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by

Jutta M. Joesch
University of Washington

Bridget G. Hiedemann
Seattle University

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Jutta M. Joesch, Ph.D.

University of Washington
Box 357660
Seattle WA 98195-7660

email: joesch@u.washington.edu
voice: 206-783-7049 or 206-528-3127
fax: 206-528-3550

Bridget G. Hiedemann, Ph.D.

Seattle University
Broadway and Madison
Seattle WA 98122-4460

email: bgh@seattleu.edu
voice: 206-296-2803
fax: 206-296-2486

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ABSTRACT

Survey data indicate that many parents do not use non-parental care for their young children, even when both parents work. Previous studies of the demand for child care assumed that all parents respond to financial incentives. Since non-consumption may be the result of social, psychological or ethical considerations and unconnected with price and income levels (Pudney 1991), this assumption may not be appropriate. To assess the sensitivity of child care demand estimates to assumptions about reasons for non- consumption, we estimate the demand for non-relative care for preschoolers with double-hurdle, tobit and dominance models. The results suggest that both financial and non-financial considerations lead to zero child care consumption, that the decision to use any care differs from the decision of how many hours of care to use and that estimates vary by the child=s age.

THE DEMAND FOR NON-RELATIVE CHILD CARE AMONG PRESCHOOLERS: A DOUBLE-HURDLE APPROACH

Issues surrounding child care have captured the attention of both academics and policy makers as more women with young children have joined the labor force and as welfare reform discussions have focused on how to enable mothers to become self-sufficient. A variety of federal and state policies seek to assist families with child care by altering factors such as the price of care or family income (Hofferth & Wissoker 1992; Robins 1990). For example, the Child Care Tax Credit, the largest federal child care program in the U.S., indirectly reduces the price of care by lowering a family=s tax liability. In 1991, almost 6 million households took this tax credit, with the associated tax revenue loss estimated at $2.8 billion (Internal Revenue Service 1993). Given the scope and the cost of child care policies, understanding the implications of existing and proposed programs is essential.

Survey data indicate that a considerable number of parents do not use child care, even when both parents are employed. For example, almost 50 percent of households with a child under the age of six had not used any non-parental care for their youngest child on a regular basis in the four weeks preceding the interview conducted for the Child Health Supplement to the 1988 National Health Interview Survey. The corresponding figures are 17 percent for households with working mothers and 78 percent for households in which the mother did not work (Joesch 1998). Similar statistics are reported by Hotz and Kilburn (1992) for the same age group. In a sample of families with children under age 13, 37 percent relied exclusively on parental care (if school is not classified as a form of child care) when the mother was employed. When the mother was not employed, 70 percent of the families used only parental care (Willer et al. 1991). While previous studies of the demand for child care provide useful insights, they do not explicitly address why some young children do not receive any non-parental care. This omission may have created an inaccurate picture of child care demand.

This paper presents a microeconomic analysis of the demand for child care. Throughout the paper, child care is defined as regularly scheduled care arrangements where the care provider is not a parent or other relative of the child. Child care demand is measured in hours per week. The study differs from previous studies of the demand for child care in two respects. First, the paper presents results from models that separate the decision to use any child care from the decision of how many hours of care are used. Second, it explores the possibility that some parents do not respond to financial incentives in making their child care decisions. That is, it examines whether it is appropriate to assume that all parents are potential child care consumers. While, for many goods, the assumption that everybody is a potential consumer may be reasonable, it may not be appropriate for all commodities. For example, according to Blaylock and Blisard=s work on the demand for cigarettes, Arelative prices and/or income can change by large amounts and still not induce cigarette consumption≅ (1992, p. 698). If some parents consider care provided by a non-relative unacceptable for their young children, then current estimates of the demand for child care are inconsistent.

Admittedly, large financial incentives such as high wage rates may induce parents who might otherwise stay home and care for their children to participate in the labor force and to use non-relative child care. However, some parents may object so strongly to non-relative child care that they find a way to avoid such care, even if the parents work. They may, for example, arrange shift work or rely on care provided by a relative. According to Presser (1986, 1988), 12% of full-time employed, married mothers and nearly 22% of part-time employed, married mothers worked other than a regular day schedule.

The theoretical framework in this study is based on the neoclassical utility maximization approach. It extends the model presented in Hotz and Kilburn (1991) and Ribar (1992) by introducing a discrete random preference regime (Pudney 1991) to distinguish between parents who are potential child care users and those who are not. To determine the sensitivity of child care demand estimates, the theoretical framework is complemented with several econometric models that make different assumptions about reasons for non-consumption. The data for the study come from the 1990 National Child Care Survey (NCCS) and the 1990 Profile of Child Care Settings (PCCS). The NCCS consists of a sample of 4,392 households

representative of U.S. families with children under the age of 13. The nationally representative PCCS provides information on 2,089 center-based early education and care programs. In the NCCS, information about child care arrangements is available in more detail for the youngest child in the family. Our analysis is restricted to the subset of families whose youngest child is six years or younger and not in school.

ZERO CHILD CARE CONSUMPTION

In demand analyses, non-consumption has been attributed to one or more of the following three explanations: (a) purchase infrequency, (b) rationing, or (c) a corner solution (Blundell & Meghir 1987; Pudney 1991).

Purchase infrequency refers to a situation in which consumption is observed to be zero because the commodity of interest is not bought very often and the time period for data collection is too short to record a purchase. This reason is not likely to apply to the data on child care employed here, as the National Child Care Survey inquires about child care arrangements used regularly during the two weeks prior to the interview.

Rationing occurs when consumers do not purchase a product because they are unable to locate it. In the case of child care, for example, parents may want to purchase care but are on a waiting list for the arrangement of their choice. The possibility of rationing is not considered here for lack of data.

A corner solution describes a situation of zero optimal consumption at current prices and income. If a tobit model is used to estimate the demand for a good, it is implicitly assumed that zero consumption becomes positive at a different price-income set than the one observed with zero consumption (Blundell & Meghir 1987; Lee & Maddala 1985; Maddala 1983). This assumption may not be appropriate for all goods. Most vegetarians, for example, do not avoid meat because meat is too expensive and Ateetotalers often have some ethical basis for their non-consumption≅ (Pudney, 1991, p. 161). In other words, non-consumption that is due to social, psychological or ethical reasons is unconnected with the levels of prices and income (Pudney 1991). For such consumers, financial considerations are not well suited to explain non-consumption. In addition to meat and alcohol, Pudney mentions tobacco as a third example of a

commodity that some individuals would avoid even if relative prices and/or income were to change substantially. We hypothesize that child care is an additional commodity in this category. That is, while some parents may not use non-relative care at current prices or income but would use it if prices or income were different, other parents would not use such care even if it were free or if their income were to change considerably.

There are several reasons why non-relative care may not be an acceptable arrangement for some parents with small children. One, traditional gender role ideology promotes care provided by the mother. This view is not uncommon in the U.S. today. According to Kuhlthau and Mason (1996), for example, a majority of mothers felt that parents are the best caregivers for their pre-school-aged child. Two, while the debate about the exact impact of child care on children=s cognitive and socio-emotional development is ongoing, there appears to be consensus among child development experts that care has lasting implications and that its quality is important (Baydar & Brooks-Gunn 1991; Belsky 1990; Caldwell 1993; Carnegie Corporation 1994; Hayes, Palmer, Zaslow 1990; Lamb 1996). Aware of this view and of continued reports about the low quality of many child care arrangements in the U.S. (Helburn et al. 1995), parents who are particularly concerned with their children=s developmental needs may not be willing to rely on non-relatives to care for their young children. Three, some parents may want more control than others over parenting style or the values imparted on their children. Finally, other parents may not want to spend time away from their children because they value time with their children above alternative activities.

If our hypothesis is correct, then financial considerations are not helpful in understanding some parents= demand for non-relative child care, and a tobit model would generate inconsistent estimates (Blundell & Meghir 1987; Lee & Maddala 1985; Maddala 1983). Dominance models are based on the premise that zero consumption results from a lack of interest in the commodity. Observations with a value of zero are consequently excluded from demand estimates. If this premise is correct, then models that do not use zero-valued observations yield more efficient estimates. However, dominance models preclude the possibility that non-consumers respond to financial incentives. While it is unlikely that all observations of

zero child care are due to price and income constraints, it is also unlikely that none of these observations represents such a situation. In the absence of *a priori* information on reasons for non-consumption, estimates from dominance models therefore also run the risk of inconsistency (Blaylock & Blisard 1992).

Double-hurdle models provide flexibility in modeling demand by incorporating more than one reason for zero consumption. The framework used in this paper accommodates the possibility that some parents do not regard child care acceptable for their young children and that other parents do not use it under their current financial circumstances. Detailed descriptions of the theoretical framework and corresponding econometric models are provided after a discussion of the existing literature on the demand for child care.

RELATED LITERATURE

The labor supply and child care literatures provide information on the demand for child care. Labor supply studies typically report an inverse relationship between the cost of child care and women=s labor force participation (Averett, Peters & Waldman 1992; Blau & Robbins 1988, 1991; Cackley 1995; Connelly 1992; Fronstin & Wissoker 1994; Heckman 1974; Kimmel 1992; Ribar 1992; Stolzenberg & Waite 1984). This finding suggests that children spend more time in child care the lower its price, all else equal. Brayfield (1995) qualifies this result. She concludes that high- as well as low-priced child care appear to discourage maternal employment. She attributes the negative effect of low-priced care to women=s reluctance to choose poor quality arrangements for their children.

The child care literature has mainly focused on the types and number of care arrangements, rather than the amount of time children spend in care (Blau & Robins 1988, 1991; Blau & Hagy 1998; Casper, Hawkins & O=Connell 1994; Chaplin, Robins, Hofferth, et al. 1997; Folk & Yi 1994; Hofferth, Chaplin & Wissoker 1994; Hofferth & Wissoker 1992; Lehrer 1989; Leibowitz, Waite & Witsberger 1988; Robins & Spiegelman 1978; U.S. Bureau of the Census 1992; Veum & Gleason 1991; Waite, Leibowitz & Witsberger 1991). Exceptions include studies by Hofferth et al. (1991), Hotz and Kilburn (1991), and Ribar (1992).

Using data from the National Child Care Survey, Hofferth et al. (1991) report descriptive statistics for the care of children under age 13. Time in child care differs by the child's age, family income, demographic

characteristics and place of residence, suggesting that the demand for child care is related to economic and demographic factors.

Ribar (1992) simultaneously estimates women=s labor supply and the hours children spend in paid and unpaid care. His results confirm the findings of labor supply studies that parents purchase fewer hours of child care when care is more expensive. He also reports that paid and unpaid care appear to be substitutes. In addition, for families who have more income from sources other than the mother=s earnings, hours in paid care are longer and hours in unpaid care are shorter. Ribar's study is one of a few to provide information about time spent in child care, but his results are restricted to families in which the mother is married and working. The demand for child care is estimated with a tobit model.

Hotz and Kilburn (1991) contribute to the child care literature by demonstrating that it may be problematic to generalize estimates of the demand for child care from a sample of working women to all households. Their results suggest that the demand for child care is more sensitive to price changes when the mother is not employed. Also, in contrast to studies of working women only, Hotz and Kilburn find that higher income levels from sources other than the mother's earnings lower the demand for child care in a sample of working and non-working mothers. Like Ribar, Hotz and Kilburn derive their estimates from a tobit model.

In summary, existing studies of the demand for child care rely on either descriptive statistics or tobit models. Thus far no study has allowed for the possibility that some parents may not respond to financial incentives. If some parents do not consider child care an acceptable alternative then current estimates of the demand for child care are inconsistent. The following section describes a conceptual framework that addresses financial and non-financial reasons for not using child care.

CONCEPTUAL FRAMEWORK

Equation (1) specifies a utility function for parents of young children.

$$U = U \{ Q (\beta\_H_C , K_M , K_F , K_R ; Z_1) , G , K_M , K_F , L_M , L_F ; Z_2 \} \quad (1)$$

where:

U = utility
Q = child quality
β = 1 if potential or actual child care user, 0 otherwise
H_C = hours of child care
K_M = mother=s time spent caring for child
K_F = father=s time spent caring for child
K_R = relatives= time spent caring for child
Z_1 = exogenous parental characteristics that affect the production of child quality
G = parental consumption
L_M = mother=s non-market, non-child care time
L_F = father=s non-market, non-child care time
Z_2 = exogenous parental characteristics that affect parental preferences

Following Hotz and Kilburn (1991) and Ribar (1992), utility depends on child quality[1] (Q), parental consumption (G), father=s and mother=s Aleisure≅ time (L_F, L_M), defined as non-market and non-child care time, and exogenous characteristics that affect parental preferences (Z_2). Embedded in this utility function is a production function for child quality. Child quality is specified as depending on the amount of time parents and relatives spend with the child (K_F, K_M, K_R), exogenous parental characteristics that affect the production of child quality (Z_1), and the time the child spends in child care (H_C). The parameter β^* indicates the extent to which child care is acceptable to parents. Values of β^* are below zero if child care is regarded unfavorably.

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

$$\beta = 0 \quad \text{if } \beta^* \# 0$$

[1] In contrast to Hotz and Kilburn (1991) and Ribar (1992), this model considers the quality of the youngest child in the family rather than average child quality.

Child care is in the parents= utility function only if $\beta = 1$. Following Pudney (1991), we assume that the preference parameter β^* is distributed as

$$\beta^* = \alpha'Z + u, \quad u \sim N(0, 1) \tag{3}$$

where:

α = vector of unknown parameters
Z = vector of observed personal characteristics

In the double-hurdle literature, equation (2) is often referred to as the participation equation, since it models whether or not an individual is a potential/actual consumer of the commodity of interest (Blaylock & Blisard 1992; Jones 1989).

The usual constraints on time and financial resources complete this model. The maternal and paternal time constraints are:

$$T_M = L_M + H_M + K_M \tag{4}$$

$$T_F = L_F + H_F + K_F$$

where:

H_M = mother=s hours of market work
H_F = father=s hours of market work
T_M = total amount of time available to the mother
T_F = total amount of time available to the father

while the budget constraint is

$$G + pH_C = w_M H_M + w_F H_F + v \tag{5}$$

where:

p = hourly price of market-based child care
w_M = mother=s hourly wage rate
w_F = father=s hourly wage rate
v = non-labor income

The price of parental consumption is normalized to one.

The so-called consumption equation describes optimal hours of child care (H_C^*), if child care is in the utility function, that is, if $\beta=1$. Optimal hours of child care are obtained by maximizing the utility function subject to the full-income budget constraint (combined budget and time constraints). Parents compare the market price of child care with the shadow price of producing child quality using parental inputs. If the

market price is lower than the shadow price, an interior solution results; otherwise a corner solution is obtained. This corner solution is motivated by the full-income budget constraint. For interior solutions, optimal hours of child care are found by solving the implicit equation $U_Q Q_{Hc}/U_G=p$ for H_C^* (Hotz & Kilburn 1991). Assuming that the solution for H_C^* can be adequately approximated by a tobit model, the consumption equation takes the form:

$$\begin{aligned} H_C^* &= \gamma' C + \varepsilon; \quad \varepsilon \sim N(0, \sigma^2) \\ H_C^{**} &= H_C^* \quad \text{if } H_C^* > 0 \\ H_C^{**} &= 0 \quad \text{if } H_C^* \# 0 \end{aligned} \tag{6}$$

where:

γ = unknown parameter vector
C = vector of observed personal characteristics, prices, and income

According to this model, parents use child care if they are potential users of care ($\beta=1$) and if optimal hours of care are positive ($H_C^*>0$). Thus, child care demand (H_C) takes the form $H_C = \beta \exists H_C^{**}$, or

$$\begin{aligned} H_C^* &= \gamma' C + \varepsilon \text{ if } H_C^* > 0 \text{ and } \beta = 1 \\ H_C &= \{ \; 0 \text{ if } H_C^* \leq 0 \text{ and } \beta = 1 \\ &\quad\; 0 \text{ if } \beta = 0 \end{aligned} \tag{7}$$

ECONOMETRIC MODELS

The child care demand equation described in equation (7) is estimated with double-hurdle models. Additional econometric models, in particular, tobit, first-hurdle dominance and complete dominance models, are estimated to ascertain how sensitive child care demand estimates are to assumptions regarding zero child care consumption. A description of the five econometric models estimated in this study is provided below. The discussion draws on Blaylock and Blisard (1992), Jones (1989) and Blundell and Meghir (1987).

Double-Hurdle Model with Dependence

In the double-hurdle model with dependence, positive hours of child care are observed when potential child care consumers are at an interior solution. Positive consumption requires passing two "hurdles": (a) the participation and (b) the consumption hurdle. Parents who pass the participation hurdle ($u > -\alpha'Z$ in equation (3)) consider child care an acceptable option, but may not purchase it because of price or income considerations. Parents who pass the consumption hurdle ($\varepsilon > -\gamma=C$ in equation (6)) consider child care affordable, but may nevertheless not purchase it for non-financial reasons. Thus, in the double-hurdle model, zero consumption may be due to either financial or non-financial motivations. The likelihood function for the double-hurdle model with dependence takes the form:

$$L = \prod_{0} P\{ \overline{PH} \text{ or } \overline{CH} \} \bullet \prod_{+} \{ P(PH \text{ and } CH) P(H_C \mid PH \text{ and } CH) \}$$

$$= \prod_{0} \{ 1 - P(PH \text{ and } CH) \} \bullet \prod_{+} \{ P(PH) P(CH \mid PH) P(H_C \mid PH \text{ and } CH) \}$$

$$= \prod_{0} \{ 1 - P(u > -\alpha'Z) P(\varepsilon > -\gamma'C \mid u > -\alpha'Z) \} \bullet$$
$$\prod_{+} \{ P(u > -\alpha'Z) P(\varepsilon > -\gamma'C \mid u > -\alpha'Z) g(H_C \mid \varepsilon > -\gamma'C, u > -\alpha'Z) \}$$

$$= \prod_{0} \{ 1 - \Theta(\alpha'Z, \gamma'C/\sigma, \rho) \} \bullet \prod_{+} \Phi\{ \frac{\alpha'Z + \rho/\sigma(H_C - \gamma'C)}{\sqrt{1 - \rho^2}} \} \frac{1}{\sigma} \phi\{ \frac{H_C - \gamma'C}{\sigma} \} \quad (8)$$

where:

0	=	zero consumption
+	=	positive consumption
PH	=	passing participation hurdle
CH	=	passing consumption hurdle
g	=	truncated density function
ϕ	=	standard normal density function
Φ	=	standard normal distribution function
Θ	=	bivariate standard normal distribution function

and $(u, \varepsilon) \sim$ bivariate normal $(0, 0, 1, \sigma^2, \rho)$. Correlation between the error terms u and ε permits the possibility that unobserved characteristics influence both the participation and the consumption decision.

Double-Hurdle Model with Independence

The dependent double-hurdle model reduces to the independent double-hurdle model when the correlation between the error terms u and ε is restricted to zero. This restriction implies that unobserved characteristics that influence whether parents are potential users of child care are uncorrelated with unobserved characteristics that influence how much child care is purchased. The likelihood function for this model is:

$$L = \prod_0 \{ P (\overline{PH} \text{ or } \overline{CH}) \} \bullet \prod_+ \{ P (PH \text{ and } CH) P (H_C \mid PH \text{ and } CH) \}$$

$$= \prod_0 \{ 1 - P (PH) P (CH) \} \bullet \prod_+ \{ P (PH) P (CH) P (H_C \mid PH \text{ and } CH) \}$$

$$= \prod_0 \{ 1 - P (u > -\alpha' Z) P (\varepsilon > -\gamma' C) \} \bullet \prod_+ \{ P (u > -\alpha' Z) P (\varepsilon > -\gamma' C) g (H_C \mid \varepsilon >$$

$$= \prod_0 \{ 1 - \Phi (\alpha' Z) \Phi (\frac{\gamma' C}{\sigma}) \} \bullet \prod_+ \Phi (\alpha' Z) \frac{1}{\sigma} \phi \{ \frac{H_C - \gamma' C}{\sigma} \} \quad (9)$$

Tobit Model

The independent double-hurdle model reduces to the tobit model if the probability of passing the participation hurdle is assumed to be one. This is equivalent to restricting the parameter β in utility function (1) to one and implies that all parents are potential users of child care. Thus, everybody is assumed to be responsive to financial incentives. The likelihood function for the tobit model is

$$L = \prod_{0} P(\overline{CH}) \bullet \prod_{+} \{ P(CH) P(H_C \mid CH) \}$$
$$= \prod_{0} \{ 1 - \Phi(\frac{\gamma' C}{\sigma}) \} \bullet \prod_{+} \frac{1}{\sigma} \phi \{ \frac{H_C - \gamma' C}{\sigma} \} \qquad (10)$$

First-Hurdle Dominance Model

In the double-hurdle and tobit models, current non-users of child care contribute to the consumption equation. If zero child care consumption stems exclusively from a lack of parental interest, more efficient demand estimates may be obtained by excluding parents who do not use child care from the consumption equation. The first-hurdle dominance model, also known as the sample selection model, includes all parents in the participation equation but restricts the consumption equation to users of care. Thus, a corner solution due to the budget constraint is not possible in this model. This restriction can be seen in the likelihood function for the first-hurdle dominance model: in contrast to the dependent double-hurdle model, the probability of passing the consumption hurdle conditional on passing the participation hurdle (i.e., $P(\varepsilon > -\gamma' C \mid u > -\alpha' Z)$) is not included in the likelihood function. In addition, the consumption

equation is not conditional on the probability of passing the consumption hurdle ($\varepsilon > -\gamma'C$). The first-hurdle dominance model allows for a correlation between u and ε, the error terms of the participation and consumption equations. The likelihood function for this model can be written as follows:

$$L = \prod_{0}\{ P (\overline{PH}) \} \bullet \prod_{+}\{ P (PH) P (H_C \mid PH) \}$$

$$= \prod_{0}\{ 1 - P (u > -\alpha'Z) \} \bullet \prod_{+}\{ P (u > -\alpha'Z) g (H_C \mid u > -\alpha'Z) \} \qquad (11)$$

$$= \prod_{0}\{ 1 - \Phi (\alpha'Z) \} \bullet \prod_{+}\frac{1}{\sigma} \phi \{ \frac{H_C - \gamma'C}{\sigma} \} \Phi \{ \frac{\alpha'Z - \rho / \sigma (H_C - \gamma'C)}{\sqrt{1 - \rho^2}} \}$$

The Complete Dominance Model

The complete dominance model takes the first-hurdle dominance model one step further by assuming independence between the error terms u and ε. The complete dominance model is estimated with a probit model for the participation decision and an ordinary least squares regression for the consumption equation. The OLS regression is based only on observations with positive values for the dependent variable.

Model Selection

Maximum likelihood ratio tests are used to assess whether various pairs of nested models are statistically equivalent: the double-hurdle model with dependence versus the double-hurdle model with independence, the double-hurdle model with independence versus the tobit model, and the first-hurdle dominance versus the complete dominance model. Non-nested models are compared following Vuong=s (1989) approach.

Vuong=s approach requires determining the variance of the difference between two likelihood functions of interest. The variance is defined as

(12)

where:

$f(y_i \mid X_i ; \alpha)$ = likelihood model 1
$g(y_i \mid Z_i ; \beta)$ = likelihood model 2

Under the null hypothesis that models 1 and 2 are equivalent, the test statistic Z_0 is a standard normal variable,

$$Z_0 = \frac{LR_n(\alpha, \beta)}{\omega \sqrt{n}} \tag{13}$$

where:

LR_n = log (max. likelihood model 1 / max. likelihood model 2)

The test statistic can be used to test three competing hypotheses: (1) the two models are equivalent:

$$H_0 : E\{ \log \frac{f(y_i \mid X_i ; \alpha)}{g(y_i \mid Z_i ; \beta)} \} = 0 \tag{14}$$

(2) model 1 is better than model 2,

$$H_A1 : E\{ \log \frac{f(y_i \mid X_i ; \alpha)}{g(y_i \mid Z_i ; \beta)} \} > 0 \tag{15}$$

and (3) model 1 is worse than model 2.

$$H_A2 : E\{ \log \frac{f(y_i \mid X_i ; \alpha)}{g(y_i \mid Z_i ; \beta)} \} < 0 \tag{16}$$

DATA

Empirical estimates of the econometric models are based on data from the 1990 National Child Care Survey (NCCS) and the 1990 Profile of Child Care Settings (PCCS). Both surveys were conducted between November 1989 and May 1990 within the same 100 U.S. counties or county groups. Geographic identifiers allow a matching of households and child care providers by county/county group.

The NCCS is a sample of 4,392 families representative of U.S. families with children under the age of 13. The NCCS is not restricted to children whose mothers are in the labor force. In addition to basic demographic and labor force participation information for all household members, the NCCS provides comprehensive data on how families care for their children. In particular, it contains information on child care use, child care schedules, and child care expenditures for up to four children in each household. The term child care in the NCCS refers to regularly scheduled care arrangements that parents make for their children when they are not available and/or to provide an enriching experience for the child. Regular arrangements are defined as care that was used at least once a week for the two weeks prior to the survey (Hofferth et al. 1991).

We restricted the sample for this study to families whose youngest child is six years of age or younger and not in school. In addition we selected cases in which the mother was the survey respondent. Missing values reduced the sample size further, resulting in a final count of 1,699 observations. The analysis focuses on care provided by non-relatives.

The nationally representative PCCS provides information on 583 regulated home-based family day care providers and 2,089 center-based early education and care programs. This survey includes questions on topics such as fee schedules, children's activities, health and safety, caregiver characteristics and experience, and operation costs and income. Data from center-based early education and care programs were used to predict child care prices. A detailed description of the procedure is provided in the next section.

EMPIRICAL MODEL

As discussed, the conceptual framework and the corresponding econometric models require a participation and a consumption equation. The participation equation distinguishes between parents who are potential users of child care and those who are not, while the consumption equation describes optimal hours of child care given financial considerations. The empirical specification of these equations include maternal, child, and household characteristics that may affect child care choices. Paternal characteristics are not included in the empirical specification because some of the mothers are unmarried. The variables are briefly described below and summarized in Table 1. Descriptive statistics can be found in Table 2.

[Tables 1 & 2 about here]

The child=s age is included in both the participation and consumption equation. Children=s physiological, cognitive and socio-emotional needs vary by age, and the type and amount of care that is most appropriate depends on these needs. For children under three, for example, a low ratio of children to adults has been identified as important. Older children, on the other hand, benefit from interactions with other children and with adults who are trained in early childhood education (Carnegie Corporation 1994). Some parents may therefore view child care more favorably for pre-schoolers than for infants, all else constant, or may wait until the child reaches a certain age to consider child care altogether [2]. To capture parents= response to the changing needs of children, the child=s age enters the participation equation as a set of dummy variables (under six months, between six months and one year, between one and two years, between two and three years, between three and four years, between four and five years, and five years and older). In the consumption equation, the child=s age is represented in quadratic form.

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[2] There is some evidence that parents select different modes of care depending on the child's age (Blau 1991; Kisker & Maynard 1991; Leibowitz, Waite, & Witsberger 1988; Veum & Gleason 1991).

Previous work (Leibowitz et al. 1988; Lehrer 1983, 1989) suggests that educational attainment influences women=s awareness of age-appropriate child care and may, in turn, influence their child care choices. To capture the effects of maternal education and awareness of age-appropriate child care on child care choices, the participation and consumption equations include a set of dummy variables indicating educational attainment and a dummy variable indicating whether the mother has background in child development. The educational attainment variables distinguish among less than a high school degree, a high school degree (the reference category), some college education, a college degree, and more than a college degree.

According to some studies, the selection of child care mode varies by race (Robins & Spiegelman 1978; Leibowitz, Waite, & Witsberger 1988), suggesting that the extent of child care use may differ as well. Other studies do not support this finding (Duncan & Hill 1977; Yaeger 1979). Thus, the participation and consumption equations include dummy variables indicating whether the mother is African American and whether she is Hispanic.

The mother=s religious affiliation and the child=s sex may influence whether parents consider using child care, but these characteristics are unlikely to influence hours of care. The two factors are thus appropriate in the participation but not in the consumption equation [3]. Religious affiliation may reflect attitudes and values with respect to child care. Following Lehrer and Chiswick (1993), this study classifies individuals as ecumenical Protestant, exclusivist Protestant, Mormon, Catholic, Jewish, other religion [4], or no religion. As discussed in Lehrer and Chiswick (1993), the location of religious groups along an "exclusivist-ecumenical" continuum depends on "the clarity with which they draw their membership boundaries" (p. 386): those at the exclusivist end of the continuum place more emphasis on religious group boundaries than do those at the ecumenical end of the continuum. Mothers are classified as ecumenical

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[3] These variables are also used to identify the participation equation.

[4] The Aother religion≅ category includes mothers who indicated a religion other than Protestant, Mormon, Catholic, Jewish, or no religion.

Protestant if they describe their religious affiliation as Episcopalian, Lutheran, Methodist, Presbyterian, United Church of Christ, other Protestant, or non-denominational, while those describing themselves as Baptist or Pentecostal are classified as exclusivist Protestants. Compared to those who do not identify with a particular religion, groups such as exclusivist Protestants and Mormons may have more traditional values. A more traditional view of the family favors that mothers provide their children=s care themselves.

In some studies, boys and girls have been found to react differently to the type of child care they receive (Scarr & Eisenberg 1993). The child=s sex may thus also be a factor in whether or not parents consider using child care.

While religion and the child=s sex may affect general attitudes toward child care but not optimal hours of care, family structure may affect optimal hours of care but is unlikely to shape preferences; thus, the presence of older siblings, a father, and a relative who is available to care for the child enter only the consumption equation. The presence of older siblings is measured with three variables: the number of siblings under two years, between three and five years, and between six and 17 years. Each additional young child increases the cost of child care, while school-age children require supervision and often transportation after school. Accordingly, optimal hours of care may depend negatively on the number of siblings in all three age groups.

The presence of alternative caregivers in or near the household provides greater opportunity for parents to substitute relative care for non-relative care. Therefore, households with two parents and those with a relative available to care for the child are expected to use fewer hours of non-relative care. Both the presence of a father in the household and the availability of a relative to provide care are measured as dummy variables.

The mother's wage, household income excluding the mother's earnings, and the price of child care determine the household budget constraint, but presumably have no effect on whether parents are potential

users of child care. Thus, these variables also enter only the consumption equation [5]. Wages for all women in the sample are predicted following the standard Heckman selection procedure to address potential endogeneity and to compute a wage rate for women who are not in the labor force (see Table 1, Appendix). By the substitution effect, an increase in the wage increases optimal hours of work which may increase demand for hours of care ceteris paribus. Although less likely, the income effect may decrease hours spent working as the wage rate increases, lowering the demand for hours of child care.

Household income, excluding the mother's earnings, has an ambiguous effect on optimal hours of child care, all else equal. If child care is a normal good, then an increase in household income increases optimal hours of care, all else constant. If child care is an inferior good, however, then an increase in household income decreases optimal hours of care. To illustrate this latter case, consider a household that seeks to maximize the mother's time with the child. The mother may limit her hours of work to the level required to maintain a certain standard of living. As household income excluding the mother's earnings increases, her optimal hours of work decrease, enabling her to spend more time with the child and thus use fewer hours of child care. Household income enters the consumption equation in quadratic form.

For two reasons, the consumption equation includes a predicted price of child care rather than the price reported by parents. First, a price for child care is not available for parents who do not use such care. Second, the prices reported by users of care are endogenous in that they represent the arrangements selected by parents. The Profile of Child Care Settings survey collected information about fees charged by child care centers and attributes of the care. Similar to Blau and Hagy (1998), we use this information to create a Aquality-adjusted≅ child care price for each of the 100 U.S. counties and county groups represented in the NCCS (see also Deaton 1988).

According to Blau and Hagy, the price of an hour of child care can be determined by a market-specific hedonic price function,

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[5] Family structure, the presence of alternative caregivers, and the budget constraint variables serve to identify the consumption equation.

$$p_m = p_m^* + \delta_m'D + \zeta_m=F + u \quad (17)$$

where:

p_m = price of market based child care in market *m*
p_m^* = price of Abaseline≅ care in market *m;* D=0
δ = unknown, market-specific parameter vector
D = vector of care characteristics
ζ = unknown, market-specific parameter vector
F = vector of market characteristics
u = error term

Small sample sizes in some of the areas surveyed by the PCCS prevent market-specific estimates of the parameters in equation (17). If it is assumed that the only variation across markets is in the intercept, then equation (17) can be rewritten as

$$p_m = p_m^Q + \delta'D + u \quad (18)$$

where $p_m^Q = p_m^* + \zeta_m=F$ can be interpreted as the quality-adjusted, hourly price of child care in market *m*. For comparability with other studies, the predicted price of child care in market *m* used in the analysis is calculated as the estimated market-specific intercept $\hat{p}_m^Q$ plus $\hat{\delta}\bar{D}$, with D set to mean sample values. This construct can be thought of as the price of an Aaverage quality≅ child care arrangement. For details, refer to Table 2 in the appendix.

RESULTS

We estimated the five econometric models described earlier with the sample of households whose youngest child is at most 6 years old and not in school. Table 3 displays the results for this sample. In addition, we conducted separate analyses by the age of the youngest child: (a) for families whose youngest child is under three years of age and (b) for families whose youngest child is three years or older. Parents' reluctance to use non-relative care is likely to be stronger for very young children; moreover, factors influencing parents' child care choices may vary with the age of the child. Results for the two subsamples are presented in Tables 4 and 5. Individual parameter estimates are described after comparing the fit of the five econometric models.

Full Sample

Model Comparisons

Among the five models in each table are three pairs of nested models. Restricting the correlation coefficient ρ to zero nests the complete dominance model in the first-hurdle dominance model and the independent in the dependent double-hurdle model. The independent double-hurdle model collapses to the tobit model when the parameters of the participation equation are set to zero.

Based on a likelihood ratio test, the null hypothesis that the complete and first-hurdle dominance models are statistically equivalent cannot be rejected ($\chi_1^2 = .02$). The same result applies to a comparison of the dependent and independent double-hurdle models ($\chi_1^2 = .08$). However, the result of a likelihood ratio test rejects the hypothesis that the standard tobit and the independent double-hurdle model are statistically equivalent ($\chi_{21}^2 = 167.7$), suggesting that the child care participation and consumption decisions are not based on the same decision-making structure, or that there is a discontinuity at zero hours of child care. The result of a Vuong test, comparing the complete dominance model with the independent double-hurdle model, suggests that the independent double-hurdle model provides a better fit ($p < .003$), implying that there may be more than one reason for parents not to use child care.

[Table 3 about here]

Parameter Estimates

According to the dominance and double-hurdle models, maternal education influences both the participation and the consumption decision. Specifically, the results from these models suggest that maternal education plays two distinct roles in families' child care decisions: a household's willingness to consider using child care, in general, is positively related to the mother's educational attainment, while hours in care are negatively associated with the mother=s educational attainment. The tobit model, which involves a single equation for zero and positive child care hours, masks these different roles. Only one of the education dummies is significant at the 10% level in the tobit model.

In the dominance and double-hurdle models, hours of child care are significantly higher for children whose mothers have child-specific education. However, the dummy variable for child-specific education is insignificant in the participation equations of these models and in the tobit model.

The results of the dominance and double-hurdle models further provide evidence that race and ethnicity operate through the consumption decision and mixed evidence that ethnicity operates through the participation decision. In all models that distinguish between a participation and consumption decision, hours of care are significantly higher for African American and Hispanic women, but according to the double-hurdle models Hispanic mothers are also less likely to be child care users. Together these results suggest that Hispanic mothers are less likely to consider using child care; yet among those who use it, hours of care are higher for families with African American and Hispanic mothers. By relying on a single equation, the tobit model obscures the relationship between race and ethnicity and child care choices.

The participation equations of the dominance and double-hurdle models show that parents are more willing to consider child care, the older their child. For hours in care, on the other hand, the child's age is insignificant at the 10% level in the consumption equations of these models. Only the tobit model, which lacks a participation equation, suggests that optimal child care hours are positively related to the child's age. Thus, a child=s age appears relevant in deciding whether to use child care at all but not in choosing the number of hours in care.

Family structure is related to the number of hours the youngest child in the family spends in non-relative child care. According to the dominance models, the youngest child spends fewer hours in care, the larger the number of siblings under two years of age. According to all five models, hours in care are also significantly lower the more school-age siblings there are in a family. In all five models, being a single mother has a statistically significant, positive effect on hours of non-relative child care and the availability of care provided by a relative has a statistically significant, negative effect on hours of non-relative care.

The demand for hours in care also depends on the household budget constraint. In all five models, the mother=s predicted wage has a statistically significant, positive effect on hours of care. Household income

(excluding the mother's earnings) and income squared are significant in all five models as well. The estimates indicate that hours of care are negatively related to household income when income is below some threshold (ranging from roughly $64,000 to $75,000) and positively related to household income above this threshold, suggesting that child care is an inferior good for most households. Although the coefficient on the predicted price of child care has the expected negative sign in all models, it is only significant in the two dominance models.

In summary, the results from the full sample indicate that the demand for child care is related to maternal, child, and household characteristics. The findings from the dominance and double-hurdle models differ from those of the tobit model with regard to maternal education, race, ethnicity and the child's age -- characteristics that influence general attitudes toward child care as well as optimal hours of care. In addition to varying in sign, many estimates also differ in magnitude.

Results by Child's Age

When the full sample is divided into a subsample of children under three years and three years and older, for both subsamples the double-hurdle models also provide a better fit than either the tobit or dominance models [6].

[Tables 4 & 5 about here]

In terms of the mother's educational attainment, the results from the two subsamples are largely consistent with the results from the full sample [7]. The estimates suggest that a household's willingness to consider using child care is generally positively related to the mother's educational attainment, while hours of care are negatively associated with her educational attainment. Again these different roles are not revealed by the tobit model.

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[6]

	Children < 3 Years	Children ∃ 3 Years
Tobit vs. double-hurdle model	$\chi_{18}^2 = 93.2$	$\chi_{11}^2 = 45.4$
Double-hurdle vs. dominance model	$p < .003$	$p < .0001$

[7] Note that for degree of freedom reasons education is measured as a continuous variable in the subsample of children 3 years of age or older.

There is no evidence that child-specific education influences child care choices for children under three years and limited evidence that child-specific education influences child care choices for children between three and six years. For the older subsample, only the tobit model indicates a positive effect of child-specific education on hours of care.

The finding that African American mothers use more hours of child care remains after stratifying the analysis by the child=s age. In these subsamples, however, there is less evidence that Hispanic mothers use more hours of care. As discussed earlier, the results based on the full sample provide mixed evidence that Hispanic women are less likely to consider using child care; analyses by the age of the child suggest that a Hispanic background reduces the likelihood of using child care only when children are very young.

Even within the age-subsamples, the participation equations reveal a positive relationship between a child's age and parents' willingness to consider child care. The child's age is insignificant in the consumption equations, except in the first hurdle dominance model for the younger subsample and the tobit model for the older subsample.

For children under three years, Catholic mothers and mothers who identify with religions other than Protestant, Mormon, Catholic, or Jewish are significantly less likely to use child care than are mothers who do not identify with any religion. There is some evidence that Mormon and exclusivist Protestant mothers are less likely to use child care for very young children [8]. The full sample does not indicate a significant relationship between the mother's religious affiliation and her willingness to consider child care.

The independent double-hurdle and both dominance models for the older subsample indicate that parents are less willing to consider non-relative child care for their sons than for their daughters. As in the results based on the full sample, the child's sex has an insignificant effect for very young children.

The effects of family structure persist after conducting separate analyses by the age of the child. Like the full sample, the results from the subsamples indicate that hours of non-relative care are negatively related to

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[8] The older subsample does not include any Mormon or Jewish mothers or mothers whose religion is Aother≅.

the presence of a father, the availability of relative care, and the number of school-age siblings. In addition, the dominance models based on the younger subsample suggest that hours in care are negatively associated with the number of very young siblings.

In the stratified samples estimates for financial incentives vary by age. For very young children, the price of child care and income significantly influence hours of care. Hours in care depend negatively on its predicted price and child care appears to be an inferior good for most households. For older children, on the other hand, the price estimate is never significant but income is significant in some models. As in the full sample, the mother's predicted wage is positively associated with hours of non-relative care in both subsamples.

The results from the subsamples indicate that the roles of the mother's ethnicity and religious affiliation, the child's sex, income, and the predicted price of child care differ with the child=s age.

Table 6 presents predicted probabilities of passing the participation and consumption hurdles for each subsample. These probabilities are evaluated at the respective sample means. As expected, the predicted probabilities of passing the participation hurdle are higher for parents with children between three and six years than for parents with children under three years, suggesting that parents are more likely to consider child care acceptable for preschool children than for infants and toddlers. The predicted probabilities of passing the consumption hurdle are also higher for parents with children in the older age group.

[Table 6 about here]

CONCLUSIONS

As the number of women who have opted to work while their children are young has increased, interest in understanding the demand for child care has grown. According to survey data, a large percentage of parents do not use non-parental child care while their children are young. By examining why many parents do not use any non-relative care, this paper adds to our understanding of the demand for child care. The theoretical framework generalizes the model presented in Hotz and Kilburn (1991) and Ribar (1992), by allowing for

the possibility that not all parents are potential child care users. To explore this possibility empirically, we estimate and compare tobit, dominance, and double hurdle models of the demand for child care.

In the context of the demand for child care, a tobit model implicitly assumes that all parents respond to financial incentives when they decide whether and how much child care to use. Dominance models implicitly attribute zero child care consumption to a lack of interest in such care. Double hurdle models distinguish between whether child care is considered at all and to what extent financial incentives influence the demand for such care. The tobit model is based on a consumption equation that describes optimal hours of care as a function of prices, income and preference shifters. In addition to the consumption equation, the dominance and double hurdle models include a participation equation. The participation equation assesses whether parents consider using child care at all.

Several conclusions are offered. First, child care decisions differ by the age of the child. Not surprisingly, parents are more likely to rely exclusively on parental or relative care for infants and toddlers than for preschool children. Parents also appear to react more to a change in the price of child care or the mother=s wage rate when their youngest child is under three years of age than when the child is between three and six years old.

Second, the implications of models with separate participation and consumption equations differ from those of the single-equation tobit model. For example, the tobit model indicates a significant positive relationship between the child=s age and hours in child care. According to the dominance and double hurdle models, children who are at least one year of age are more likely to attend child care, the older they are. Yet age does not appear to be a factor in choosing the number of hours of care for the children who are in care. Similarly, the dominance and double hurdle models suggest that the mother=s education level, race and ethnicity play different roles in the two decisions, while the tobit model masks the differences. These comparisons highlight the importance of separating the decision to use any care from the decision of how many hours of care are used.

The third conclusion derives from a comparison between the tobit model, which is based on the assumption that all parents are potential child care consumers, and the double-hurdle model which relaxes this assumption. Likelihood ratio tests reject the restrictions imposed by the tobit model. Estimates from the independent double hurdle model suggest that 59% of parents with average characteristics consider child care acceptable (i.e., pass the participation hurdle) when their youngest child is under three years of age and 70% of such parents consider child care affordable (i.e., pass the consumption hurdle). In contrast, when the youngest child is between three and six years old, 88% of parents with average characteristics consider child care acceptable and 84% of such parents consider child care affordable. Thus, estimates based on the independent double hurdle model indicate that approximately 41% of parents with children under three years and 12% of parents with children between three and six years would avoid child care provided by somebody other than a parent or relative even if it were free or if their income were to change considerably. These findings suggest that price and income subsidies are not effective for all parents and are more likely to influence the child care decisions of parents with preschool children than those with infants and toddlers.

With the change in women=s employment patterns and welfare reform discussions focusing on increasing female labor force participation rates, proposals to change the structure of the child care subsidy system in the United States have become more common. The results from this study suggest that assessments of the impact of such proposals may want to take into account that child care decisions vary with the child=s age and that not all parents are potential child care consumers.

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TABLE 1. DEFINITION OF VARIABLES

Variable	Definition
DEPENDENT VARIABLES	
Child Care	
Hours in Child Care	hours/week youngest child spent in all types of regularly scheduled non-parental, non-relative care during week prior to interview
Use of Child Care	1 if youngest child attended regularly scheduled non-parental, non-relative child care during week prior to interview, 0 otherwise
Employment	
Labor Force Participation	1 if mother worked during week prior to interview, 0 otherwise
Wage Rate	dollars/hour mother earned on primary job
COVARIATES	
Child Care	
Price of Child Care	Aquality-adjusted≅ average fee/hour of center-based early education and child care programs by county/county group
Relative Available	1 if relative other than those living in household is available to care for youngest child on regular basis, 0 otherwise
Children	
Age youngest child=s age in months/12	
< 6 months	1 if youngest child=s age less than 6 months, 0 otherwise
6-12 months	1 if youngest child=s age between 6 and less than 12 months, 0 otherwise
1-2 years	1 if youngest child=s age between 1 and less than 2 years, 0 otherwise
2-3 years	1 if youngest child=s age between 2 and less than 3 years, 0 otherwise
3-4 years	1 if youngest child=s age between 3 and less than 4 years, 0 otherwise
4-5 years	1 if youngest child=s age between 4 and less than 5 years, 0 otherwise
5-6 years	omitted reference category for child=s age
Boy	1 if youngest child is boy, 0 if girl
Number of Children	total number of children under age 18 who live in household
Number of Siblings	
0-2 years	number of children age 2 or younger in household, excl. youngest
3-5 years	number of children between ages 3 and 5 in household, excl. youngest
6-17 years	number of children between ages 6 and 17 in household, excl. youngest
Whether Children	
0-2 years	1 if 1 or more children age 2 or younger in household, 0 otherwise
3-5 years	1 if 1 or more children between ages 3 and 5 in household, 0 otherwise
6-12 years	1 if 1 or more children between ages 6 and 12 in household, 0 otherwise
13-17 years	1 if 1 or more children between ages 13 and 17 in household, 0 otherwise
Mother	
Education	
< 12 years	1 if mother has fewer than 12 years of education, 0 otherwise
12 years	omitted reference category for education
13-15 years	1 if mother has between 13 and 15 years of education, 0 otherwise
16 years	1 if mother has 16 years of education, 0 otherwise
17 or more years	1 if mother has 17 or more years of education, 0 otherwise

TABLE 1. DEFINITION OF VARIABLES (continued)

Variable	Definition
Mother	
Child-Specific Education	1 if mother has received training/education related to young children, 0 otherwise
Ethnicity	
Hispanic	1 if mother is hispanic, 0 otherwise
Non-Hispanic	omitted reference category for ethnicity
Race	
African American	1 if mother is African American, 0 otherwise
Non-African American	omitted reference category for race
Religion	
Catholic	1 if mother is Catholic, 0 otherwise
Jewish	1 if mother is Jewish, 0 otherwise
Exclusivist Protestant	1 if mother is Baptist or Pentecostal, 0 otherwise
Ecumenical Protestant	1 if mother is Episcopalian, Lutheran, Methodist, Presbyterian, United Church of Christ, or Other Protestant/non-denominational, 0 otherwise
Mormon	1 if mother is Mormon, 0 otherwise
Other Religion	1 if mother is other religion, 0 otherwise
No religion	omitted reference category for religion
Wage Rate (predicted)	dollars/hour mother earned on primary job - predicted
Work Experience	per cent of time mother worked between age 18 and time of interview
Household Characteristics	
Headship	
single mother	1 if mother does not live with a partner, 0 otherwise
2 parents	omitted reference category for headship
Income	total yearly household income, excluding mother=s earned income
Region of Residence	
Northeast	omitted reference category for region of residence
Midwest	1 if household resides in the mid-west, 0 otherwise
South	1 if household resides in the south, 0 otherwise
West	1 if household resides in the west, 0 otherwise
Unemployment Rate	1989 unemployment rate in primary sampling unit, if available, in state otherwise

TABLE 2. DESCRIPTIVE STATISTICS

Variable	MEAN	SD	MIN	MAX
DEPENDENT VARIABLES				
Child Care				
Hours	12.46	18.28	0	97.67
Use	.45	.50	0	1
Employment				
Labor Force Participation	.47	.50	0	1
Wage Rate (reported)	4.30	6.38	0	80
COVARIATES				
Child Care				
Price of Child Care (predicted)	1.22	.35	.7	2.10
Whether Relative Available	.51	.50	0	1
Children				
Age	2.22	1.50	0	6.75
< 6 months	.14	.34	0	1
6-12 months	.12	.33	0	1
1-2 years	.22	.42	0	1
2-3 years	.21	.41	0	1
3-4 years	.15	.35	0	1
4-5 years	.12	.32	0	1
5-6 years	.05	.21	0	1
Boy	.53	.50	0	1
Number of Children	1.99	.98	1	7
Number of Siblings				
0-2 years	.08	.29	0	4
3-5 years	.34	.52	0	2
6-17 years	.57	.85	0	6
Whether Children				
0-2 years	.70	.46	0	1
3-5 years	.57	.50	0	1
6-12 years	.38	.49	0	1
13-17 years	.06	.24	0	1
Mother				
Education				
< 12 years	.10	.30	0	1
12 years	.41	.49	0	1
13-15 years	.25	.43	0	1
16 years	.17	.38	0	1
17 or more years	.07	.25	0	1
Child-Specific Education	.29	.45	0	1
Ethnicity				
Hispanic	.09	.29	0	1
Non-Hispanic	.91	.31	0	1
Race				
African American	.10	.30	0	1
Non-African American	.90	.32	0	1

TABLE 2. DESCRIPTIVE STATISTIC (continued)

Variable	MEAN	SD	MIN	MAX
Mother continued				
Religion				
Catholic	.31	.46	0	1
Jewish	.01	.09	0	1
Exclusivist Protestant	.22	.41	0	1
Ecumenical Protestant	.31	.46	0	1
Mormon	.01	.09	0	1
Other Religion	.04	.20	0	1
No religion	.09	.29	0	1
Work Experience	.69	.33	0	1
Household Characteristics				
Headship				
single mother	.16	.37	0	1
2 parents	.84	.36	0	1
Income	26,416.00	23,520.00	0	162,500.00
Region of Residence				
Northeast	.19	.40	0	1
Midwest	.28	.45	0	1
South	.32	.47	0	1
West	.20	.40	0	1
Unemployment Rate	5.28	1.22	2.6	9.3

N = 1,699.

TABLE 3. ESTIMATES OF THE DEMAND FOR CHILD CARE - CHILDREN # 6 YRS

Variable	Dominance		Tobit	Double-Hurdle	
	Complete	First-Hurdle		Independent	Dependent
(A) Participation					
Child					
Age					
6-12 months	.248H	.248H		.116	.105
	(.062)[a]	(.062)[a]		(.517)[a]	(.566)[a]
1-2 years	.559***	.559***		.460**	.463**
	(.000)	(.000)		(.005)	(.006)
2-3 years	.663***	.663***		.539***	.539**
	(.000)	(.000)		(.002)	(.002)
3-4 years	1.032***	1.032***		1.033***	1.034***
	(.000)	(.000)		(.000)	(.000)
4-5 years	1.368***	1.368***		1.506***	1.512***
	(.000)	(.000)		(.000)	(.000)
5-6 years	1.639***	1.639***		2.155***	2.154***
	(.000)	(.000)		(.000)	(.000)
Boy	-.102	-.102		-.136	-.136
	(.117)	(.123)		(.158)	(.167)
Mother					
Child-specific education	.026	.026		-.087	-.087
	(.740)	(.739)		(.467)	(.471)
Education					
< 12 years	-.307**	-.307**		-.148	-.150
	(.010)	(.010)		(.434)	(.428)
13-15 years	.274***	.274***		.394**	.396**
	(.001)	(.001)		(.002)	(.002)
16 years	.685***	.685***		1.065***	1.070***
	(.000)	(.000)		(.000)	(.000)
17 or more years	.729***	.729***		.667***	.666***
	(.000)	(.000)		(.001)	(.001)
African American	.053	.053		-.236	-.231
	(.640)	(.635)		(.101)	(.110)
Hispanic	-.138	-.138		-.321H	-.322H
	(.241)	(.258)		(.051)	(.052)
Catholic	-.160	-.160		-.233	-.233
	(.168)	(.170)		(.175)	(.184)
Jewish	.502	.502		.402	.350
	(.188)	(.203)		(.445)	(.525)
Exclusivist Protestant	-.142	-.142		-.203	-.215
	(.246)	(.241)		(.239)	(.227)
Ecumenical Protestant	.003	.003		.013	.016
	(.977)	(.977)		(.940)	(.929)
Mormon	-.624	-.624		-.711	-.738
	(.124)	(.117)		(.174)	(.178)
Other Religion	-.191	-.191		-.297	-.288
	(.301)	(.313)		(.248)	(.271)
Intercept	-.864***	-.864***		-.246	-.245
	(.000)	(.000)		(.256)	(.266)

TABLE 3. ESTIMATES OF THE DEMAND FOR CHILD CARE - CHILDREN # 6 YRS. (continued)

Variable	Dominance Complete	Dominance First-Hurdle	Tobit	Double-Hurdle Independent	Double-Hurdle Dependent
(B) Consumption					
Children					
Child=s Age	-.278	-.788	7.023***	2.883	3.041
	(.846)[a]	(.657)[a]	(.000)[a]	(.111)[a]	(.105)[a]
Child=s Age^2	-.007	.004	-.207	-.255	-.249
	(.977)	(.988)	(.540)	(.414)	(.423)
Number of Siblings					
0-2 years	-5.117*	-5.022*	-3.049	-3.186	-3.225
	(.016)	(.029)	(.272)	(.199)	(.195)
3-5 years	-.904	-.911	-.315	-.262	-.272
	(.423)	(.386)	(.834)	(.837)	(.830)
6-17 years	-1.898**	-1.864**	-4.262***	-3.084***	-3.112***
	(.007)	(.010)	(.000)	(.000)	(.000)
Mother					
Child-specific education	2.335*	2.313H	2.181	3.669*	3.605*
	(.050)	(.056)	(.202)	(.017)	(.019)
Education					
< 12 years	1.754	2.283	.536	2.346	2.252
	(.462)	(.402)	(.855)	(.448)	(.465)
13-15 years	-4.517***	-4.978**	.478	-4.839**	-4.594*
	(.001)	(.002)	(.801)	(.008)	(.025)
16 years	-9.119***	-10.189***	-.156	-11.722***	-11.156***
	(.000)	(.000)	(.947)	(.000)	(.001)
17 or more years	-8.533***	-9.673**	-5.871H	-13.074***	-12.649***
	(.000)	(.002)	(.078)	(.000)	(.001)
African American	6.782***	6.768**	3.489	8.903**	8.690**
	(.000)	(.003)	(.172)	(.002)	(.004)
Hispanic	4.271*	4.504*	.518	5.703*	5.498*
	(.037)	(.025)	(.846)	(.016)	(.023)
Single mother	7.204***	7.217***	11.111***	9.896***	9.890***
	(.000)	(.000)	(.000)	(.000)	(.000)
Wage Rate (predicted)	1.525***	1.525***	2.430***	2.436***	2.434***
	(.000)	(.000)	(.000)	(.000)	(.000)
Income ($1,000)	-.193***	-.194***	-.157H	-.235***	-.234***
	(.001)	(.001)	(.051)	(.001)	(.000)
Income^2	.001***	.001***	.001*	.002***	.002***
	(.001)	(.000)	(.047)	(.000)	(.000)
Relative Available	-5.420***	-5.447***	-14.558***	-8.357***	-8.337***
	(.000)	(.000)	(.000)	(.000)	(.000)
Price of Child Care (predicted)	-3.620*	-3.631*	-1.721	-2.000	-2.008
	(.016)	(.018)	(.418)	(.286)	(.283)
Intercept	32.185***	35.916***	-10.612**	15.112***	13.855*
	(.000)	(.000)	(.007)	(.000)	(.031)
σ	14.238	14.201***	25.155***	17.068***	17.095***
		(.000)	(.000)	(.000)	(.000)
ρ	-.184			.076	
		(.570)			(.812)
-Log Likelihood (A) + (B):	4150.539	4150.527	4056.162	3967.325	3967.286

Note: N = 1,699.

a numbers in parentheses are p-values.

H,*,**,*** indicates significant at 10, 5, 1, .1% level.

TABLE 4. ESTIMATES OF THE DEMAND FOR CHILD CARE - CHILDREN UNDER 3 YRS.

Variable	Dominance		Tobit	Double-Hurdle	
	Complete	First-Hurdle		Independent	Dependent
(A) Participation					
Child					
Age					
6-12 months	.253H	.301*		.092	.194
	(.057)[a]	(.020)[a]		(.643)[a]	(.239)[a]
1-2 years	.568***	.606***		.473*	.493**
	(.000)	(.000)		(.013)	(.006)
2-3 years	.673***	.690***		.502*	.507**
	(.000)	(.000)		(.009)	(.006)
Boy	-.060	-.069		-.083	-.084
	(.440)	(.371)		(.471)	(.387)
Mother					
Child-specific education	-.027	-.024		-.113	-.079
	(.774)	(.798)		(.450)	(.598)
Education					
< 12 years	-.242H	-.249H		-.320	-.319
	(.097)	(.100)		(.144)	(.148)
13-15 years	.285**	.282**		.407*	.394*
	(.004)	(.005)		(.015)	(.018)
16 years of	.653***	.665***		.996***	1.026***
	(.000)	(.000)		(.000)	(.000)
17 or more years	.699***	.694***		.473*	.466*
	(.000)	(.000)		(.036)	(.039)
African American	.037	.007		-.245	-.292
	(.780)	(.958)		(.175)	(.102)
Hispanic	-.288*	-.300*		-.363H	-.355H
	(.049)	(.042)		(.081)	(.089)
Catholic	-.318*	-.283*		-.485*	-.419*
	(.023)	(.039)		(.031)	(.025)
Jewish	.364	.553		.156	.406
	(.353)	(.131)		(.774)	(.367)
Exclusivist Protestant	-.238	-.148		-.416H	-.272
	(.104)	(.296)		(.067)	(.144)
Ecumenical Protestant	-.112	-.130		-.190	-.194
	(.422)	(.341)		(.399)	(.283)
Mormon	-.715H	-.589		-.917H	-.600
	(.082)	(.110)		(.097)	(.162)
Other Religion	-.483*	-.549*		-.758*	-.722**
	(.027)	(.013)		(.016)	(.009)
Intercept	-.742***	-.787***		.113	.017
	(.000)	(.000)		(.645)	(.945)
(B) Consumption					
Children					
Child=s Age	-6.195	-11.226*	5.431	-1.341	-5.255
	(.124)	(.019)	(.310)	(.795)	(.388)
Child=s Age^2	1.902	3.006*	.357	1.343	2.269
	(.125)	(.026)	(.836)	(.394)	(.208)

TABLE 4. ESTIMATES OF THE DEMAND FOR CHILD CARE - CHILDREN UNDER 3 YRS. (continued)

Variable	Dominance Complete	Dominance First-Hurdle	Tobit	Double-Hurdle Independent	Double-Hurdle Dependent
(B) Consumption continued					
Children					
Number of Siblings					
0-2 years	-6.206**	-5.885*	-4.018	-3.189	-2.786
	(.007)[a]	(.025)[a]	(.222)[a]	(.247)[a]	(.304)[a]
3-5 years	-.680	-.598	-.720	.548	.692
	(.639)	(.658)	(.722)	(.744)	(.681)
6-17 years	-3.282**	-3.160**	-5.025**	-4.452***	-4.321**
	(.004)	(.008)	(.002)	(.001)	(.002)
Mother					
Child-specific education	1.566	1.664	-.149	1.779	2.075
	(.357)	(.386)	(.953)	(.461)	(.481)
Education					
< 12 years	3.286	4.739	3.192	9.469H	11.256H
	(.346)	(.211)	(.462)	(.076)	(.077)
13-15 years	-4.776*	-6.714**	1.838	-4.703H	-7.378*
	(.018)	(.004)	(.513)	(.100)	(.050)
16 years	-7.929***	-12.392***	3.369	-10.055***	-16.391***
	(.001)	(.000)	(.324)	(.000)	(.001)
17 or more years	-7.387*	-12.395**	-5.228	-11.482*	-14.740**
	(.022)	(.005)	(.283)	(.013)	(.010)
African American	6.443*	6.391H	2.827	9.655*	12.107*
	(.019)	(.059)	(.452)	(.033)	(.026)
Hispanic	5.759H	8.330*	-2.834	4.940	7.843
	(.073)	(.034)	(.490)	(.237)	(.128)
Single Mother	6.224*	6.206*	13.098***	10.904**	11.072**
	(.015)	(.030)	(.000)	(.002)	(.002)
Wage Rate (predicted)	1.481***	1.501***	2.760***	2.764***	2.757***
	(.000)	(.000)	(.000)	(.000)	(.000)
Income ($1,000)	-.204*	-.206*	-.175	-.270**	-.269**
	(.014)	(.016)	(.142)	(.008)	(.010)
Income^2	.001*	.001**	.001	.002***	.002***
	(.012)	(.004)	(.134)	(.001)	(.001)
Relative Available	-4.628**	-4.745**	-16.312***	-8.130***	-8.180***
	(.003)	(.003)	(.000)	(.000)	(.000)
Price of Child Care (predicted)	-4.637*	-4.865*	-4.761	-4.983H	-5.220H
	(.033)	(.045)	(.130)	(.084)	(.072)
Intercept	37.697***	53.450***	-8.188	18.314**	30.062***
	(.000)	(.000)	(.175)	(.002)	(.000)
σ 15.172	16.863***	29.388***	18.872***	20.530***	
		(.000)	(.000)	(.000)	(.000)
ρ	-.588**			-.533*	
		(.003)			(.030)
-Log Likelihood (A) + (B):	2452.462	2455.439	2374.234	2327.611	2326.907

Note: N = 1,174.

a numbers in parentheses are p-values.

H,*,**,*** indicates significant at 10, 5, 1, .1% level.

TABLE 5. ESTIMATES OF THE DEMAND FOR CHILD CARE - CHILDREN 3 YRS. and OLDER

Variable	Dominance Complete	Dominance First-Hurdle	Tobit	Double-Hurdle Independent	Double-Hurdle Dependent
(A) Participation					
Child					
Age					
4-5 years	.427***	.427**		.571*	.407*
	(.001)[a]	(.002)[a]		(.024)[a]	(.043)[a]
5-6 years	.701***	.701***		1.294*	1.116**
	(.000)	(.000)		(.021)	(.010)
Boy	-.244*	-.244*		-.482*	-.234
	(.045)	(.048)		(.029)	(.126)
Mother					
Child-specific education	.188	.188		.365	.189
	(.209)	(.213)		(.202)	(.476)
Years of Schooling	.166***	.166***		.196***	.237***
	(.000)	(.000)		(.001)	(.000)
African American	.166	.166		-.121	-.303
	(.457)	(.471)		(.714)	(.321)
Hispanic	.215	.215		.044	.015
	(.323)	(.345)		(.909)	(.965)
Catholic	.180	.180		.405	.246
	(.389)	(.414)		(.242)	(.280)
Exclusivist Protestant	.030	.030		.196	.138
	(.891)	(.896)		(.559)	(.566)
Ecumenical Protestant	.234	.234		.549	.383
	(.256)	(.279)		(.119)	(.109)
Intercept	-2.114***	-2.114***		-2.063*	-2.467**
	(.000)	(.000)		(.013)	(.002)
(B) Consumption					
Children					
Child=s Age	-2.156	-1.583	29.544*	16.315	16.164
	(.852)	(.890)	(.032)	(.211)	(.273)
Child=s Age^2	.146	.117	-2.850H	-1.788	-1.986
	(.913)	(.929)	(.076)	(.234)	(.248)
Number of Siblings					
3-5 years	1.138	1.165	4.432H	2.264	2.868
	(.592)	(.601)	(.091)	(.403)	(.269)
6-17 years	-.713	-.688	-3.750***	-2.713**	-3.015**
	(.477)	(.475)	(.001)	(.007)	(.003)
Mother					
Child-specific education	1.632	1.752	4.176H	2.251	1.844
	(.353)	(.324)	(.064)	(.306)	(.510)
Years of Schooling	-1.214**	-1.037	.001	-1.180*	-2.578***
	(.007)	(.218)	(.998)	(.026)	(.000)
African American	5.804*	5.904H	4.784	6.757	8.217H
	(.038)	(.079)	(.163)	(.114)	(.091)
Hispanic2.900	3.106	4.204	4.216	4.422	
	(.299)	(.209)	(.220)	(.164)	(.266)
Single Mother	7.290**	7.252**	7.819**	8.598**	8.402**
	(.002)	(.002)	(.007)	(.003)	(.003)

TABLE 5. ESTIMATES OF THE DEMAND FOR CHILD CARE - CHILDREN 3 YRS. and OLDER (continued)

Variable	Dominance Complete	Dominance First-Hurdle	Tobit	Double-Hurdle Independent	Double-Hurdle Dependent
(B) Consumption continued					
Wage Rate (predicted)	1.431***	1.430***	1.892***	1.897***	1.989***
	(.000)[a]	(.000)[a]	(.000)[a]	(.000)[a]	(.000)[a]
Income ($1,000)	-.154H	-.154H	-.162	-.185H	-.178
	(.060)	(.085)	(.126)	(.074)	(.117)
Income^2	.001	.001	.001H	.001	.001
	(.149)	(.335)	(.092)	(.156)	(.232)
Relative Available	-5.809***	-5.782***	-12.368***	-8.870***	-7.955***
	(.000)	(.000)	(.000)	(.000)	(.000)
Price of Child Care (predicted)	-2.874	-2.844	1.406	.153	-.121
	(.193)	(.191)	(.618)	(.954)	(.965)
Intercept	47.635H	42.208	-61.467*	-3.610	23.054
	(.061)	(.194)	(.043)	(.900)	(.478)
σ 13.557	13.320***	19.535***	15.791***	17.988***	
		(.000)	(.000)	(.000)	(.000)
ρ	.151			-.836***	
		(.792)			(.000)
-Log Likelihood (A) + (B):	1625.953	1625.949	1585.536	1564.923	1562.863

Note: N = 507.

a numbers in parentheses are p-values.

H,*,**,*** indicates significant at 10, 5, 1, .1% level.

TABLE 6. PROBABILITY OF PASSING PARTICIPATION AND CONSUMPTION HURDLES

	Children < 3 Years			Children ∃ 3 Years		
	Complete Dominance	Tobit	Independent Double-Hurdle	Complete Dominance	Tobit	Independent Double-Hurdle
Probability of passing participation hurdle	.35 (.00)[a]	N.A.	.59 (.45)[a]	.68 (.00)[a]	N.A.	.88 (.03)[a]
Probability of passing consumption hurdle	N.A.	.35 (.00)[a]	.70 (.00)[a]	N.A.	.73 (.00)[a]	.84 (.00)[a]
Probability of passing both hurdles	N.A.	N.A.	.41 (.45)[a]	N.A.	N.A.	.74 (.03)[a]

Note: Probabilities are calculated at sample means.
a numbers in parentheses are p-values.

APPENDIX

TABLE A1. ESTIMATES OF MOTHER=S WAGE RATE AND LABOR FORCE PARTICIPATION

Variable	Wage Rate	Labor Force Participation
Black	-1.51	-.31*
Education		
< 12 years	-2.10	-.29H
13-15 years	1.44H	.33**
16 years	5.24***	.54***
17 or more years	10.20***	1.12***
Work Experience	.11	-.16
Work Experience Squared	9.65**	1.52**
Number of Children		.004
Whether Children		
0-2 years	-.10H	-.05
3-5 years	-.09**	.08
6-12 years	-.10***	.02
13-17 years	-.04	.30H
Income ($1,000)		-.01***
Region of Residence		
Midwest	-1.42	-.01
South	.29	.24*
West	-.18	-.05
Unemployment Rate	.29	-.006
Intercept	-5.53**	-.85**
σ	7.89***	
ρ	.96***	
N 624	1,251	

Note: -Log Likelihood 3396.88.

H indicates significant at 10% level.
* indicates significant at 5% level.
** indicates significant at 1% level.
*** indicates significant at .1% level.

TABLE A2. ESTIMATES OF AVERAGE HOURLY FEE REGRESSIONS FOR CENTER CARE

Variable	Estimate
Group Size	-0.003
Staff-Child Ratio	0.510
Accredited Organization	0.152
Listed with R&R Agency	0.108*
Years in Operation	0.006**
Close to Public Transportation	-0.004
Full-Time	0.282**
Year Round	0.314***
Extended Hours Offered	-0.007
After School Care Provided	0.017
Based in Public School	-0.627***
Religious-Sponsored Program	0.045
Other-sponsored Program	-0.639***
Non-profit Independent Center	0.060
For-profit independent Center	0.131H
Primary Goal of Program	
Providing loving environment	0.235*
Preparing children for school	0.281*
Providing compensatory education	-0.048
Promoting child development	0.359***
Teaching appreciation for culture	0.084
Providing religious instruction	0.233
Percent of Staff	
Who are teachers	0.004*
Who are assistants	0.004H
Who are specialists	-0.006H
Percent of Teachers	
With master=s degree	0.003*
With bachelor=s degree	0.003*
With associate=s degree	0.002
With some college	0.001
With child development associate=s certificate	-0.0004
Who attendend some high school	-0.003
Randomly Chosen Teacher has Special Training	-0.004
Randomly Chosen Techer=s Years of Experience	-0.006
Staff Turnover	-0.0002
Percen of Children	
Who are black	-0.006***
Who are hispanic	-0.013***
Who are asian	-0.008***
Who are other minority	-0.005
Region[a]	
Alabama central city	-0.811**
Arizona central city	-0.050
California central city	-0.012
California other metropolitan	-0.169
Colorado central city	-0.278
Connecticut central city	0.409
Florida central city	-0.437*
Florida other metropolitan	-0.538*

TABLE A2. ESTIMATES OF AVERAGE HOURLY FEE REGRESSIONS FOR CENTER CARE (continued)

Variable	Estimate
Georgia central city	-0.128
Georgia other metropolitan	-0.544*
Georgia nonmetropolitan	-0.771*
Hawaii central city	-0.471
Idaho nonmetropolitan	-0.339
Illinois central city	-0.128
Illinois other metropolitan	-0.428H
Illinois nonmetropolitan	-0.900***
Indiana central city	0.182
Indiana other metropolitan	-0.850***
Kentucky other metropolitan	-0.884***
Louisiana other metropolitan	-0.719***
Maryland other metropolitan	-0.364
Massachusetts central city	0.275
Massachusetts other metropolitan	0.144
Massachusetts nonmetropolitan	0.102
Michigan central city	-0.371H
Michigan other metropolitan	0.073
Minnesota central city	-0.072
Minnesota other metropolitan	-0.520*
Minnesota nonmetropolitan	-0.797**
Nebraska central city	-0.490*
Nebraska nonmetropolitan	-0.839**
New Hampshire nonmetropolitan	-0.617*
New Jersey central city	-0.638*
New Jersey other metropolitan	-0.221
New Mexico other metropolitan	-0.623*
New Mexico nonmetropolitan	-0.150
New York central city	-0.280
New York other metropolitan	-0.472H
North Carolina central city	-0.547*
North Carolina other metropolitan	-0.755**
North Carolina nonmetropolitan	-0.773***
Ohio central city	-0.461*
Ohio other metropolitan	-0.835*
Oklahoma central city	-0.720**
Oklahoma other metropolitan	-0.917***
Oregon nonmetropolitan	-0.606*
Pennsylvania central city	-0.010
Pennsylvania other metropolitan	-0.675**
Rhode Island other metropolitan	-0.112
South Carolina other metropolitan	-0.893***
South Carolina nonmetropolitan	-0.890***
Tennessee central city	-0.677**
Tennessee nonmetropolitan	-0.961***
Texas central city	-0.654***
Texas other metropolitan	-0.896***
Virginia central city	-0.982***
Virginia other metropolitan	-0.185
Washington central city	-0.058

TABLE A2. ESTIMATES OF AVERAGE HOURLY FEE REGRESSIONS FOR CENTER CARE (continued)

Variable	Estimate
Washington other metropolitan	-0.342
West Virginia other metropolitan	-0.939*
Wisconsin other metropolitan	-0.550*
Wisconsin nonmetropolitan	-0.648*
Washington DC (omitted category)	
Intercept	0.755*
Adjusted R^2	.49

Note: N = 1,146.

a The NCCS/PCCS define central city as counties with cities whose population is at least 100,000 people and other metropolitan areas as all remaining metropolitan counties.

H indicates significant at 10% level.

* indicates significant at 5% level.

** indicates significant at 1% level.

*** indicates significant at .1% level.