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Transitions Between Child Care Arrangements for German Pre-Schoolers

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Abstract

This study uses a descriptive statistical approach to analyze the dynamics of child care for German pre-schoolers of all ages. Age-specific and duration-specific hazard rates for leaving informal care and for leaving formal care are calculated for various risk groups. Differences in the hazard rates across risk groups indicate the presence of important factors affecting transitions. The factors that we examine relate to household characteristics, the employment status of the mother, and regional supply. We find strong support for the hypotheses that households with fewer pre-schoolers and working mothers have greater demand for pre-school formal care. This demand also appears to be supply driven. The hazard rates of subsequent children does not differ significantly from those of the first child.

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Introduction

In recent years, there has been much debate about public policy concerning child care for pre-schoolers in Germany. In 1990 the German Parliament passed a law that will entitle each child aged three and older to a slot in a German Kindergarten starting in 1996. It will be the task of the communities to provide these slots and to support efforts to increase the number of slots in day care facilities for infants and toddlers. Having decided that government intervention is desirable, the next important step is to analyze the determinants of child care demand so that an effective child care policy can be designed.

Given this background, it is somewhat surprising that studies on the economics of child care demand based on German data are hard to find. To our knowledge the only study examining German child care from an economic perspective is the cross-sectional study of Merkle (1993). Based on the 1987 wave of the German Socio-Economic Panel (GSOEP), Merkle analyzed female labor supply and child care demand, but only for pre-schoolers over three years old. She did not examine the demand for care of infants and toddlers.

In this study we examine the determinants of child care demand for German pre-schoolers of all age groups. Our primary focus is the effect of five factors influencing this demand. Three of these factors relate to the current structure of the household in which the pre-schooler resides. First, economies of scale are possible in an informal care arrangement when there is more than one pre-schooler in the household (see, for example, Hofferth and Wissoker 1992, Ribar 1992, Brandon 1993, and Hotz and Kilburn 1994 for discussions in an American setting, and Merkle 1993 for a German context). Second, the absence of a male head of household will have an impact on the household budget constraint

and may reduce the set of feasible child care alternatives (see, for example, Kimmel 1992 for an American study). Third, a dynamic factor allows households to adjust to what they feel is the optimal child care arrangement as they learn from experience across children. This factor has not been discussed previously in the child care literature.

A fourth important factor relating to child care demand concerns the labor force status of the mother. As shown by Hotz and Kilburn (1991) in the case of American child care, demand patterns differ strongly across households with employed and non-employed mothers.

The fifth factor relates to the strong likelihood that child care demand in Germany is supply-driven regionally. This possibility has been discussed by Merkle (1993), while Gustafsson and Stafford (1992) present a similar argument for the case of Sweden.

The analysis employs nonparametric estimates of the probability that children of a certain age leave formal and informal child care arrangements conditional on having been in the given arrangement for a given length of time and tests for differences in these probabilities across different demographic groups and cohorts. The demographic groups and cohorts are defined in such a way that significant differences in the probabilities indicate the presence of one of the five factors described above. Transitions into and out of formal care arrangements are examined to determine changes in demand patterns across age cohorts and cohorts representing the same duration of time spent in the given arrangement.

This transition analysis represents a dynamic approach to the study of child care demand. Even in the broad Anglo-Saxon literature on the economics of child care studies static approaches predominate.[1] To our knowledge there are only four studies using a similar framework: Floge (1985), Blau and Robins (1991a and 1991b), and Wolf and Sonenstein (1991).

The paper is organized as follows. First, we start with a brief overview of the German child care system. Second, the theoretical background is given for the five effects that we examined,

followed by a description of the data used. Third, the statistical methodology is briefly explained. In a fourth section, the results are presented and discussed. Finally, we close with conclusions and perspectives on future research.

The German Child Care System[2]

The child care behavior of households cannot be understood without a knowledge of the broader framework in which this behavior takes place. In this section we present the relevant background for the German child care system. Because children under three and children three and over face different possibilities in the German child care system, it is important to discuss these two age groups separately.

Care for Children Under Three Years Old

The role of the public sector in providing care for infants and toddlers in Germany is guided by a policy based on the traditional picture of a family in which the mother takes the role of a housewife when the children are young (see Kurz 1992). A comprehensive parental leave and child care and education benefit law gives fiscal incentives for a parent to stay at home and take care of young children. If a caretaking parent does not want to be the only care provider, she may opt for an informal care arrangement, such as having a relative, friend, or baby-sitter as the care provider for her young children. Alternatively, German parents of young children may consider a formal care arrangement, sending their infants and toddlers to infant day care (so-called "Krippe") or to family day care ("Tagesmutter," literally day mother).

The German infant day care center is for infants and toddlers up to the age of three. As Table 1 indicates, 1.8 percent of all West German[3] children under three were cared for in infant day care in 1990; however, there is some regional diversity. Approximately 98 percent of all slots in infant day care were provided by the community or non-profit organizations, and only 2 percent by for-profit

organizations (Statistisches Bundesamt [Federal Statistics Office] 1992). Slots in infant day care are scarce and first priority usually goes to the children of single parents or low-income families. In 1990 about 26 percent of children below the age of three were cared for in licensed family day care (Deutsches Jugendinstitut [German Youth Institute] 1993 and Tietze, Rossbach, and Roitsch 1993).

Care for Children Three and Over

The main type of institutional care for children three years and over is the German Kindergarten. The German Kindergarten is a (non-mandatory) day care center for children three and over until they enter school. As Table 1 shows, approximately 80 percent of all children between three and six years old attended Kindergarten in 1990.[4] Kindergartens are usually open only four hours a day and therefore are not a complete care solution for all working parents—it has been estimated that only 12 percent of the slots in Kindergartens are full-day slots (Moss 1988). Although the general public considers the Kindergarten to be part of the educational system, it does not belong legally or organizationally to the German school system. In 1990, 99.6 percent of Kindergarten slots were provided by the communities or non-profit organizations (Statistisches Bundesamt 1992).

Federal child care regulations exist for infant day care, family day care, and Kindergartens. However, the federal law represents only a general framework which the German states can shape with their own legislative rules. Currently the majority of German states have specific regulations for infant day care, family day care, and especially Kindergartens.

In contrast to the child care debate in other countries child care policies in Germany concentrate more on giving each child the same opportunities to succeed when he or she enters school after Kindergarten. Thus, the child care discussion in Germany is less concerned with the employment status of mothers than, for instance, in the United States.

The Factors Affecting Transitions

In this section we present some theoretical considerations on the five demand factors and their effects on transitions between child care arrangements. In our analysis, special emphasis is placed on controlling for the child's age. Empirical research in child care frequently has treated the entire group of pre-schoolers as homogeneous. This ignores the fact that the needs of children change as they grow older. The literature on child development has suggested that the most appropriate type of care changes with the age of the child, even among pre-schoolers (see, for example, Leibowitz, Waite, and Witsberger 1988).

In analyzing transitions between different child care arrangements, it is also important to distinguish between the directions in which a transition can occur. Clearly, explanations for a transition from informal care to formal care will vary from ones for a transition in the reverse direction. We begin with transitions to formal care.

Transitions from Informal Care to Formal Care

The Economies of Scale Effect.   As discussed in many studies on child care demand, economies of scale effects are possible when there is more than one child. Merkle (1993) shows that the demand for a slot in a German Kindergarten is significantly influenced by the number of children in the household. This may be due to the fact that economies of scale exist when a parent takes care of the children. In such a case the total savings may increase with each additional child, since, for example, the fee per child is the same for each child in formal care. However, total savings depend on whether the other children in the household are pre-schoolers or school-children, since the care required by pre-schoolers is much more costly than for school-children (Leibowitz et al. 1988). Therefore, the probability of entering formal care for children in households with other pre-schoolers

should be smaller than the corresponding probability for children in households with no other pre-schoolers.

The Single-Parent Household Effect. For single-parent households child care is generally a more urgent problem than for two-parent families. Therefore, many child care studies have concentrated on married mothers (see, for example, Brandon 1993 and Ribar 1992) or have made separate analyses for children of married and single mothers (see, for example, Kimmel 1992). In most cases a single parent must work full-time to support the family, making an all-day care arrangement for the child necessary. An employment effect, which will be discussed below, deals with different probabilities for entering formal care due to parental employment status. However, there is another factor at work in single-parent households—they usually have fewer informal child care possibilities open to them, by virtue of the fact that there is no other partner to take care of the child. This availability factor will increase the difference between the probability of entering formal care for children living in a single-parent household and for children living in a two-parent family.

The Learning Effect. The effect of learning on child care demand is an issue that has not been addressed in the literature to date. It is reasonable to suppose that parents learn from the child care experience with their first child. The first possibility is that they act cautiously and keep this child at home as long as possible. But with subsequent children they may come to believe that it is not necessarily to the child's disadvantage to let her be cared for in formal care. A second possibility, resulting in fewer turnovers to formal care for subsequent children, is that parents have a bad experience with formal care for their first child and decide to keep subsequent children at home. Which possibility is dominant is an empirical question. However, because it is still widely debated whether formal care for infants and toddlers is appropriate, we suspect that the first child has a much smaller probability of entering formal care at a young age than subsequent children.

The learning effect and the economies of scale effect can neutralize or reinforce each other. Neutralization occurs if, in the learning effect, the probability of a subsequent child entering

formal care is higher than for the first child, whereas in the economies of scale effect the opposite

is true if the first child is still a pre-schooler. Reinforcement occurs if, in the learning effect, a

subsequent child has a lower probability of entering formal care. The tests that we conducted show how

these two effects interact.

The Employment Effect.   For non-employed mothers involved in home work, placing pre-

schoolers in formal care is likely to be suboptimal because it reduces their shadow wage. For employed

mothers, on the other hand, formal care may be much more desirable than alternative informal care

arrangements because better caretaker reliability in formal care will entail fewer work absences.

These arguments suggest that employed mothers send their child into formal care much earlier than do

non-employed mothers. Hotz and Kilburn (1991) showed that child care demand patterns of children in

the United States differ strongly for employed and non-employed mothers. Merkle (1993) found that the

demand for a slot in a German Kindergarten is not significantly related to the employment status of a

mother. However, we feel that it is important to use our methodology to examine the employment effect

for all age groups.

The Supply Effect.   That regional supply factors affect demand in a significant way has been

shown in studies by Lehrer (1989), Hofferth and Wissoker (1992), Brandon (1993), and Merkle (1993). In

Germany the market for child care is rarely in equilibrium, with excess demand at prevailing prices.

Formal child care in Germany is offered mainly by communities or non-profit organizations. The German

child care market is not very competitive as a result of high barriers to entry (for example, in the

form of requirements for the quality and characteristics of facilities) and the absence of subsidies

to for-profit organizations. A state of excess demand can continue indefinitely. Thus, it seems

reasonable to ask if children living in regions with a relatively high supply of formal care slots

enter formal care earlier than children living in regions with a below average supply.

Transitions from Formal Care to Informal Care

      The Economies of Scale Effect.   In the context of transitions back to informal care, this effect states that as soon as there is an additional child in the household parents will take older children out of formal care. Thus, the probability of returning to informal care for children with pre-school siblings in the household should be higher than for children with school-age or no other siblings.

      The Learning Effect.   As mentioned previously, if parents have a bad experience with formal care for their first child, they are likely to keep subsequent children at home. This means that subsequent children who do enter formal care will be less likely to leave, since they will have had older siblings with favorable formal care experiences. Therefore, a first child might have a higher probability of an exit from formal care than subsequent children.

      The Employment Effect.   For this type of transition an employment effect will arise because a (recently) non-employed parent will want to take children out of formal care to effect a shadow wage increase. This will result in a higher probability of leaving formal care for children of non-employed mothers compared to children of employed mothers.

      We do not present the results below for the single-parent household effect for transitions out of formal care—uniformly insignificant results were due to an extremely small sample size. Nor do we present results for a supply effect for this type of transition, since prevailing excess demand for formal care should not affect the exit rate from formal care.

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Data

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      The data used in our analysis comes from the English Language Public User File of the German Socio-Economic Panel (GSOEP). This German Panel Study has been conducted annually since 1984. A sample of 5,921 households was selected to represent the entire population of West Germany, including

Germany's five largest groups of foreign nationals. East German households were added in 1990 (see Wagner, Burkhauser and Behringer 1993). The analysis in this study is based on the West German subsample of the GSOEP and excludes foreign nationals.[5]

For our dynamic analysis, we used information from the first nine waves of the GSOEP, covering the years 1984 to 1992. This information was used to construct durations for arrangements for pre-schoolers. The sample was restricted to children for whom a half-year birth window can be inferred. Further, the assumption was made that each child is in informal care immediately after birth (there appears to be strong support for this in the data), but may switch to formal care as early as the first interview after birth (usually a six-month period after the child is born). To avoid cases with substantial loss of information within the care history, all children born in 1982 or earlier were excluded from the sample, since the period between birth and the first interview in 1984 would have greatly exceeded six months.

One further attempt was made to restrict the period between birth and the first interview to approximately six months. For children born in the early part of 1983, the length of time to the first interview would likely have been closer to one year. The following strategy was implemented to keep such children out of the sample. From the information of the first interview in 1984, the calendar month of the interview was obtained.[6] Children born before the corresponding calendar month in 1983 were excluded from the sample. For children retained in the sample and born between 1983 and the interview in 1986, it is possible to observe a complete pre-school care history. For children born after the interview in 1986, the history can, in principle, be observed until 1992. Once missing information for a child care history was found, the spell of the child care state observed in the previous year was deemed to be ongoing (right-censored), and the history was ended.

The child care information used in the analysis was taken from a set of questions about children in the household below the age of 16, answers to which are given by one household member in

each wave of the GSOEP. The current child care arrangement was obtained from the answer to the following question:

"Which of the following institutions is your child visiting at the present time?"

The possible answers for respondents with pre-school children are:

(1) Infant Day Care; Kindergarten; Family Day Care: half day
(2) Infant Day Care; Kindergarten; Family Day Care: all day
(3) No institution.

This question is asked for the four oldest children in each household.[7] Based on respondents' answers to these questions, it is possible to define child care arrangements for each child.

By informal care we mean care by the mother, father, a relative, a babysitter, or a friend. It can take place either in the home of the parents or in the home of the caretaker. Common to all of these possibilities is the fact that care will usually take place in small groups and is not regulated by the state. A child is considered to be in informal care if the respondent says that the child is visiting none of the institutions named.

By formal care we mean any combination of child care types that does not involve only informal care. Formal and informal care are not mutually exclusive—if formal care is used, some kind of informal care is frequently used as well. This is especially true for Germany, where most formal child care is half-day care. Therefore, a precise distinction can be made only between informal care alone and informal care together with formal care. However, for convenience, the simple expression "formal care" will be used to describe the second situation—a child is said to be in formal care if the respondent answers that the child is visiting one of the institutions named, regardless of whether it is half day or all day.

The child care question refers only to the current state of affairs each time it is asked. There is no guarantee against multiple changes in the type of child care arrangement occurring from one

interview to the next. Such changes are not observed in the data and, to the extent that multiple changes occur within the period, the hazard rates that will be presented are biased downward. We feel confident that this bias is not severe. The relative frequency of observed switches between formal and informal care from year to year appears to be small enough in most cases to suggest that multiple switches within a single-year interval do not occur regularly. Moreover, to the extent that a switch represents a short, temporary change or simply a brief experiment with a particular arrangement, we would not want it to affect the analysis.

Excluding the case of missing information, each child care history was followed until it was reported that the child was in school. Because virtually all children in Germany are in school at age seven, each history was concluded with the seventh interview after birth (at approximately age six and a half).

In the final analysis sample, there are 992 children, belonging to 711 mothers. The maximum number of children for a mother in our sample is five.

Methodology

An expedient starting point for the discussion of our age-duration profiles is a brief presentation of what duration modelers call discrete-time event-history analysis. Event-history analysis is said to take place in discrete time if it is not possible to pinpoint precisely when during a period an event occurs. There are two types of events that are of concern to us: a change in child care arrangements from informal care to formal care and the reverse—a change in child care arrangements from formal care to informal care. In neither case do the data allow us to pinpoint precisely when during a period (in our case the time interval between birth and the first interview after birth, or, otherwise, the time interval between successive interviews) an event takes place; accordingly, the analysis is in discrete time.

A spell is the total time period between two events. An informal care spell is a spell that is spent in informal care, while a formal care spell is a spell that is spent in formal care. The duration of a spell is the total length of time (in periods) between the two events delineating the spell. For the first informal care spell the first event is birth rather than a change of arrangements to informal care from formal care. The end of the first informal care spell is a change to formal care. For all spells after the first informal care spell the events marking the span of the spell are changes from one type of arrangement to the other. The first period of the first informal care spell represents approximately one-half year of calendar time; the six remaining periods each last approximately one full year.

Typically, the duration modeler is interested in obtaining a description of the durations of a given type of spell. One type of description is the probability that the duration of a certain spell type lasts t periods, for all possible values of t. This describes the probability density function of the spell type. It is an unconditional description in that nothing else is required to happen; a conditional description requires a conditioning event to occur as well. The most common type of conditional description discussed by duration modelers is the hazard rate (or conditional failure rate). The hazard rate is the conditional probability that the duration of a certain type lasts less than $t + 1$ periods, given that it has lasted at least t periods.

A simple duration profile (as distinct from an age-duration profile) gives estimates of the hazard rate for each possible value of t (the current duration) for the given spell type. An age-duration profile, on the other hand, gives estimates of the hazard rate for the given spell type for each possible value of t and each possible age (in periods) of the child.

Estimates of the hazard rates were obtained using a simple nonparametric procedure which enables a straightforward description of variation in the data due to both the age of the child and the current duration of the spell. In a simple duration profile the estimate of the hazard rate for the

period is the ratio of the number of spells of the given spell type that end in period t, $c(t)$, to the number of spells of the given spell type that last to the beginning of period t, i.e., the number of spells in the risk set for period t, denoted by $n(t)$. Thus, the estimate of the hazard rate at t, $h(t)$, is given by $h(t) = c(t)/n(t)$. An estimate of the standard error of the hazard rate at t is given by $s(t)$ $= (h(t)(1 - h(t))/n(t))^{1/2}$.

For an age-duration profile, an estimate of the age-specific hazard rate at t is denoted by $h(t,a)$, where a stands for the age of the child. The denominator of the estimate is $n(t,a)$, the number of spells that last to the beginning of period t and for which the child has age a (in periods) at the end of period t.[8] The numerator of the estimate is $c(t,a)$, given by the number of the $n(t,a)$ spells that end in period t. Thus, $h(t,a) = c(t,a)/n(t,a)$. The standard error of the estimate is given by $s(t,a) = (h(t,a)(1 - h(t,a))/n(t,a))^{1/2}$. The asymptotic t-statistic of the age-specific hazard rate is given by the ratio of $h(t,a)$ to $s(t,a)$.

Finally, if there are two independent age-duration profiles, labeled 1 and 2, it is possible to test whether age-specific hazard rates are equal across profiles.[9] The asymptotic t-statistic for this test is given by the formula:

$$(h_1(t,a) \& h_2(t,a))/((s_1(t,a))^2 \% (s_2(t,a))^2)^{1/2},$$

where $s_i(t,a)$ is the standard error of $h_i(t,a)$ for each i.

For the analysis below tests for the presence of factors affecting transitions were performed in the following manner: two independent age-duration profiles were created, each consisting of periods from child care spells of the correct type. Then, to test for different hazard rates for the same cells across profiles, we used the asymptotic t-test described above.

Whether each period of the child care spell of the correct type contributed to the first or second profile was decided by determining to which of two appropriate risk groups the period belonged. The determination of the risk group for a period was made on the basis of values for control variables

described in the Appendix. A list of the two risk groups for each of the five effects is given in Table 2.

We used nonparametric hazard rate estimates for the age-duration profiles in this study because they do not require the choice of a particular specification, which would bias estimates if the specification were incorrect. However, an important disadvantage of this nonparametric technique is that a new risk group must be defined for every relevant combination of control variables. This makes it difficult to control for several factors simultaneously without severely restricting sample size in the risk groups. To some extent our parsimonious use of controls leads to a problem of heterogeneity within risk groups. Note, however, that this problem is alleviated to the extent that individuals can change risk groups over time depending on the current values of the control variables used in the analysis.

Results

In the GSOEP data, children who complete an informal care spell before going to school spend on average four and a half years after birth in informal care. The average completed duration for other types of spells is much shorter. If a child enters formal care as a pre-schooler and exits before entering school, the average stay in formal care is approximately 21 months. Rarely do more than four transitions occur. The most common pattern is that a child enters formal care between the age of three and five and stays until entering school.

In Tables 3 and 5 an age-duration profile from the entire sample is presented for each of the two types of transition. The columns give the age of the child in approximate number of years. The rows give the current duration of the spell in approximate number of years. In each cell, the estimated hazard rate and standard error is given, together with the relevant sample size, which is denoted by n.

Transitions from Informal Care to Formal Care

We start with the hazard rate estimates for the transition from informal care to formal care in Table 3. The age-duration profile for this kind of transition has the following properties. Hazard rates along the diagonal represent the conditional probabilities of entering formal child care for the first time. The relevant approximate durations for these rates in years are 0.5, 1.5, 2.5, and so on. All hazard rates above the diagonal represent the conditional probabilities of a switch from informal to formal care when the child has already been in formal care at least once before. The relevant approximate durations for these rates in years are 1, 2, 3, and so on. As the diagonal indicates, the conditional probability of first entering formal care increases with age and reaches a maximum in the sixth period. By the age of six months, only 1 percent of the children have entered formal care. For the next two years the conditional probability of leaving informal care is approximately 4 percent in each year. This is followed by two years of substantial increases in the hazard rate, peaking at 78 percent for the age group 4.5 to 5.5.

The complete age-duration profiles used to test for the presence of the five factors are not presented. For transitions from informal to formal care we present only the results from the diagonal of the age-duration profiles of the two risk groups. Table 4 summarizes the results. For each effect there are three columns. The first column gives the results for the first risk group, the second gives the results for the second group at risk, while the third shows the t-statistics. For each risk group, the first line in a cell gives the hazard rate, the second gives the standard error, and the third shows the sample size.

The Economies of Scale Effect. As shown in Table 4, the estimated conditional probability for German infants between the ages of 0.5 and 1.5, having no siblings in the household under age 16, is higher than for the same age in the other risk group. The difference is significant at the 5 percent level for a one-tailed test. The only other difference significant at the 5 percent level occurs for

children between the ages of 3.5 and 4.5. Nearly 80 percent of all pre-schoolers still in informal

care and without siblings in the household enter formal care at this age; however, the figure is only

67 percent for pre-schoolers in a household where economies of scale could occur.[10]

  The Single-Parent Household Effect. For the case of single-parent versus two-parent German

households, the results are the opposite of what was expected. Children in single-parent households

under six months old or between the ages of 2.5 and 3.5 have significantly lower hazard rates for

entering formal care than children in the same age groups in two-parent households. The fact that

German Kindergartens are only half-day care facilities might be a partial explanation for the higher

age group, since employed single mothers may need all-day care. The fact that no child of a single

mother was in formal care at the age of six months is noteworthy given that infant day care centers are

supposed to give priority to children of single mothers.

  The Learning Effect. The results for the learning effect do not give support for learning by

parents. The hazard rates for the two risk groups do not differ significantly for any cell.

  The Employment Effect. The empirical results in Table 4 clearly verify the existence of an

employment effect. For the four youngest age groups children of employed mothers show a higher

conditional probability of entering formal care that is significant at the 1 percent level.

Differences are insignificant for the three oldest age groups, i.e., from age 3.5 on. The results show

that as children grow older the employment status of the mother becomes a less important factor in the

movement to formal care.

  The Supply Effect. The results in Table 4 suggest that hazard rates are higher in states with

above average levels of formal care supply for children between the ages of 1.5 and 4.5. For the period

between the ages of 2.5 and 3.5, the hazard rate is 40 percent in states with above average supply and

26 percent in states with below average supply. The difference is significant at the 1 percent level

based on a one-tailed test. For the two periods surrounding this one, the difference is significant at only the 5 percent level.

Transitions from Formal Care to Informal Care

In Table 5 the age-duration profile for transitions from formal care back to informal care is presented. In most age groups, the hazard is highest at a duration of one year. The parents of children who return to informal care after such a short time may be of the opinion that their child was not doing well in formal care. After the first year in a formal care spell the conditional probability of a transition back to informal care is relatively low. There are few cases in the data of a child being in formal care for a period of three years or longer—to some extent this may be due to the right-censoring of the spells. The results also indicate that children under the age of 3.5 experience more instability in their child care arrangements than older children. This is consistent with Blau and Robins (1991a).

The analysis for transitions back to informal care concentrates on the upper right corner of the relevant profile because of small sample sizes for age groups below 3.5. As there are also small sample sizes for ages 3.5 and above for durations of three years or more, we are left with the upper right corner of the profile—ages 3.5 and above for durations of one or two years.[11] The results are given in Table 6, which is set up the same way as Table 4.

The Economies of Scale Effect. If this effect exists, children with siblings should experience more turnovers from formal care to informal care than their counterparts without siblings. The reason for this is that turnovers from formal care may coincide roughly with sibling births. Hazard differences are significant at the 1 percent level for children between the ages of 3.5 and 4.5 with one year in formal care. For the other four cells examined, there are no differences significant at the 5 percent level.

The Employment Effect. Estimated hazard rates of returning to informal care for children of non-employed mothers do not differ significantly from the estimated hazards for children of employed mothers.

The Learning Effect. As Table 6 indicates, a learning effect leading to higher turnover rates for the first child compared to subsequent children does not appear to exist. This is the same result as for transitions into formal care.

Conclusion

This study presents a statistically descriptive approach for examining transitions between different child care arrangements for pre-schoolers in Germany. Using a data set representative of West German pre-schoolers born after the first half of 1983, we constructed age-duration profiles for transitions between formal and informal care and tested the existence of factors affecting transitions between child care arrangements. These factors related to household characteristics of a child, the employment status of the mother and regional differences in supply of formal child care. In contrast to Blau and Robins (1991a), one of the few studies in which turnovers between child care arrangements are analyzed, this study distinguishes the direction of transitions from one child care arrangement to the other. It is also distinct from Blau and Robins (1991a) in that hazard rates for specific child care arrangements are presented.

The focal points of this study are:

1. Younger children experience higher rates of turnover in child care arrangements than older pre-schoolers.

2. There are indications of an economies of scale effect. Children in larger households have a lower probability of entering formal care than those in smaller households. Given the decline in the number of children in German households due to the decreasing fertility rates, these results indicate an increase in the demand for formal child care in the

future. Turnover from formal care arrangements is also affected by economies of scale due to sibling births.

3. This study is the first to address the possible existence of learning effects. As consumers of child care, parents do not appear to learn from previous child care experiences. Whether such effects can be observed with other data is an interesting topic for future research.

4. Children of employed mothers enter formal care earlier and more frequently than children of non-employed mothers. However, we did not find a significantly higher turnover rate from formal care to informal care when the mother is not employed. Nevertheless, the results give the first indication that the use of formal child care in Germany may depend strongly on the employment status of the mother. If this is indeed the case, there is a need for German day care centers to respond to the requirements of employed mothers with younger pre-schoolers, e.g., flexible opening times, lunch service and transportation to and from home.

5. The demand for formal child care in Germany is supply driven. As child care is part of the regional infrastructure, regional differences in the supply of formal care increase the gap in educational standards among regions.

The age-duration profile is an important nonparametric tool for analyzing the duration of child care spells in West Germany. A confirmatory step would be to analyze German child care spells in the framework of a semi-parametric duration model that incorporates many relevant covariates. Results might change if we control simultaneously for a large set of discrete qualitative covariates as well as for continuous quantitative factors. For example, taking account of these factors would allow us to gauge the direct influence of parental resources on the duration of child care arrangements. This study demonstrates that the emphasis of such a duration model should be on the number of children in the household, the employment status of the mother, and supply indicators.

	Slots in Infant Daycare Per 100 Children, Aged Under 3			Slots in Kindergartens Per 100 Children, Aged 3 to 6		
TABLE 1 **PRE-SCHOOL PROVISION RATES FOR GERMANY,** **1982, 1986, 1990 BY STATE**						
	1982	**1986**	**1990**	**1982**	**1986**	**1990**
Schleswig-Holstein	0.3	0.6	0.7	62	62	64
Hamburg	10.2	11.0	9.8	59	56	52
Lower Saxony	0.8	0.9	1.6	56	67	66
Bremen	0.6	0.9	2.0	74	87	75
Northrhine-Westphalia	0.2	0.4	0.9	69	78	75
Hesse	1.4	1.5	1.8	92	92	90
Rhineland-Palatina	0.4	0.4	0.5	98	100	98
Baden-Württemberg	1.2	1.2	1.1	105	105	104
Bavaria	0.9	0.9	0.9	68	69	72
Saarland	0.6	0.4	0.8	99	96	95
Berlin	17.8	19.8	17.9	64	66	65
Federal Average	1.4	1.6	1.8	77	81	80

Source: Statistisches Bundesamt (1985, 1988, 1992), and authors.

TABLE 2

RISK GROUPS FOR THE EFFECT TESTS

Effects	First Group at Risk	Second Group at Risk
Economies of Scale Effect	Only one child in the household	More than one child in the household
Single-Parent Household Effect	Single-parent household	Two-parent household
Learning Effect	First child with no other children in the household	Subsequent children with no other pre-schoolers in the household
Employment Effect	Mother employed	Mother not employed
Supply Effect	Living in a state with above average supply of formal care	Living in a state with below average supply of formal care

Source: Authors.

TABLE 3

**AGE DURATION PROFILE FOR TRANSITIONS FROM
INFORMAL CARE TO FORMAL CARE**
(entire sample)

Duration of Care	Age of Child						
	Aged 0 to 0.5	Aged 0.5 to 1.5	Aged 1.5 to 2.5	Aged 2.5 to 3.5	Aged 3.5 to 4.5	Aged 4.5 to 5.5	Aged 5.5 to 6.5
1 or 0.5 years	0.010 (0.003) n=992	C (C) n=0	0.200 (0.179) n=5	0.857 (0.132) n=7	0.636 (0.145) n=11	0.429 (0.187) n=7	0.300 (0.145) n=10
2 or 1.5 years		0.040 (0.007) n=820	C (C) n=0	0.250 (0.217) n=4	0.000 (0.000) n=1	1.000 (0.000) n=2	C (C) n=0
3 or 2.5 years			0.039 (0.008) n=646	C (C) n=0	1.000 (0.000) n=3	0.000 (0.000) n=1	C (C) n=0
4 or 3.5 years				0.310 (0.020) n=513)	C (C) n=0	C (C) n=0	1.000 (0.000) n=1
5 or 4.5 years					0.701 (0.028) n=271	C (C) n=0	C (C) n=0
6 or 5.5 years						0.780 (0.054) n=59	C (C) n=0
7 or 6.5 years							0.200 (0.179) n=5

Source: Authors.

TABLE 4

**TRANSITIONS FROM INFORMAL CARE TO FORMAL CARE: RESULTS FROM
THE DIAGONAL OF THE AGE-DURATION PROFILES**

Child's Age Group and Duration of Being in Informal Care	Economies of Scale Effect			Single-Parent Household Effect			Learning Effect		
	Risk Group			Risk Group			Risk Group		
	I	II	t-stat	I	II	t-stat	I	II	t-stat
Aged 0 to 0.5; 0-5 years in informal care	0.009 (0.004) n=469	0.011 (0.005) n=523	-0.467	0.000 (0.000) n=25	0.010 (0.003) n=967	-3.179	0.007 (0.004) n=459	0.024 (0.017) n=83	-1.018
Aged 0.5 to 1.5; 1.5 years in informal care	0.055 (0.012) n=363	0.028 (0.008) n=457	1.866	0.048 (0.046) n=21	0.040 (0.007) n=799	0.161	0.056 (0.012) n=355	0.031 (0.018) n=97	1.186
Aged 1.5 to 2.5; 2.5 years in informal care	0.051 (0.015) n=214	0.032 (0.009) n=432	1.096	0.050 (0.049) n=20	0.038 (0.008) n=626	0.236	0.053 (0.016) n=207	0.037 (0.018) n=107	0.655
Aged 2.5 to 3.5; 3.5 years in informal care	0.270 (0.038) n=137	0.324 (0.024) n=376	-1.210	0.150 (0.080) n=20	0.316 (0.021) n=493	-2.016	0.267 (0.039) n=131	0.264 (0.042) n=110	0.062
Aged 3.5 to 4.5; 4.5 years in informal care	0.797 (0.050) n=64	0.671 (0.033) n=207	2.091	0.625 (0.171) n=8	0.703 (0.028) n=263	-0.452	0.783 (0.053) n=60	0.684 (0.052) n=79	1.337
Aged 4.5 to 5.5 5.5 years in informal care	0.750 (0.153) n=8	0.784 (0.058) n=51	-0.210	0.500 (0.250) n=4	0.800 (0.054) n=55	-1.173	0.857 (0.132) n=7	0.750 (0.088) n=24	0.674
Aged 5.5 to 6.5; 6.5 years in informal care	0.000 (0.000) n=1	0.250 (0.217) n=4	-1.155	0.000 (0.000) n=1	0.250 (0.217) n=4	-1.155	c (c) n=0	0.000 (0.000) n=3	

	Employment Effect			Supply Effect		
	Risk Group			**Risk Group**		
Child's Age Group and Duration of Being in Informal Care	**I**	**II**	**t-stat**	**I**	**II**	**t-stat**
Aged 0 to 0.5; 0-5 years in informal care	0.047 (0.017) n=149	0.004 (0.002) n=843	2.488	0.031 (0.031) n=32	0.009 (0.003) n=960	0.708
Aged 0.5 to 1.5; 1.5 years in informal care	0.105 (0.020) n=238	0.014 (0.005) n=582	4.464	0.074 (0.050) n=27	0.039 (0.007) n=793	0.688
Aged 1.5 to 2.5; 2.5 years in informal care	0.070 (0.017) n=227	0.021 (0.007) n=419	2.662	0.211 (0.094) n=19	0.033 (0.007) n=627	1.887
Aged 2.5 to 3.5; 3.5 years in informal care	0.384 (0.037) n=177	0.271 (0.024) n=336	2.584	0.396 (0.036) n=182	0.263 (0.024) n=331	3.047
Aged 3.5 to 4.5; 4.5 years in informal care	0.731 (0.046 n=93	0.685 (0.035) n=178	0.794	0.780 (0.046) n=82	0.667 (0.034) n=189	1.992
Aged 4.5 to 5.5 5.5 years in informal care	0.800 (0.089) n=20	0.769 (0.067) n=39	0.275	0.786 (0.110) n=14	0.778 (0.062) n=45	0.063
Aged 5.5 to 6.5; 6.5 years in informal care	0.000 (0.000) n=2	0.333 (0.272) n=3	-1.225	0.000 (0.000) n=1	0.250 (0.217) n=4	-1.155

TABLE 4 (CONT.)

TABLE 5

**AGE-DURATION PROFILE FOR TRANSITIONS FROM
FORMAL CARE TO INFORMAL CARE**
(entire sample)

Duration of Care	Age of Child						
	Aged 0 to 0.5	Aged 0.5 to 1.5	Aged 1.5 to 2.5	Aged 2.5 to 3.5	Aged 3.5 to 4.5	Aged 4.5 to 5.5	Aged 5.5 to 6.5
1 year	C (C) n=0	0.750 (0.153) n=8	0.370 (0.093) n=27	0.391 (0.102) n=23	0.053 (0.020) n=131	0.073 (0.021) n=150	0.000 (0.000) n=36
2 years		C (C) n=0	1.000 (0.000) n=1	0.200 (0.103) n=15	0.083 (0.080) n=12	0.010 (0.010) n=97	0.055 (0.031) n=55
3 years			C (C) n=0	C (C) n=0	0.000 (0.000) n=10	0.000 (0.000) n=9	0.038 (0.038) n=26
4 years				C (C) n=0	C (C) n=0	0.000 (0.000) n=6	0.000 (0.000) n=5
5 years					C (C) n=0	C (C) n=0	0.000 (0.000) n=2
6 years						C (C) n=0	C (C) n=0
7 years							C (C) n=0

Source: Authors.

TABLE 6

TRANSITIONS FROM FORMAL CARE TO INFORMAL CARE: SELECTED RESULTS
FROM THE AGE-DURATION PROFILES

Child's Age Group and Duration of Being in Formal Care	Economies of Scale Effect			Learning Effect			Employment Effect		
	Risk Group			Risk Group			Risk Group		
	I	II	t-stat	I	II	t-stat	I	II	t-stat
Aged 3.5 to 4.5; 1 year in formal care	0.000 (0.000) n=24	0.065 (0.024) n=107	-2.737	0.000 (0.000) n=23	0.045 (0.031) n=44	-1.447	0.055 (0.031) n=55	0.053 (0.026) n=76	0.048
Aged 4.5 to 5.5; 1 year in formal care	0.029 (0.029) n=34	0.086 (0.026) n=116	-1.457	0.036 (0.035) n=28	0.075 (0.036) n=53	-0.788	0.069 (0.033) n=58	0.076 (0.028) n=92	-0.165
Aged 5.5 to 6.5; 1 year in formal care	0.000 (0.000) n=5	0.000 (0.000) n=31		0.000 (0.000) n=4	0.000 (0.000) n=16		0.000 (0.000) n=12	0.000 (0.000) n=24	
Aged 4.5 to 5.5; 2 years in formal care	0.000 (0.000) n=16	0.012 (0.012) n=81	-1.006	0.000 (0.000) n=15	0.000 (0.000) n=39		0.000 (0.000) n=48	0.020 (0.020) n=49	-1.010
Aged 5.5 to 6.5; 2 years in formal care	0.154 (0.100) n=13	0.024 (0.024) n=42	1.265	0.167 (0.108) n=12	0.000 (0.000) n=21	1.549	0.080 (0.054) n=25	0.033 (0.033) n=30	0.736

Source: Authors.

Appendix

Definition of the Control Variables

This section describes the control variables used to define the risk groups for the age-duration profiles.

Economies of Scale Effect.   For this effect, information on the number of pre-schoolers and school-children living in the household was used. Whether a child is a pre-schooler can be ascertained from a question asking whether the child is in school.

Single-Parent Household Effect.   For the effect concerning single mothers, a time-varying variable identifying a single-parent household was used.

Learning Effect.   To test this effect, information about whether a child is the first child of its parents was used. A retrospective question in 1985 asked for the birth years of up to eight children and enabled us to obtain the requisite information. To disentangle the learning effect and the economies of scale effect we excluded arrangement periods at the time of which there were other pre-schoolers in the household.

Employment Effect.   For the employment effect an indicator variable for employment is needed. We used the information on the current employment status of a respondent in the month of the interview. A mother is considered to be employed if she reports any kind of employment, regular or irregular, comprising full-time or part-time work, or vocational training. The group of non-employed mothers consists of women who show no employment or are unemployed. This group also includes mothers who are on parental leave.

Supply Effect.   To test the effect concerning the supply of formal care, state-specific information on the supply of formal care was used.[12] It was obtained from a quadrennial federal survey conducted by the German Federal Statistics Office which collects the number of slots in infant day care

or Kindergartens per 1,000 children in the appropriate age groups living in a given state. Information

on family day care is not collected by age group. We estimated the number of family day care slots for

infants and older pre-schoolers separately using an age distribution in Tietze et al. (1993) and

combined these values with infant day care and Kindergarten values. Given this information, a dummy

variable was created to indicate whether the child lived in a state with a child per slot ratio for the

relevant type of formal care that was greater than the West German average. Two out of 11 West German

states had an infant day care ratio greater than the average, while five states had a Kindergarten

ratio greater than the average. As Table 1 shows, the ratios for each state with the exception of

Bremen are stable in relation to the West German average.[13] Hence, there is virtually no time variation

in the supply variables.

Endnotes

1.   Recent studies on various aspects of the demand of child care for pre-schoolers using a static framework include Hofferth and Wissoker (1992), Leibowitz, Klerman, and Waite (1992), Michalopoulos, Robins, and Garfinkel (1992), Ribar (1992), Brandon (1993), and Hotz and Kilburn (1994).

2.   For a more detailed description of the German child care system in English see Tietze, Rossbach, and Ufermann (1989).

3.   All figures refer only to West German children.

4.   These figures are biased upward, since they do not take into account that some of the slots in a German Kindergarten will be taken by children younger than three or older than six.

5.   In a separate analysis for foreign pre-schoolers we found significantly different transition patterns than for German pre-schoolers.

6.   The information about the interview month of each wave is not available in the first English Language Public User File of the GSOEP. This information will be available in the new release of the Public User File. We would like to thank the Deutsches Institut für Wirtschaftsforschung [German Institute for Economic Research] for making this information available to us.

7.   In the first wave no distinction was made between half day and all day care and the family day care category was missing as an alternative institution.

8.   Note that spells that were right-censored at the end of period t contribute to $n(t,a)$.

9.   Two age-duration profiles are independent if, for all t, no spell contributes to both $n_1(t,a)$ and $n_2(t,a)$.

10.   We do not present the results of tests in which we examined whether we would obtain different results by changing the second risk group. In these tests, the second risk group was composed of households with more than one pre-schooler or of households with only one pre-schooler and at least one other child of school age.

11.   The age group 3.5 to 4.5 for a duration of two years is also excluded from Table 6 because of a small sample size.

12.   We would like to thank the Deutsches Institut für Wirtschaftsforschung [German Institute for Economic Research] for providing us with the state of residence variable.

13.   Bremen is the smallest German state, consisting of only two cities.

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