI (Deutsches Jugendinstitut) (2002): *Zahlenspiegel. Daten zu Tageseinrichtungen für Kinder.* München.

HAAN, Peter, Viktor STEINER and Katharina WROHLICH (2005): Dokumentation des Steuer-Transfer-Mikrosimulationsmodells 1999-2002. Mimeo.

JOESCH, Jutta M. and Bridget G. HIEDEMANN (2002): The demand for nonrelative child care among families with infants and toddlers: A double-hurdle approach, *Journal of Population Economics* Vol. 15: 495-526.

JURCZYK, Karin, Thomas RAUSCHENBACH and Wolfgang TIETZE (ed) (2004): *Von der Tagespflege zur Familientagesbetreuung. Zur Zukunft öffentlich regulierter Kinderbetreuung in Privathaushalten*. Beltz:Weinheim and Basel.

KORNSTAD, Tom and Thor O. THORENSEN (2002): A Discrete Choice Model for Labor Supply and Child Care. Statistics Norway Discussion Paper No. 315.

KREYENFELD, Michaela and Karsten HANK (2000): Does the availability of child care influence the employment of mothers? Findings from western Germany, *Population Research and Policy Review* Vol. 19: 317-337.

LOKSHIN, Michael (2004): Household Childcare Choices and Women's Work Behavior in Russia, *The Journal of Human Resources* Vol. 39/4: 1094-1115.

MADDALA, G. (1983): *Limited Dependent and Qualitative Variables in Econometrics*. New York: Cambridge University Press.

MEDIA-FORSCHUNG UND –SERVICE (2004): Mehr Kinder. Mehr Leben. Ergebnisse der repräsentativen Forsa-Befragung. Mimeo.

MERKLE, Lucie E. (1994): *Frauenerwerbstätigkeit und Kinderbetreuung. Eine theoretische und empirische Analyse für die Bundesrepublik Deutschland*. Physica-Verlag: Heidelberg.

ONDRICH, Jan and C. Katharina SPIEß (1998): Care of Children in a Low Fertility Setting: Transitions between Home and Market Care for Pre-School Children in Germany, *Population Studies*, Vol. 52/1: 35-48.

POIRIER, Dale J. (1980) : Partial Observability in Bivariate Probit Models, *Journal of Econometrics* Vol. 12: 209-217.

SPIEß, C. Katharina (1998): *Staatliche Eingriffe in Märkte für Kinderbetreuung. Theorie und Empirie im deutsch-amerikanischen Vergleich*. Campus-Verlag: Frankfurt and New York.

SPIEß, C. Katharina and Felix BÜCHEL (2003): Effekte der regionalen Kindergarteninfrastruktur auf das Arbeitsangebot von Müttern, in: Schmähl, W. (ed.): Soziale Sicherung und Arbeitsmarkt. *Schriften des Vereins für Socialpolitik*, Vol. 294. Duncker&Humblot: Berlin.

WROHLICH, Katharina (2004): Child Care Costs and Mothers' Labor Supply: An Empirical Analysis for Germany. *DIW Discussion Paper* No. 412, Berlin.

Appendix

Definition of the spatial structure type variable

Type 1	key cities in region type 1
Type 2	counties of very high population density in region type 1
Type 3	counties of high population density in region type 1
Type 4	counties in rural areas in region type 1
Type 5	key cities in region type 2
Type 6	counties of high population density in region type 2
Type 7	rural counties in region type 2
Type 8	counties in rural areas with higher population density (region type 3)
Type 9	counties in rural areas with lower population density (region type 3)

Region Type 1: Agglomerations with high density
Region Type 2: Urban areas
Region Type 3: Rural areas

Source: Bundesamt für Bauwesen und Raumordnung (2002).