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Time for Children, a Study of Parents' Time Allocation*

Daniel Hallberg and Anders Klevmarken[†]

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Abstract

Process benefit scores indicates that time with own children is preferred before all other activities, closely followed by market work. The trade-off between parents' time with their own kids and market work, and its dependence on out-of-home day-care is analyzed in a simultaneous equation framework. Our empirical results suggest that parents' decisions about market work and time with children are strongly interdependent. Economic incentives work primarily through decisions about market work, while the direct effects on time with kids are weak. The results suggest that a change in the mother's work hours influences less the parents' time with their children than a change in the father's work hours does. This would imply that a policy working to increase the time with own children should primarily influence the father's work hours. We also find that parents prefer joint activities with children, and that out-of-home child-care is not chosen as a substitute for own time with kids.

Keywords: Time-use, child-care, family economics, simultaneous equation system, three-stage least squares, process benefits.

JEL Classification: D1, C5, J13, J22

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1 Introduction

It is likely that people always have and always will experience the shortage of time, that there is not enough time to do all one might want to do. Sometimes one gets the impression that modern society has increased pressure on people's participation in market work, household work and leisure activities. Modern society offers more activities among which we need to choose. Technical progress has increased productivity in market work and household work but less so in leisure activities. It takes as much time to enjoy an opera performance today as it did 200 years ago. Burenstam-Linder (1970) discussed "The harried leisure class", and there are frequently articles in newspapers and popular media about the difficulties to get time for everything.¹

It is often claimed that parents, and in particular parents with small children, is a group that suffers more from the shortage of time than most other groups. The major explanation to any change in the situation of families with children is the increased female labor force participation and the fact that in most families both parents work in the market. But one could also mention increased separation rates and increased frequency of single parenthood. Single mothers are vulnerable both to budget and time squeezes.

Economic theory of time allocation is not very conclusive and implications depend on what is assumed about time with children, i.e., whether it is to be considered "preferred leisure" or just an input in the household production process. In a traditional Becker-Gronau type of model², the parents'

¹A recent example is a series of articles in the Swedish daily Dagens Nyheter under the common heading "Har Du tid?" (Can you find the time?) published Oct. 2000; "Med tiden som bristvara" (Time is an article in short supply), "Det finns inget kvar av livet" (There is nothing left of life), "Tiden försvinner när båda jobbar" (Time runs out when both work); "Alla kämpar de mot bristen på tid" (Everyone struggle against the shortage of time), "Bristen på fritid är ingen klassfråga" (The lack of leisure time crosses all class barriers); "Färre pauser och mer ansvar i alla jobb" (Fewer brakes and more responsibility is common in all places of work), "Redan fullbokade engagerar sig mer" (Those already fully booked take on even more commitments), "Någon måste ta sig tid" (Someone has to do it!)

²This section relies on Bolin (1998), which is an excellent summary of several household

comparative advantages are very important in determining the allocation of time, while it is unimportant who generates the incomes and hence who gets an income change. In the cooperative bargaining model³, the comparative advantages are still important but outside options of each parent will modify and dampen results given by the Becker type of model. The income of each family member matters for the intra-household allocation of resources. In non-cooperative models one parent's decision about time in home production and market work will depend on the action of the other parent. In these models there is a "free rider" problem and the relative importance of comparative advantages is even less than in the cooperative model.

Changes in parents' endowment of human capital, in relative wages and incomes and in public policies to provide inexpensive child-care and other benefits to families with children have certainly influenced people's allocation of time. Much effort has gone into analyzing their impact on the supply of labor. We know relatively less about effects on time-use outside the labor market and in particular about child related time.

What do data suggest? Table 1 (borrowed from Klevmarken and Stafford, 1999) shows that fathers in the Nordic countries used 4-5 hours per day with their kids while mothers used 6-8 hours. Both parents used more time with younger kids than with the older. The studies behind the estimates in Table 1 relate both to different countries and different years, but in our judgement the difference in time is more important than the difference between these rather similar countries. We thus believe that time with own children has decreased. The two Swedish observations support this belief.

Additional details are given in Table 2, which shows time with and without children by hours of market work and gender. The change in time-use is small after differences in market work have been eliminated. For instance, there is no decline in time with kids either for full-time or part-time working mothers, but there is a major difference in time with kids between the two groups. Full-time working mothers use about three hours less. The increase in female market work is thus likely to explain a major share of the decline

models.

³See Chiappori (1988, 1992), and Apps & Rees (1997).

in time with kids for mothers.⁴

Why is it important to analyze parents' time with their children? There are both investment and consumption motives to allocate time to children. To have children is pension insurance in less developed cultures. Parents invest in children and get their return when children contribute to the support of their parents. Also in the modern societies of the West the young working generations provide for the old retired ones, but this is usually done in collective forms and there is only a weak link between each child's performance and the parents' well being when retired. Nonetheless, investments in children are important for economic growth and because it takes such a large share of current economic resources. Klevmarken and Stafford (1999) estimated that in Sweden total investments in children amounted to the same order of magnitude as investments in machinery and buildings.

The time young couples think they can allocate to children is also likely to influence the very decision to have children. If the early labor market career takes most of young couples' time, they are likely to postpone having children. This might be a partial explanation to the rather low fertility rates found in many Western countries.

The purpose of this paper is to analyze how economic incentives determine parents' allocation of time to their children taking the interdependence between market work, child-care and leisure into account. The concept of "process benefits" will play a prominent role in our analysis and in section 2 it is introduced in a simple utility maximization framework. Section 3 introduces the data used and presents descriptive evidence of the relative importance of process benefits in various activities. An econometric model is specified in section 4 for an empirical analysis the results of which are given in section 5. Section 6 concludes.

⁴The shift from part-time to full-time work is reflected in the two groups relative sample size shown in the last two rows of the table. The the share of full-time working mothers increased from 25 percent to 36 percent. For fathers we find a marginal decline from 67 to 64 percent.

2 Process benefits in a utility maximizing framework

Consider a household with a single parent. Assume that this parent derives utility from market work (t_h), from consumption goods bought on the market (X), from her children (C), from the time she spends with them (t_c), and from leisure activities (t_l). The utility function is

$$U = U(X, C, t_h, t_c, t_l). \quad (1)$$

This utility function is maximized subject to the following constraints; a production function for child quality, a budget constraint, and a time constraint,

$$C = c(t_c) \quad (2)$$

$$wt_h = X \quad (3)$$

$$T = t_h + t_c + t_l, \quad (4)$$

where w is the hourly wage rate and T is total time.⁵ The first order conditions for an optimal solution can be written in the following way,

$$U_{t_h} + U_X w = U_{t_c} + U_C \frac{\partial c}{\partial t_c} = U_{t_l} \quad (5)$$

which says that the marginal utility of market work, the marginal utility of children and the marginal utility of leisure must all be equal. Utility from market work comes in two ways, as a process benefit from working and as a consumption benefit of market goods.⁶ The utility of children also has two sources, the process benefit and the utility of having a child. Suppose now

⁵Becker (1960) studies fertility, introducing child quality as an commodity, which is produced by inputs of goods and parental time.

⁶We borrow Thomas Juster's (1985) terminology "process benefits" for the well-being derived from doing an activity independently of its end result. This concept of direct utility sometimes goes under the term "joint production", which can be seen as a special case in the household production function literature, see Becker (1965), and e.g. Lancaster (1966).

that all marginal utilities and the marginal product are decreasing in their arguments. In this simple model an increase in the wage rate w will increase market consumption and/or decrease market time. A decrease in market time will increase time with the children and/or leisure time. The marginal utility of children and of leisure will then decrease. If the marginal utility of children decreases less than the marginal utility of leisure for a given change in time-use, then relatively more time will become allocated to the children.

If the marginal product of bringing up children increases exogenously then more time is allocated to children while market time and leisure time is reduced. If the productivity of raising children is related to the schooling of the parents, then well-educated parents might be expected to use more time with their kids than less educated parents. But education is also positively related to the wage rate, and well-educated parents might have jobs, which give them relatively high process benefit from working. In the end it is not at all obvious that schooling will have a positive relation to time with kids. It depends on how highly well-educated parents value children relative to other sources of well-being.

The budget constraint (3) does not include nonlabor income, but it can easily be added. An increase in nonlabor income will increase purchases of consumption goods and/or be used to buy more leisure time or more time with the kids. The relative magnitude of these two effects will depend on the process benefits of market work. The smaller they are the more market time will be bought off in favor of leisure and time with kids. If the marginal benefit of children decreases less rapidly than the marginal benefit of leisure relatively more time will be used for children. If parents value children more highly than private leisure we might then expect to find that high-income parents spend more time with their children than low-income parents do.

The simple model above is a one-parent model. In most families there are two spouses and their interaction will in general influence the outcome, time with children. Depending on what is assumed about the interaction between the spouses it becomes more or less important who gets an increase in income or in the wage rate and who is well-educated. Comparative advantages in child raising and in market work are still important, but differences in

preferences for children, market work and leisure will become important too, and so will each spouse's own opportunities outside the family in the case of a game theoretical model.

This is not the place to systematically investigate all possible outcomes for various models, but rather to suggest a few hypotheses, which seem likely to us.

Assume that child quality is a "public good" within the family, the level of which depends on the time input of both spouses. Also assume that parents' time input at least to some degree are substitutes. If one spouse gets a wage increase and there is some form of income pooling in the family, then the other spouse will react as if the family got an income increase. The size of this income increase will depend on the relative importance of the substitution and income effects for the spouse who got the wage increase. If the income effect dominates, both spouses are likely to increase the activities they prefer most (children) and buy off time from the market. If the substitution effect dominates the first spouse will use more time in the market while the other will use less. If process benefits from market work are high for both spouses the additional income will be used for consumption. The first spouse is likely to increase market work and decrease other activities. The second spouse (no wage increase) will only decrease market work and increase child and leisure time marginally. If the first spouse chooses a reduction in child time, it will reduce child quality and thus the well-being of the second spouse. Her marginal utility of child quality will then increase and to balance this change she will increase child time at the expense of market and/or leisure time. If her process benefits of market work are high she will substitute leisure time for child time.

If there is no income pooling and no joint consumption of market goods the second spouse will only suffer from lower child quality and try to compensate by more child time and less time for market work and/or leisure. Compared to the previous case the reduction in market time is likely to be smaller because there is no need to compensate for a reduction in the marginal utility of consumption. Because income is not pooled the second spouse's consumption standard is not directly influenced by the first spouse's

increased wage rate.

If there is income pooling and one spouse's nonlabor income increases, this will primarily influence the other spouse in the same way as any income increase. If the increase will cause the first spouse to increase his child time, then there is a secondary effect on the second spouse, whose benefits from child quality will increase. She will reduce (increase less) her child time and increase (more) her time for other activities.

Let's now return to the single parent model and introduce out-of-home child-care. The production function (2) for child quality is modified in the following way,

$$C = c(t_c, t_{cc}) \quad (6)$$

where t_{cc} is hours in out-of-home child-care. The budget constraint will also have to include the expenditures for this kind of child-care,

$$wt_h = X + p_{cc}t_{cc} \quad (7)$$

where p_{cc} is the charge for one hour of out-of-home child-care. From these assumptions follows the marginal condition,

$$U_C \frac{\partial c}{\partial t_{cc}} = U_X p_{cc} \quad (8)$$

which says that the marginal utility of another hour in day care must equal that of spending the cost for this hour on consumption goods. This must hold jointly with the first order condition, which is now modified to

$$U_{t_h} + U_X w = U_{t_c} + U_C \frac{\partial c}{\partial t_c} - U_X p_{cc} = U_{t_l}. \quad (9)$$

For simplicity it is assumed that out-of-home child-care involves no minimum (or maximum) time restrictions and that the charge is constant. In this model parents will only choose out-of-home child-care if it is an efficient way to increase child quality. Day care might then free time for other activities including market work, and the incomes from market work are needed to pay for day care. The introduction of day care will in general increase

market work and decrease time for children and leisure.

There are furthermore no constraints such that day care is necessary if the parent is to work in the market at all. If we add a binding constraint,

$$t_h = t_{cc} \quad (10)$$

the marginal condition becomes,

$$U_{t_h} + U_X(w - p_{cc}) + U_C \frac{\partial c}{\partial t_h} = U_{t_c} + U_C \frac{\partial c}{\partial t_c} = U_{t_l}. \quad (11)$$

The marginal utility of market work now has three components: process benefits, consumption of market goods after day care have been paid for and the child quality created at the day care center. The sum of these components must equal the marginal utility of children created at home and the marginal utility of leisure. Without the constraint (10), the choice of day care was basically a consumption decision, but in this model it becomes a decision that is vital for labor supply. In this model, one would therefore expect children to stay longer hours in day care centers compared to the former model. A wage increase is likely to have a smaller effect on hours of work in this model than in the previous one because now an increase in market hours will not only decrease the marginal process benefit of working but also the marginal utility of child quality. In addition, at least part of the income increase from work will have to go to increased day care expenditures, while in the former model this was an unrestricted consumption decision.

The introduction of out-of-home child-care will thus in general increase market work and decrease time in other activities including own time with the kids. The size of the decrease in this activity will depend on how high the process benefits from interacting with children and the benefits from the quality of children are relative to the benefits from leisure. If the marginal utility of interacting with children is relatively insensitive to changes in the time used with children while the marginal utility of leisure levels off more quickly, a decrease in leisure will balance most of the increase in market work, while time with children decreases much less.

All models have implicitly assumed that a child does not need attention the full 24 hours of a day, an assumption which is realistic for older kids but not for very young kids. For a single mother there is no leisure unless someone else can step in and take care of the children. If (public) day care is available she has the option to leave the children at a day care center and use this time for market work. The rules for public day care are usually such that day care is only available while the mother works. In a two parent family there is much more flexibility because one of the parents can take care of the children when the other needs time off. In a model with two parents and with small kids one might thus like to impose the following constraint,

$$t_{cf} + t_{cm} + t_c + t_{cc} = T \quad (12)$$

where t_{cf} and t_{cm} are the father's and the mother's own time and t_c their joint time with their children. Although the exercise to work through such a model is not carried out here, this model should imply that both parents have less leisure compared to the solutions of the previous models and that wage rate and income elasticities with respect to market work and other activities are smaller.

In summary this analysis suggests the following.

- Time with children, market time and leisure are highly interdependent.
- If process benefits of market work and child care are high, the substitution effect of an increase in the wage rate will be relatively high, and the compensating adjustment in non-market time will primarily become a reduction in leisure while time with children is more inelastic.
- If process benefits of market work are high the income effect on time with children will be small.
- There is no clear prediction as to the effect of schooling on time with children.
- The availability of out-of-home child care will increase market work and reduce time with kids, but if the process benefits of time with

children is high there will be less reduction in child related time and more in leisure time.

3 Data

3.1 Data source

Data used in this study are taken from the Swedish household panel study Household Market and Nonmarket Activities (HUS).⁷ The 1984 and 1993 waves of data collection included time-use surveys. For each respondent a time-use diary was collected by telephone for two randomly selected days. In households with two spouses they were both interviewed about the same days. No fixed format was used either for time slots or for activities. The respondents own words were recorded by the interviewer and later activity coded. For each activity the respondent was asked if someone else was present. One of the response alternatives was “children of the household”.

The 1984 wave was a random sample from the domestic non-institutionalized Swedish population at the end of 1983 in the age range 18-74 years. Approximately 2500 respondents participated in the time-use survey, which corresponds to a response rate of a little more than 70%. The 1993 wave included the panel from 1984 and random refreshment samples from 1986 and 1993. Approximately 3500 individuals participated in the time-use survey 1993.

In this study only a sub-sample of respondents is used. Time-use is likely to depend on marital status, whether single or living in a union. In particular the situation of single mothers (fathers) is likely to be very different from that of married couples with children. Both groups are undoubtedly interesting to study, but in our case the share of singles in the sample is about 20 per cent and the share of singles with children much less. A study of singles

⁷Household Market and Nonmarket Activities (HUS), see Klevmarken & Olovsson, Household Market and Nonmarket Activities. Procedures and Codes 1984-1991, volumes I-II, IUI/Almquist & Wiksell International 1993, Flood, Klevmarken & Olovsson, Household Market and Nonmarket Activities (HUS), volumes III-VI, Department of Economics, Uppsala University, and <http://www.handels.gu.se/econ/econometrics/hus/husin.htm>

would suffer from a too small sample size. We have thus chosen the sub-sample of married or cohabiting couples with children, from which we have responses from both spouses.

3.2 Process benefits

In the theoretical discussion above the concept "process benefit" was important to understand people's behavior. Do we have any empirical evidence, which support that doing an activity independently of its outcome yields well-being? More than 25 years ago Thomas Juster suggested the concept "process benefits" and designed questions to measure them (Juster 1985, Dow and Juster 1985), which were used in the U.S. time-use surveys carried out at the Institute for Social Research (ISR), University of Michigan. A subset of these questions was also used in the Swedish HUS time-use surveys. The respondents were asked to state how enjoyable they found various activities on a scale from 0 to 10. They were asked to disregard the result of the activity, whether it was important or socially proper.⁸

An analysis of the responses to these questions in the HUS surveys show that people do not all anchor their scores at the same value and not at the score 5 in the middle of the scale. The over all mean was 6.3 in 1984 and 6.5 in 1993. Women had on average 0.2 higher scores than males. In order to control for the individual differences in mean score we have experimented by subtracting the individual mean from each individual's activity score. The conclusions from this analysis were, however, the same as those based on the raw scores, so we have chosen only to publish the latter in Table 3. Although the whole list of activities was read to the respondent before a response was requested for each activity, it is possible that the order of

⁸The following phrases were used: "Now we have some questions about how ENJOYABLE you find engaging in certain activities. Think of a scale from 10 to 0. If you enjoy a certain activity very much, give 10 points. If you dislike it strongly, give 0 points. If you find it neither particularly unpleasant nor particularly enjoyable, give it 5 points. If you think it is relatively enjoyable, you might give it six or seven points. We are interested in the activity independent of any result, and not in whether you think it is important or socially proper to engage in it. I will first read the entire list of activities we are asking about. After wards, I will ask you to assign points to these activities one by one, as I read them."

the questions (activities) will influence the result. The first question might serve as an anchor point. The activities in Table 3 are presented in the same order they were asked, starting with Watching TV and ending with the child-related activities. To save space standard errors of the mean scores are not included in the table, but they are of the order of 0.1.

Table 3 displays the process benefit scores estimates for parents by activity, gender and age of the youngest child.⁹ We find that playing with children and being in charge of children gets the highest process benefits for both genders followed by market work. Women also give rather high scores to reading books and magazines while men rank this activity lower. There are other gender differences as well. For instance, women give a higher score for being in charge of children than playing with children, while the reverse is true for men. Neither men nor women enjoy cleaning the house, but men dislike it more than women. Women enjoy repair and maintenance work less than men do. In this case the process benefit scores correlate positively with the time men and women allocate to these activities.

There are also minor differences in process benefit scores depending on how old the children are. Activities with children score a little higher in families with young children, than in families with older children. Older children have parents who have relatively high preferences for market work. Women, in particular, increase their preferences for market work, when the children grow older. The consistent main result from Table 3 is though that activities with children score higher than anything else, even higher than leisure activities. Even more remarkable is the high score for market work, only second to activities with children.

It might not be straightforward to identify these estimates with the marginal process benefit of an activity, but these results strongly suggest that doing an activity yields utility and that parents have very high preferences for activities with their children and for market work.

⁹To be precise, Table 3 includes household heads and any spouse of a head in households with children. This implies that all respondents must not be biological parents of (all) the children in a household, but in most households they are.

4 Empirical analysis

4.1 An econometric model of parental differences in time allocated to children

The analysis in section 2 suggests ways in which differences in wage rates, incomes, schooling and the use of day-care could influence the time allocated to kids, but to say something more specific about signs and magnitudes an empirical analysis is needed. Our strategy is not to estimate a full structural model using specific assumptions about the functional forms of utility functions and interaction between spouses, but still to use a model which recognizes the joint dependence of time allocated to different activities and the interdependence of spouse's time-use.

Consider the following interdependent switching regression system for parents' time with kids,

$$\begin{aligned}
 t_{cf}^* &= \alpha_{01} + \alpha_{11}t_{cm} && + \alpha_{41}t_{cc} && + \alpha_{61}Y + \alpha_{71}\mathbf{X}_f + \alpha_{81}\mathbf{X} + \varepsilon_{f1} \\
 t_{cf}^{**} &= \alpha_{02} + \alpha_{12}t_{cm} && + \alpha_{22}t_{hf} + \alpha_{32}t_{hm} && + \alpha_{42}t_{cc} + \alpha_{52}w_f + \alpha_{62}Y + \alpha_{72}\mathbf{X}_f + \alpha_{82}\mathbf{X} + \varepsilon_{f2} \\
 t_{cm}^* &= \beta_{01} + \beta_{11}t_{cf} && + \beta_{41}t_{cc} && + \beta_{61}Y + \beta_{71}\mathbf{X}_m + \beta_{81}\mathbf{X} + \varepsilon_{m1} \\
 t_{cm}^{**} &= \beta_{02} + \beta_{12}t_{cf} && + \beta_{22}t_{hf} + \beta_{32}t_{hm} && + \beta_{42}t_{cc} + \beta_{52}w_m + \beta_{61}Y + \beta_{71}\mathbf{X}_m + \beta_{81}\mathbf{X} + \varepsilon_{m1}
 \end{aligned} \tag{13}$$

The time-use variables and the wage rates were defined in section 2. Y is family nonlabor income, \mathbf{X}_f and \mathbf{X}_m are vectors of gender specific exogenous variables such as schooling and age, and \mathbf{X} is a vector of common exogenous variables such as family size, day of the week and season. The corresponding α :s and β :s are unknown parameters.

The first pair of equations in (13) explain the mother's time with kids and the second the father's time. Parents' behavior are assumed to depend on if they have a job or not. Equations t_{cf}^* and t_{cm}^* give the observed hours with children if parents do not work in the market, while t_{cf}^{**} and t_{cm}^{**} apply if they do. The choice of work hours is endogenous, and so becomes the switch between the equations. A reduced form model for the decision to

work is given by

$$t_{cs} = t_{cs}^* \text{ if } L_s^* \leq 0, t_{cs} = t_{cs}^{**} \text{ otherwise,} \quad (14)$$

$$L_s^* = \gamma_s' \mathbf{Z}_s + \eta_s, \quad (15)$$

$$L_s = 0 \text{ if } L_s^* \leq 0, L_s = 1 \text{ otherwise,} \quad (16)$$

where L_s is a dummy indicator for employment status, \mathbf{Z}_s is a vector of gender specific and common exogenous variables explaining the work decision, γ_s is an unknown parameter vector, and $s = m, f$. In our empirical work job status is determined from the main interview while hours of work applied to the designated day for the time-use interview.^{10 11}

All random errors are assumed to be multivariate normal. There is no *a priori* assumption of zero correlation. The model thus accounts for the case when the choice of labor market status depends on the parents' preferences for children. This would, for instance, be the case if there was a negative correlation between ε_{f1} and η_f .

The effect of one parent's time with children of a change in an exogenous variable will in general consist of two components, one selection effect because some of the parents take up work or leave the labor market, and one move "along" the time-use equation. Another way to say the same thing is that $E(t_{cs}|t_{hs}, \text{exogenous variables})$, $s = m, f$, will depend on the selection process. If the decision to work is completely random and independent of time with children, then there is no selectivity effect and the time-use equations can be estimated from each of the two subgroups "working" and "non-working" respectively without any compensation for selectivity. But in the presence of selectivity such estimates would become conditional on

¹⁰As a consequence there are observations of employed with zero hours of work, for instance because the respondent was sick, on holidays or temporarily on leave on the designated day. There are also examples of the reversed case, i.e., unemployed with positive hours of work. The employment coding are nevertheless made consistently from the answer in the main interview.

¹¹One might be troubled if the share of zeros is high in t_{cs} , $s = m, f$. However this is not a major problem since the zero shares are as low as 4-9 per cent, depending on gender and year of observation, which did not suggest a need to reformulate the model to capture this very mild concentration of observations to the zero point.

the selection that has actually taken place in the sample and they would in general not become robust for changes in the exogenous variables.

Focus for the moment on the case when both spouses have a job. If mother's time and father's time in care of their children are substitutes, we would expect $\alpha_{1j} < 0$ and $\beta_{1j} < 0$, $j = 1, 2$. However, if both parents have high process benefits from activities with their children, and they have a preference for doing these activities jointly, the sign of these two parameters might well be reversed. Own market work is expected to decrease own time with children, hence $\alpha_{22} < 0$ and $\beta_{32} < 0$. If one spouse works long hours the other spouse is expected to substitute in child related activities and then we would expect $\alpha_{32} > 0$ and $\beta_{22} > 0$.

If time in out-of-home child-care is a substitute for parents' own time in bringing up kids, and out-of-home child-care thus increases "child quality", then α_{4j} and β_{4j} , $j = 1, 2$, should be negative. However, if it primarily is a complement to market work, then it will only influence parents' time with the kids through their market work. The direct effects (α_{4j} and β_{4j} , $j = 1, 2$) should be zero. Even if out-of-home child-care increases "child quality", process benefits from activities with children may be so high that the effect of out-of-home child-care on parents' time with kids might become small.

The budget effect of changes (differences) in wage rates and nonlabor income should primarily come through adjustments in hours of market work. But income differences will also determine people's propensity to buy household services and packages of services and goods such as ready-made food, which could free time for activities with children. If the former effect dominates α_{52} , β_{52} , α_{6j} , and β_{6j} , $j = 1, 2$, should all be small.

4.2 Estimation

All time-use variables are endogenous choice variables. The wage rate variables entering the household budget constraint are the net after tax wage rates. Because the tax rate is a function of income the net wage rate will

depend on choices about work hours and thus become endogenous too.¹²

The variable t_{cc} , the number of hours a child is in out-of-home childcare, was never precisely defined. In fact we do not know how much time each child in a family spent in day care or in any form of out-of-home childcare during the day of the time-use. The variable we can use is if the family is using out-of-home childcare or not, taken from the main interview.¹³

The model produces four different groups of observations: Both parents work, non of the parents work, the father works but the mother does not and the mother works but the father does not.¹⁴ The corresponding sample frequencies are shown in Table 4. The probability of each of these cases can be estimated from a bivariate probit according to (14)-(16). We would have a two-equation model for each case. Because the sample frequencies are so small for all but the case when both parents work, we will only estimate the model for this case.¹⁵ As usual, to obtain the selectivity corrected equations we include $E(\varepsilon_{s2}|L_m^* > 0, L_f^* > 0)$ in the equations for t_{cs} ($s = m, f$), which are functions of the probability that both parents work in the market.

The model can thus be estimated by a two step procedure: First estimate the bivariate probit and the expressions for the conditional expectation up to a finite number of unknown parameters and obtain the conditional expectations of ε_{m2} and ε_{f2} , then estimate the interdependent system by, for instance, 3SLS.

For each of the endogenous variables t_{hf} , t_{hm} , t_{cc} , w_f , and w_m we will need at least one unique identifying instrument. To avoid identification by functional form we should also have at least one unique Z -variable in the probit step. The unique instruments are:

- t_h : Age of the respondent and age squared, if self-employed, season (four dummies), weekday/week end, and interactions with weekday/week end.

¹²This was especially true in the 1980s before the big tax reform in Sweden.

¹³Assuming that out-of-home child-care was only available in weekdays.

¹⁴Ignore for the moment the fact that we have included the cross effect from the spouse's hours in market work in (13).

¹⁵The sample of employed is further reduced since we have missing values in the wage rate.

- t_{cc} : living in the rural parts, if university degree.
- w : Polynomials of gross wage rate, interest paid on house loans (only 1984, in this year deductions resulted in lower marginal taxes).
- L : Years of labor market experience after depreciation for any current spell of no work and ditto squared¹⁶, if disabled person in household, if the household owns a vacation home.

The exogenous variables included in the time-use equations are:

- \mathbf{X}_s ($s = m, f$): Years of schooling.
- \mathbf{X} : age of youngest child, number of children, if other adults in household, square meter of space in current home (which serve as an indicator of household wealth).

5 Empirical results

Diagnostic statistics from the reduced form are listed in Table 5. The reset test is passed by all time-use equations, while the equations for the net wage rates signal specification errors. The reduced form is just a linear function and it does not capture the log-linearity of an earnings function and the nonlinear tax system might also contribute to a significant reset test. We are, however, not primarily interested in the wage rate function, but only use it to compute an instrument. Because the time-use functions pass the test we have not attempted any reformulation. Most skewness and kurtosis measures deviate too much from 0 and 3 respectively not to reject an assumption of normality. However a mild deviation from normality is acceptable and these measure are not alarmingly high. All tests of homoskedasticity reject this hypothesis, which might suggest specification errors, but it might also be the result of kurtosis. Sargan's test of overidentification (Table 6) suggests that

¹⁶Depreciated labor market experience is generated as $EXP/(1+r)^t$, where EXP is labor market experience, t is years since last employed, and r is set to .03.

all equations for child related time pass this test. In an over all evaluation we therefore accept the given specification.

The model specifies that the spouse's time with the kids, the own and the spouse's market time, the net wage rate and if the household uses out-of-home child-care all are endogenous to own time with the kids. Table 7 shows the results from the test whether these variables can be considered exogenous. The joint F-test rejects this hypothesis. The t-tests for each variable separately and by equation show a somewhat mixed result. Except for the spouse's time with the kids all variables show a high t-score in at least one equation. Considering all these results and the theoretical reasons to assume that all these variables are endogenous we decided to treat them all as endogenous and estimate the model with 3SLS. The last two columns of Table 9 permit a comparison with OLS estimates. A few OLS estimates differ much from the 3SLS estimates. This we take as support of our estimation strategy.

The model was estimated for each year separately (Table 8) and then also for the pooled data set with only an intercept dummy for 1993 added (Table 9).¹⁷ There are differences in estimates but data do not reject pooling.¹⁸

Looking at the pooled estimates in Table 9 we find that parents do not substitute for each other in activities with their children but rather complement each other.¹⁹ The estimates of the effect of one spouse's time in child related activities on the other spouse's child related time are very close to one. Own market time has a negative effect on time with kids, but only significantly so for males. If one spouse works more in the market the other will use more time with the children, but again it is only the husband's market work that has a significant effect on his wife's time with children. Variations in the wife's hours of market work have neither any significant

¹⁷ Wage rates and nonlabor incomes were in constant 1993 Swedish crowns.

¹⁸ The χ^2 -values for the null of not accepting pooling are 19.98, 20.54, and 29.56, with p -values 0.22, 0.20, and 0.59, for t_{cm} , t_{cf} , and jointly, respectively.

¹⁹ To be more precise, the estimates suggest that there is jointness in the sense that if one parent in one day uses much time for the kids the other parent will also do it, but our data do not necessarily imply that they spend all hours together, although such an interpretation is likely.

effects on her own child related time nor on that of her husband.

Although an insignificant estimate cannot immediately be interpreted as a small effect, it is tempting to suggest the following policy relevant interpretation. A policy that increases female hours of market work will not markedly change the kids' time with their parents, while a policy that stimulates fathers to stay more at home will increase the kids' time with their father but not reduce their time with the mother. Comparing the 1984 and 1993 estimates we find that this interpretation applies more to 1993 than to 1984. In 1984 the effects were stronger and differences in the wife's working hours had about the same own and cross effects as differences in the husband's hours. If one spouse worked long hours the other took care of the kids. In 1984 female part time work was more common than in 1993, and by 1993 women who would chose to allocate much time to children also worked full time. They must then have reduced their private leisure and household work.

The estimated effect of having out-of-home child care is negative for males and positive for females, but none of them is significantly different from zero. There is no significant effect of the net wage rates either. The pooled estimates of the nonlabor income effects are insignificant too, but in 1984 there was a significant gender difference. In high income families males used less time and females more times with their children. By 1993 this difference seems to have become smaller if it ever existed.

There is no significant difference in time-use with children due to differences in schooling. In fact, of all the exogenous variables there is only one that bites, namely to have an infant. The point estimates suggest that women initially increase their time with almost two hours per day while males decrease their hours by almost one and half hours. However, taking the interdependence and jointness in the spouses' behavior into account the mother ends up using about three hours and the father one hour and twenty minutes more with their infant than comparable parents with teenagers. These effects seem to have become stronger in 1993 than they were in 1984. In the beginning of the period more of the adjustment came through a reduction in market work. Parental leave was shorter then than in 1993 and

there was more variation in market work hours and consequently also in child related time among women than in 1993.²⁰ In 1993 almost all women with a newborn stayed away from market work for one and a half years with family benefits.

We have thus found that with the exception of having a small child there are no direct exogenous effects on child related time and no direct wage rate or out-of-home child-care effects either. A test of no exogenous influence other than having a small child does not reject this hypothesis. The corresponding estimates can be found in the second pair of columns in Table 9. These estimates are almost the same as before. The correction for selectivity becomes somewhat more important.²¹ One interpretation is that with the exception of families with a small child the process of allocating time to children partly goes through an adjustment of market work, in particular the market work of men, and partly becomes a household internal trade off between child related time and private leisure and household work. This interpretation is consistent with people having high process benefits of both market work and time with children.

Using the assumption that process benefits represent exogenous preferences we have estimated the model with the process benefit scores for market work as an exogenous variable. It contributed to the explanation of market work, but it did not contribute to the explanation of time with children.²²

6 Conclusions

Decisions about market work and time for activities with children are interdependent. If one parent works long hours in the market the other to

²⁰In 1984 parental cash benefits at the birth of a child could be obtained for 180 days. Additional 180 days could be used any time before the child became 8 years old. Full benefits were only given for 90 of these 180 days. In 1993 parents could have benefits for 450 days of which 360 with full benefits. In addition parents could obtain 60 days per year and child under 12 to stay at home temporarily, for instance if the child was sick or needed attention.

²¹The bivariate probit estimates are given in Table 10.

²²There was relatively high nonresponse in the variable process benefits from activities with children that prevented us from using it as an explanatory variable in the model.

some degree substitutes at home with the kids. The results suggest that a change in the mother's work hours influences less the parents' time with their children than a change in the father's work hours does.

The degree of substitution seems to have become smaller as more women work full time and out-of-home child-care has become more readily available. Instead the strong jointness in parents' allocation of time to their children has become relatively more important. Parents prefer joint activities with their children.

Our results do not suggest that parents chose out-of-home child-care as a substitute for own time with the children. There is no significant difference in time allocation between families with and without out-of-home child-care. A plausible interpretation is that parents use out-of-home child-care to be able to work in the market. But to combine work and time for the kids they have to cut down on private leisure and household work. These results are consistent with the strong process benefits parents derive both from activities with children and from market work.

Economic incentives from wage rate and income differences have no strong direct influence on the allocation of time to children. They all work indirectly, primarily through decisions about market work, but possibly also through decisions about consumption of leisure and leisure related goods and services.

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