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AN EMPIRICAL ANALYSIS OF THE DETERMINANTS OF CHILD CARE ARRANGEMENTS IN THE NETHERLANDS

by

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Abstract

In this paper we analyze the choice between different child care facilities. The emphasis is on careful modelling of the structure of decisions on child care arrangements. Further, we determine the price and income effects of the child care decisions.

The empirical results show that the choice between whether or not to use child care, and the specific child care arrangement chosen are sequential decisions: conditional upon an affirmative decision to use child care, the decision on the specific arrangement is being made. The decision between nursery school and other child care arrangement also has to be modelled as a sequential decision. The choice between day care centre, babysitter at her home and babysitter at child's home is taken simultaneously. We further find that a model with a different intercept for working and non-working women does not perform significantly worse than a model with separate coefficients for working and non-working women.

The empirical results further show a highly significant negative price effect on the choice whether or not to use child care. However, prices do not significantly determine the specific arrangement chosen. We also find a positive income effect on the decision to use child care. Again, income does not matter in the choice on the specific arrangements.

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1. Introduction[1]

During the first years of parenthood young mothers (and probably young fathers as well) face the question what to do with their children if both parents want to go out to work, or if they want to develop the child's attitude of getting along with peers, or if they want to enjoy leisure, or if they have educational purposes which they can not fulfil themselves. Children older than four years are taken care of by infant schools. For younger children parents have to look for other arrangements. Possible forms are: babysitter (either in the home of the babysitter or of the child), relatives, nursery school, day care center and own care. Of course these different forms have different characteristics and vary both in their impact on the development of the children and their price.

Since most (and probably all) parents care about the well-being of their offspring, it can be assumed that child care facilities are chosen with great caution. Moreover the choice of child care is accompanied by the allocation of large shares of the household's time and financial budgets. For these reasons it is interesting to analyse both the structure and the determinants of the decision for a particular form of child care arrangement. An additional reason for economists to study this choice problem is that the option of own care taking is closely related to participation in the labor market. In spite of this, interest of the economic profession in the issue of child care facilities has been rather limited. Exceptions are the studies by Lehrer (1989) and Gustafsson & Stafford (1990).

Lehrer (1989) analyses the determinants of child care arrangements for children in the pre-school age with a working mother in the United States. Lehrer's main concern is the quality of child care arrangements. Therefore, she addresses two related questions. First whether increases in the household's economic resources raises the probability of using day care center for pre-schoolers as opposed to more informal, less professional, forms of care (babysitters and relatives). Second whether there is a trade-off between quantity and quality of care arrangements; do parents who have more preschool children to look after, have a lower probability to choose day care centers? The results reported by Lehrer indicate that higher wealth increases the probability that a day care center or a babysitter in child's home is chosen, and that a trade-off between quality and quantity indeed exists.

In their study of daycare subsidies and labor supply in Sweden, Gustaffson & Stafford (1990) present the results of two different analyses. Firstly, they analyze the joint decision to use care and

[1] We would like to thank Gusta Renes for her helpfull comments on an earlier draft of this paper.

to participate in the labor market. Secondly, they analyze the decision whether or not to use child care.

The major defect of both studies mentioned here is that the authors simply postulate a particular decision structure, without taking other possibilities into account. Lehrer estimates a multinomial logit model in which the options are: day care center, babysitter at babysitter's home, babysitter at child's home and care by relative. The multinomial logit structure implies a simultaneous decision structure; all options are considered at the same moment. One alternative structure is that first the options day care center, babysitter and care by relatives are considered, and in a second stage those who prefer the babysitter-option choose between babysitter at own home and at babysitter's home. The results of this sequential model may differ considerably from those obtained with the multinomial model. The reason being the inapproriateness of the Independence of Irrelevant Alternatives-assumption in the multinomial model. Moreover, reducing the sample to working mothers presumes that the decision to participate in the labor market precedes the child care decision. This conjecture might be correct, but it should be tested.

Gustafsson & Stafford estimate two different (binomial) logit models. In the first model the two outcomes are either 'use day care and participate' or 'not use day care and/or don't participate'. In the second model the choice is between 'using day care' and 'not using day care'. The first model implicitly assumes a sequential decision structure in which the first stage is the choice between 'participation and use of day care' versus 'no day care use and/or no participation'. In the second stage the choice is between 'participation/no care use', 'no participation/care use' and 'no participation/no care use'. The sequential structure implies that the differences between these latter three options play no role in the first stage. In the second model the choice is between 'care use' and 'no care use'. This choice is taken independent of the participation decision. This implies either a sequential structure in which the choice between care and no care is the first stage and the choice between participation and non-participation the second, or a structure with two independent dichotomous decisions. Obviously the two different models estimated by Gustafsson & Stafford are mutually exclusive. Possibly one of the models describes the true decision structure, but then the other model is incorrect. But since Gustafsson & Stafford do not investigate the decision structure the reader does not know which, if any, model is the correct one.

In Groot, Maassen van den Brink & Oosterbeek (1991), we analyzed the relation between the decisions to participate in the labor market or not, and to use child care or not. The results indicate that a sequential structure in which the decision maker first chooses whether to participate or not, and then whether to use child care or not, gives the best description of the data. For the Dutch situation this result is somewhat surprising as it is often thought that the low labor force participation rate of

women in the Netherlands is caused by a shortage of child care facilities. Our results provide no support for this view. Another indication that this view is erroneous is the fact that in recent years the growth of married women's labor force partipation exceeds the growth of the supply of care facilities.

In this paper we analyze the choice between different child care facilities. Ideally, we should take into account our previous findings and assume that women first decide whether to participate, and then decide which child care mode they prefer. For the empirical analysis this would imply that we analyze the child care choice separately for working and non-working mothers. However, analyzing the child care choice separately for working and non-working women yields too few observations to draw any statistically significant conclusions. Therefore, we test whether we may ignore the distinction between working and non-working women in their child care choice in this paper.

In Section 2 we present our own model which differs from the model discussed above not only by letting the data determine the decision structure and not imposing an arbitrairy decision structure in advance, but also by taking into account the prices of the different care modes. By using a data set of both working and non-working women, we implicitly assume that the determinants of child care choice do not differ between working and non-working women. In section 4 we show whether this assumption is tenable. Section 3 contains a description of the data, in Section 4 we present the empirical findings. Section 5 concludes.

2. The model

Each woman in the sample is confronted with five options: 1. to use nursery school, 2. use a day care center, 3. to take a babysitter in babysitter's home, 4. to take a babysitter in child's home, or 5. not to use child care arrangements. Let $V_i(p_i, y; x)$ be the indirect utility function of choosing option i ($i = 1,2,3,4,5$), where p_i is the price of the child care arrangement, y is income, and x is a vector of taste shifters. We assume that the indirect utility function is linear in prices p, income y and individual characteristics x:

$$V_i = p_i\gamma + y\alpha_i + x\beta_i + u_i \qquad (1)$$

where γ, α_i and β_i are parameters and u_i is a random term. We assume that u_i are indentically and independently Gumbel distributed.

The price of not using child care arrangements is given by the value of the woman's time devoted to child care, i.e. the woman's expected own net wage rate. The prices of the child care arrangements are market prices. The price of choosing alternative i, p_i, is a choice specific variable varying over choices with a choice-independent parameter γ. Income y and values of the individual specific variables x do vary not over choices, the associated parameters a_i and β_i, however, do. If $\gamma = 0$ the coefficients yield the probability that an individual will choose one of the five alternatives, given her income y and characteristics x. If $a_j = \beta_j = 0$ (j = 1,2,3,4,5) the coefficient of this model, γ, yields the relative valuation of the price of alternative i, p_i.

One way of modelling the woman's decision process on child care arrangements is to assume that alternative i is chosen if and only if this alternative provides the highest utility:

$$V_i > \max V_j \qquad i,j = 1,2,3,4,5 \qquad \text{and } i \neq j \tag{2}$$

This specification of preferences yields the multinomial logit model. In the multinomial logit model women decide simultaneously on whether or not to use child care arrangements and on the type of child care arrangements used. In this model the alternative to using a specific type of child care arrangement is not to use child care at all. As is well-known, the validity of the results of the multinomial logit model crucially depends on this Independence of Irrelevant Alternatives (IIA) assumption. If this assumption does not hold, the estimated coefficients can be quite misleading (for an example cf. Van den Berg and Groot 1990).

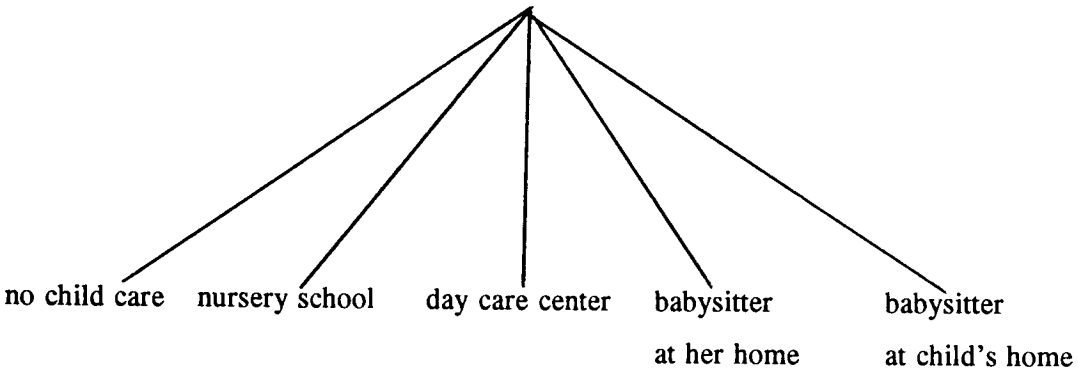
In this paper we test the simultaneous decision model against sequential decision models. Various sequential decision making models are conceivable. The most obvious is the one in which the woman first decides whether or not to take child care, and, if the answer to this question is affirmative, decides which type of child care to use. In this model other types of child care arrangements serve as an alternative to the one actually chosen, if one decides to use child care.

A more general structure of decision making is obtained in a model in which the possibility is allowed that the woman decides over every child care mode separately. In this general model, the woman first decides whether or not to use child care. If the answer to this is affirmative, she decides whether she will use nursery school or one of the other child care arrangements. If she decides not to use nursery school but one of the other arrangements, she has to decide whether to use day care center, or a babysitter. If she decides to use a babysitter, she finally has to decide whether to use a babysitter at her home or a babysitter at the child's home. In figure 2.1 the decision trees of the two models described - the simultaneous model and the sequential model - are presented.

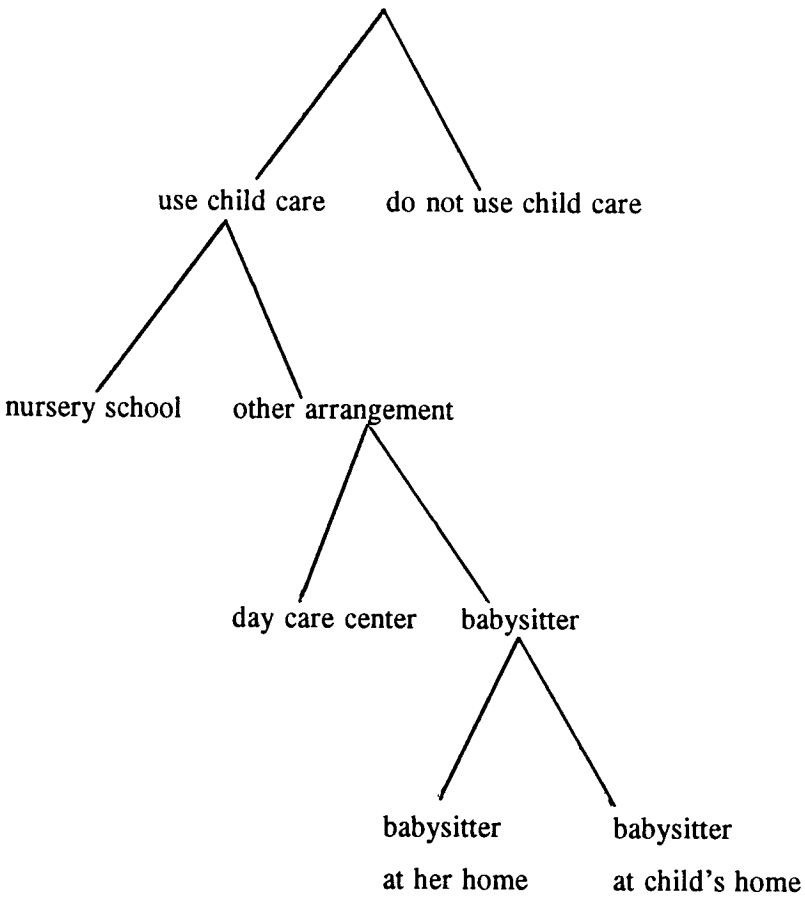
Figure 1.1.

Decision structures

Simultaneous model



Sequential model



To test these and other alternative models we develop a nested model in which both sequential and simultaneous decision making processes are special cases. A description of this nested model can be found in Maddala (1983, p. 67-70). For a description of the Wald test, see Schram and Van Ophem (1989). As the sequential model in which the woman decides over each child care mode separately is the most general specification, we will restrict our description to this model.

Let P_i be the probability of using child care at all, $P_{j|i=1}$ the probability of using a nursery school given that one uses child care ($i = 1$), $P_{k|i=1,j=0}$ the probability of using a day care center given that one uses child care ($i = 1$) but does not use nursery school ($j = 0$), and $P_{l|i=1,j=k=0}$ the probabilty of using a babysitter at her home given that one uses child care ($i = 1$) but does not use nursery school or day care center ($j = k = 0$). The joint probabilities P_{ijk} and P_{ijkl} can then be written as:

$$P_{ijk} = P_{k|i=1,j=0} * P_{j|i=1} * P_i \qquad (3.3.a.)$$

and

$$P_{ijkl} = P_{l|i=1,j=k=0} * P_{k|i=1,j=0} * P_{j|i=1} * P_i \qquad (3.3.b.)$$

Let W be a vector of observable characteristics[2]. If π_1 is a vector of parameters determining the decision to use child care, π_2 is a parameter vector determining the choice between nursery school and other child care arrangements, π_3 is a parameter vector determing the choice between day care center and babysitter, and π_4 vectors of parameters determining the choice between a babysitter at her home and a babysitter at the child's home, the conditional probability $P_{l|i=1,j=k=0}$ can be written in the logistic form as:

$$P_{l|i=1,j=k=0} = \exp(W\pi_4)/(1 + \exp(W\pi_4)) \qquad (3.4.)$$

To test the alternative models we define the so-called 'inclusive value' as (cf. Maddala 1983, p. 69):

$$I_1 = \log(1 + \exp(W\pi_4)) \qquad (3.5.)$$

The conditional probability to use either nursery school or a babysitter can now be written as:

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[2] Prices are excluded from this vector of exogeneous variables.

$$P_{k|i=1,j=0} = \exp(W\pi_3 - I_1)/(1 + \exp(W\pi_3) - I_1) \quad (3.6.)$$

A more general framework is obtained by allowing the inclusive values to have a coefficient σ_1 other than 0. The nested model is defined by:

$$P_{k|i=1,j=0} = \exp(W\pi_3 - (1 - \sigma_1)I_1)/(1 + \exp(W\pi_3 - (1 - \sigma_1)I_1) \quad (3.7.)$$

where σ_1 is a parameter. From (3.7.) it can be seen that if $\sigma_1 = 0$ the model becomes a multinomial model in which the woman decides jointly between nursery school, babysitter at her home, and babysitter at child's home. If $\sigma_1 = 1$, the woman decides separately over the type of babysitter (i.e. babysitter at her home or babysitter at child's home).

From (3.7.) we can again define a new set of inclusive values I_2 as:

$$I_2 = \log(1 + \exp(W\pi_3 - (1 - \sigma_1)I_1) \quad (3.8.)$$

Then choice between nursery school and other child care arrangements in the nested logit model is defined by:

$$P_{j|i=1} = \exp(W\pi_2 - (1 - \sigma_2)I_2)/(1 + \exp(W\pi_2 - (1 - \sigma_2)I_2) \quad (3.9.)$$

where σ_2 is again a parameter, which indicates whether the decision to use nursery school or to use one of the other child care arrangements are taken separately ($\sigma_2 = 1$) or jointly ($\sigma_2 = 0$).

Finally, from the estimates in (3.9.) we can calculate inclusive values to include in the equation of the choice whether or not to use child care at all, as:

$$I_3 = \log(1 + \exp(W\pi_2 - (1 - \sigma_2)I_2) \quad (3.10.)$$

The probability to use child care P_i becomes:

$$P_i = \exp(W\pi_1 - (1 - \sigma_3)I_3)/(1 + \exp(W\pi_1 - (1 - \sigma_3)I_3)) \quad (3.11.)$$

The nested model can be estimated by first estimating the parameters π_4 from the conditional-choice equation (3.4.), then to calculate the inclusive values I_1. With these inclusive values the coefficients

of the choice between day care center and babysitter, equation (3.7.), are estimated. These estimates are used to construct the inclusive values I_2. In the next step the coefficients π_2 and σ_2 are estimated from (3.9.). Again, inclusive values are calculated (I_3). These inclusive values are inserted in equation (3.10.), allowing us to estimate π_1 and σ_3.

With the estimates of σ_1, σ_2 and σ_3 the structure of the decision process can be determined. For example, if a test on $\sigma_1 = \sigma_2 = \sigma_3 = 1$ is rejected and a test on $\sigma_1 = \sigma_2 = \sigma_3 = 0$ can not be rejected the multinomial logit model of simultaneous decision making is supported. Alternatively, if a test on $\sigma_1 = \sigma_2 = \sigma_3 = 0$ is rejected and a test on $\sigma_1 = \sigma_2 = \sigma_3 = 1$ can not be rejected the sequential specification of modelling preferences over child care arrangements is the preferred one.

3. The data

The data are taken from the Dutch Supplementary Provision Survey 1987 (Aanvullend Voorzieningengebruik Onderzoek 1987). From this data set we have taken a sub-sample of women with children aged below four in 1987. Only the first child in this age bracket is used in the analysis. After discarding observations for which essential information could not be retrieved, 672 observations are used in the analysis.

In Table 3.1. the frequency distribution of child-care use is given. Table 3.1. shows that less than 40% of the women with children aged below four make use of child care arrangements. Nursery school is the most frequently used arrangement.

Table 3.1. Frequency distribution child care use

	Number	Percentage
No child care use	393	58.5
Nursery school	165	24.6
Day care centre	29	4.3
Babysitter, her home	34	5.1
Babysitter, child home	51	7.6

Child care choice is expected to be governed by prices, income and preferences. Prices are choice dependent; income is an individual specific variable.If child care use is a non-giffen good, price

theory predicts that the own price effect of child care use is negative: higher prices of a child care arrangement decrease the use of that arrangement. If child care arrangements are substitutes the cross price effects will be positive: higher prices for one arrangement increase the use of another arrangement. Income is defined as net labor income of the partner (Income partner)[3]. Assuming that child care arrangements are a normal good, we may expect a positive income effect: a higher income increases the probability of child care use.

Taste differences are captured by a number of individual characteristics. The exogeneous variables in the model include a dummy variables indicating whether the woman is living in the western, urbanized part of the country (Province), whether she is of any religious conviction (Church), and whether she is married (Married)[4]. Also a dummy variable is included indicating whether other children in the household make use of child care arrangements (Other children). We further controlled for education (Years of education) and age of the mother, and the age of the child.

We have also included some variables for the supply of child care arrangements. Unfortunately the data set lacks direct information on the supply of child care facilities. Therefore, we have used two proxy variables: the degree of urbanization and a dummy variable indicating whether the woman thinks there are child care facilities in the neighbourhood (Facilities). We assume that in highly urbanized areas the supply of child care arrangements is larger. The variable 'Facilities' serves as the woman's own perception of the supply of child care facilties.

In table 3.2. the means and standard deviations of the explanatory variables are given.

The expected prices are calculated from price equations[5]. The value of the time the woman herself spends on child care is defined by the opportunity costs, i.e. by the woman's predicted net wage rate. The predicted wage rate is calculated by a wage equation[6]. From the data it emerges that the time the woman herself spends on child care is the most expensive. Of the purchased child care a babysitter at the child's home is the most expensive.

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[3] Unlike Lehrer (1989) we have not included the women's income or hours of work since hours of work of the woman is a endogeneous variable.

[4] Unless stated otherwise, the dummy variables are coded 1 = yes and 0 = no.

[5] A description of the estimated price equations is available from the authors on request.

[6] A description of the wage equation is available from the authors on request.

Table 3.2. Means and standard deviations explanatory variables

	Mean	Standard deviation
Expected wage rate	7.97	1.59
Expected price nursery school	2.07	0.66
Expected price day care centre	2.61	2.01
Expected price babysitter her home	1.77	1.29
Expected price babysitter child home	6.98	6.61
Expected price child care arrangement	3.27	1.46
Province	0.45	
Church	0.65	
Married	0.88	
Other children	0.05	
Facilities	0.85	
Years of education	12.44	3.71
Urbanization	7.98	2.94
Age mother	29.33	5.14
Age child	1.69	1.10
Income partner	262.30	278.93

4. Empirical findings

4.1. Determining the decision structure

Before discussing the empirical findings, we first determine the structure of the child care arrangement choice. The choice of the best fitting model is governed by the Leamer (1978) - Schwartz (1978) criterion[7]. The Leamer-Schwartz criterion places a penalty on the number of parameters in the model.

In table 4.1. the coefficients of the inclusive values (σ) and the values of the Leamer-Schwartz criterion are presented[8]. The first two columns contain the values of σ and the Leamer-Schwartz criterion for the choice between day care center and babysitter; the next two columns contain the values for the choice between nursery school and other child care arrangements, and in the final two columns the values for the choice whether or not to use child care are given.

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[7] The Leamer (1978) - Schwartz (1978) criterion minimizes: Loglikelihood value + log(n/2)#number of parameters, where n is the sample size (cf. Heckman and Walker 1990 for further details).

[8] The full estimation results are available from the authors on request.

In the first specification no restrictions are placed on the σ. From the coefficient of σ_1 and its standard errors it emerges that neither the sequential specification nor the simultaneous model can be rejected: neither a test on $\sigma_1 = 1$ or a test on $\sigma_1 = 0$ can be rejected. The same holds for the estimate and standard error of σ_2. For σ_3 the opposite holds: here a Wald test suggests that we both have to reject $\sigma_3 = 0$, and $\sigma_3 = 1$. So, the data do not unequivocally show that either the sequential model or the simultaneous model is the correct one. Since the test results are inconclusive, we use a goodness-of-fit criterion to determine the best fitting model.

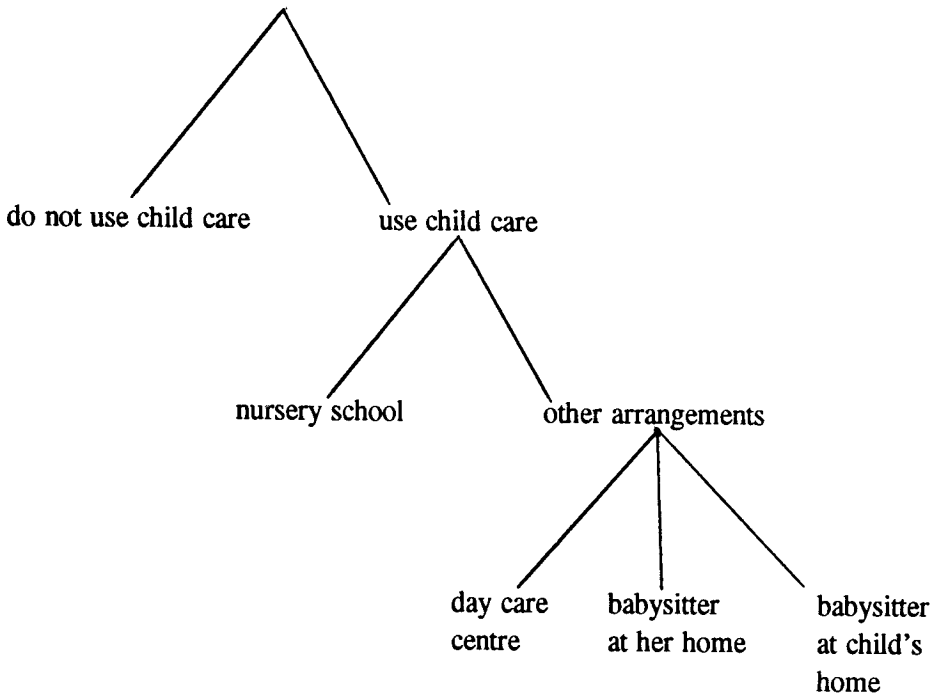
We imposed restrictions on σ in order to determine the best fitting model. For example, in specification 2 we imposed the restriction that the decision structure is fully sequential ($\sigma_1 = \sigma_2 = \sigma_3 = 1$). These restrictions coincide with the graphical representation in figure 3.1.. Alternatively, in specification 9 it is assumed that the nature of the decision structure is fully simultaneous ($\sigma_1 = \sigma_2 = \sigma_3 = 0$). As specification 2 to 9 are non-nested models we use a goodness of fit measure (the Leamer-Schwarz criterion) for distinguishing between the models.

Table 4.1. Coefficients inclusive values (standard errors in brackets) and value Leamer (1978)-Schwartz (1978) criterium

	day care center versus babysitter		nursery school versus other arrangements		use child care or not	
	σ_1	Leamer-Schwartz criterium	σ_2	LeamerSchwartz criterium	σ_3	Leamer-Schwartz criterium
1.	0.315 (2.697)	49.095	1.298 (0.911)	106.813	1.734 (0.228)	350.682
2.	1	49.138	1	106.871	1	355.934
3.	1	49.138	1	106.871	0	380.085
4.	0	49.104	1	106.871	1	355.934
5.	0	49.104	1	106.871	0	380.085
6.	1	49.138	0	108.239	1	355.934
7.	1	49.138	0	108.239	0	388.028
8.	0	49.138	0	107.901	1	355.934
9.	0	49.104	0	107.901	0	386.955

The Leamer-Schwartz criterion suggests that the specifications in which $\sigma_1 = 0$ yields the best fitting model for the choice between day care center and babysitter. The best fitting model for the choice between nursery school and other child care arrangements is the one in which $\sigma_2 = 1$, while in the choice whether or not to use child care $\sigma_3 = 1$ gives the best fit of the data.So, imposing the restrictions $\sigma_1 = 0$ and $\sigma_2 = \sigma_3 = 1$ gives the best fit of the data[9]. This amounts to a decision structure in which the woman first chooses whether or not to use child care. Conditional on the outcome of this decision being affirmative, she chooses between nursery school and other child care arrangements. This distinction between using nursery school on the one hand and using one of the other arrangements on the other hand is probably due to the fact that nursery schools are for children aged two and a half or older only. Finally, if the woman chooses for another child care arrangement, she simultaneously decides between day care center, babysitter at her home and babysitter at the child's home. In figure 4.1. this decision structure is drawn.

Figure 4.1. The decision structure of child care use: preferred model



We will base the discussion of our findings on this decision structure.

[9] This is given that we want to restrict the coefficients σ to either 0 or 1. See Van Ophem and Schram (1991) for an interpretation of values of σ between 0 and 1.

Before we turn to interpretating the findings, we test whether it is justifiable to estimate the child care choice model on a sample of both working and non-working women instead of estimating the model for both groups separately. In our companion paper (Groot, Maassen van den Brink, Oosterbeek 1991) our goodness of fit measure showed that women first decide whether or not to participate in the labor market, and that they take their child care use and mode decisions conditional upon the outcome of the participation decision. To test whether the coefficients of the child care equation for working women equal those of the non-working women, we use a likelihood ratio test.

Let L_{tot} be the value of the loglikelihood function of the choice between using child care and not using child care for the total sample of working and non-working women; L_w is the value of the loglikelihood function if the equation is estimated on the sample of working women only, while L_{nw} is the loglikelihood function of estimating the choice equation on the sub-sample of non-working women. The value of the likelihood ratio test is then defined by: $2(L_w + L_{nw} - L_{tot})$. Computing the likelihood ratio test yields a value of 47.866.[10] At the 1% level the critical value of the Chi^2 distribution with twelve degrees of freedom is 26.217, implying that the imposition of the restriction that the coefficients of the child care choice equation for working women equal those of non-working women is rejected by the data.

Applying the principle of parsimony we searched for a model with as little coefficients as possible which is not rejected against the model with different coefficients for working and non-working women. Stated otherwise, we tried to find a fitting model with as many restricted coefficients as possible. It emerged that a model with a varying intercept between working and non-working model and all other variables restricted to equality could not be rejected against the model with separate coefficients for working and non-working women. The value of the Chi_2 test is 18.600, while at the 1% level the critical value with eleven degrees of freedom is 24.725.[11]. We will base our discussion of the findings on this variable intercept model.

4.2. Estimation results

The parameter estimates of the first stage of the model - the decision whether or not to use child care - are in table 4.2. The results show a highly significant negative price effect, indicating that the higher the price of a child care arrangement the less likely it becomes that that particular arrangement is used. The mean sample probability derivative with respect to the price is -0.541. This is the own

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[10] The value of the loglikelihood function for the total sample is 221.713. The loglikelihood for working women is 42.105, and for non-working women 155.665.

[11] The value of the loglikelihood of the model with separate intercepts for working and non-working women is 207.070.

price effect of child care use. It shows that a one guilder increase in the shadow price of own child care - i.e. the net wage rate of the woman - decreases the probability that the woman spends an hour of her time on child care with 54.1%.

Table 4.2. Parameter estimates: use child care vs. do not use child care (t-values in round brackets, mean sample probability derivatives in square brackets)

Price	-5.668***	
	(11.012)	[0.541]
Intercept working women	12.737***	
	(6.947)	[1.216]
Intercept non-working women	11.095***	
	(6.267)	[1.059]
Province	0.429	
	(1.597)	[0.041]
Church	-2.574***	
	(6.951)	[-0.246]
Married	-2.107***	
	(4.466)	[-0.201]
Other children	4.457***	
	(4.962)	[0.425]
Facilities	0.710*	
	(1.735)	[0.068]
Years of education	-1.780***	
	(10.324)	[-0.170]
Urbanization	-0.023	
	(0.469)	[-0.002]
Age mother	-0.857***	
	(9.982)	[-0.082]
Age child	1.036***	
	(7.633)	[0.099]
Income partner/1000	0.010***	
	(10.030)	[0.001]
Loglikelihood	207.070	
Number of observations	672	

Partner income has a highly significant and positive effect on the use of child care arrangments. The mean probability derivative is 0.001.

The probability of using child care further increases when other children in the family use child care, with the availabilty of child care arrangements and with the age of the child. In particular the variable indicating whether other children in the family use child care has a strong effect. Each year of age of the child raises the probability that child care is being used by approximately 10%.

The probability that child care arrangements are used decreases when the woman has a religious conviction or is married. It further decreases with education and age of the mother.
Each year of education decreases the probability that child care is used by 17%, while each year of age has a negative effect of approximately 8%.

The parameter estimates of the choice between nursery school and other child care arrangements are in table 4.3. Although only a few of the coefficients show a significant effect, the entire model is significant at the 5% level as shown by the likelihood ratio test. Prices and income have no significant effect. The results show that prices and income have no significant effect on the specific arrangement chosen: apparently prices and income only matter when it comes to deciding whether or not to use child care at all.

The probability that another arrangement than nursery school is chosen increases when other children in the family use child care. This is probably due to the economies of scale of a babysitter or daycare center. The probability that nursery school is used strongly increases with the age of the child: one year of age of the child increases the probability of using nursery school by 24%. The use of nursery school also increases if it is indicated that there are child care facilities in the neighbourhood.

In table 4.4. the coefficients of the choice between day care centre, babysitter at her home and babysitter at child's home are given. Again, only a few coefficients show a significant effect. The findings show that in highly urbanized areas less use is being made of babysitters. This is probably due to the higher availability of day care centres in urbanized areas.

Table 4.3. Parameter estimates: use nursery school v. use other child care arrangement (t-values in round brackets, mean sample probability derivatives in square brackets)

Price	-0.080	
	(0.268)	[0.009]
Intercept working women	5.035***	
	(2.772)	[0.582]
Intercept non-working women	4.013**	
	(2.209)	[0.464]
Province	-0.633*	
	(1.670)	[-0.073]
Church	-0.081	
	(0.640)	[-0.009]
Married	-1.049*	
	(1.837)	[-0.121]
Other children	2.195***	
	(4.036)	[0.254]
Facilities	-1.580**	
	(2.274)	[-0.183]
Years of education	-0.014	
	(0.263)	[0.002]
Urbanization	0.018	
	(0.280)	[0.002]
Age mother	0.065	
	(1.568)	[0.008]
Age child	-2.059***	
	(7.635)	[-0.238]
Income partner/1000	0.001	
	(1.103)	[0.000]
Loglikelihood	103.351	
Number of observations	279	

Table 4.4. Parameter estimates: use babysitter at her home, use babysitter at child's home v. use day care centre (t-values in round brackets, mean sample probability derivatives in square brackets)

Price	-0.048			
	(0.348)	[-0.007]		
	babysitter at her home		babysitter at child's home	
Intercept working women	6.471**		2.652	
	(2.078)	[0.853]	(0.793)	[-0.253]
Intercept non-working women	6.911**		4.184	
	(2.122)	[0.752]	(1.269)	[-0.011]
Province	-0.288		0.092	
	(0.457)	[-0.063]	(0.066)	[0.051]
Church	0.188		0.331	
	(0.233)	[-0.005]	(0.420)	[0.041]
Married	0.708		2.029	
	(0.715)	[-0.111]	(0.751)	[0.305]
Other children	-0.820		0.844	
	(0.867)	[-0.247]	(1.031)	[0.258]
Facilities	-1.158		-0.775	
	(1.220)	[-0.117]	(0.799)	[-0.012]
Years of education	0.068		0.181*	
	(0.642)	[-0.009]	(1.787)	[0.027]
Urbanization	-0.362***		-0.392***	
	(2.816)	[-0.019]	(3.125)	[-0.032]
Age mother	-0.071		-0.057	
	(0.923)	[-0.006]	(0.742)	[0.003]
Age child	-0.488		-0.630	
	(1.387)	[0.014]	(1.442)	[-0.063]
Income partner/1000	-1.253		0.244	
	(0.974)	[-0.250]	(0.101)	[0.190]
Loglikelihood	96.177			
Number of observations	114			

5. Conclusion

The aim of this paper is twofold. The first is an analysis of the structure of decisions on child care arrangements. It emerges that the choice between whether or not to use child care, and the specific child care arrangement chosen are sequential decisions: conditional upon an affirmative decision to use child care, the decision on the specific arrangement is being made. The decision between nursery school and other child care arrangement also has to be modelled as sequential decisions. The choice between day care centre, babysitter at her home and babysitter at child's home is taken simultaneously. We further found that a model with a different intercept for working and non-working women does not perform significantly worse than a model with separate coefficients for working and non-working women.

Secondly, we have determined the price and income effects of the child care decisions. The empirical results show a highly significant negative price effect on the choice whether or not to use child care. However, prices do not significantly determine the specific arrangement chosen. We also find a positive income effect on the decision to use child care. Again, income does not matter in the choice on the specific arrangements.

References

Amemiya, T. (1985),

Advanced Econometrics, Basil Blackwell Oxford

Berg, A. van den and W. Groot (1990),

'Union membership in the Netherlands: a cross sectional analysis', **Research Memorandum 9029**, Department of Economics, University of Amsterdam

Groot, W., H. Maassen van den Brink, H. Oosterbeek (1991)

'Child care use and labor force participation of women', University of Amsterdam, mimeo

Gustafsson, S. and F. Stafford (1990),

'Daycare subsidies and labor supply in Sweden', **Research Memorandum 9001**, Department of Economics, University of Amsterdam

Heckman, J. and J. Walker (1990),

'The relationship between wages and income and the timing and spacing of births: evidence from Swedish longitudinal data, **Econometrica 58**, p. 1411-1442

Lehrer, E. (1989),

'Preschoolers with working mothers: an analysis of the determinants of child care arrangements', **Journal of Population Economics 2**, p. 251-268

Leamer, E. (1978),

Specification searches, Wiley, New York

Maddala, G. (1983),

Limited-dependent and qualitative variables in econometrics, Cambridge University Press, Cambridge

Ophem, H. van and A. Schram (1991),

'Choosing between sequential and simultaneous logit models', Department of Economics, University of Amsterdam

Schram, A. and H. van Ophem (1989)

'Sequential or simultaneous logit models: a wald specification test', **Research Memorandum 89.10**, Center for Research in Public Economics, Leiden University

Schwarz, G. (1978),

'Estimating the dimension of a model', **Annals of Statistics 6**, p. 461-464

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