

# Allocation of Parental Time and the Long Term Effect on Children\*

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**PRELIMINARY, please do not quote without permission**

## Abstract

This paper develops a structural model which links parental time use to a child's development in a household with two parents and one child. Since the allocation of home time and market work has become more equally distributed within households during the latest decades and since fathers seem to be an increasingly important part of their children's daily life, this study, opposite to most other studies within the child care literature, explicitly takes both parents' time spent on child care into account as well as child care bought in the market. The parents' optimal labor supply decisions are linked to child's development, and it is shown that the quality of market provided child care vs. the quality of parental child care is crucial for the parents' decisions. The availability of paternal child care does not seem to affect the mother's labor supply decision, though. Finally, assumptions about child care quality and substitution between mothers' and fathers' child care are tested against Danish time use data. Surprisingly, in general there is negative correlation between parental child care time and children's length of education but simple OLS regressions reveal a positive relationship between parental child care time and children's educational length. The mother's child care time seems to have greatest positive effect.

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# 1 Introduction

There has long been an interest in determining what affects child well-being and development. As suggested by Waldfogel (2005) child well-being can be divided into three interacting main domains; child health, child cognitive development, and child social and emotional development. Economists' interest is increasingly in child health, see e.g. Currie and Neidell (2005), but most often economists are interested in the cognitive development of children. That is, economists typically focus on children's reading and mathematics abilities. The subsequent effect this has on their ability to complete a certain level of education and thereafter finding a job is then studied. Unfortunately, lack of data on individuals from childhood to adulthood has caused limitations on this type of empirical research. Adolescents instead of adults have often been investigated or only young children are considered<sup>1</sup>. Most of the focus has been on the effect of maternal employment on pre-school children's cognitive development. Research has shown that early test scores are strong predictors for future educational and labor market outcomes, see e.g. Connolly et al. (1992) and Currie and Thomas (2001), and this has been one argument for looking at young children. Heckman (2000) argues with reference to research in psychology and cognition that much learning starts in infancy and takes place outside schools. He argues that families and non-institutions' success or failure with respect to skill formation in the early pre-school years leads to success or failure in post-school learning. A third but less strong argument for looking at young individuals is of course lack of data on older individuals.

A lot of research has concentrated on the effect of maternal labor supply decisions and the subsequent effect on children's cognitive development. Short term effects have been intensively investigated using a lot of different methods and datasets but no clear conclusion has emerged, though most studies suggest a negative effect on children from early maternal employment as in the studies by Ermisch and Francesconi (2000) and Ruhm (2004).

There is no doubt that children's development is very much affected by the parents' decisions for the household. Therefore, there is no reason to believe that the father's decisions should not also affect children, especially if the mother and father live in the same household. In many studies on child health and child cognitive development, though, paternal decisions are neglected. There seems to be an unwritten rule saying that focus is

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<sup>1</sup>See e.g. Ruhm (2005) for a study on the effect of maternal employment on adolescent development.

on the mother('s time) when investigating hypotheses about young children whereas focus is on father('s income) when investigating hypotheses about older and grown up children for example in an intergenerational mobility context, see e.g. the models in Becker and Tomes (1986). When studying intergenerational mobility the grown up children's education or earnings are compared mostly to the fathers' education and earnings whereas the mothers' education and earnings are neglected. Even for studies on daughters' income, the comparison is made to father's income in many cases, see e.g. Solon (1999) for a review of studies on intergenerational mobility in the labor market. This way of focusing on either the mother or the father seems somewhat inconsistent, especially if we believe in Heckman's argument stated above.

In studies focusing on the effect of mother's employment on household production of child human capital the father is more or less non-existent in quite a lot of this type of studies, despite focus in most of these studies is *not* on lone parents.

The allocation of home time and market work has become more equally distributed within most households during the latest decades. In Denmark, for example, the difference between men and women's time spent on housework has decreased from 1.25 hours per week to only 1 hour per week from 1987 to 2001. The difference between employed men and women's time spent on market work has decreased from 1.5 hours per week to 1.25 hours per week. Fathers seem to be spending more time with their children in the same time period, see Bonke (2002), and, furthermore, Gørtz (2006) shows that the amount of housework increases for both men and women when children are present in the household, even when both parents are full-time employed. Therefore, evidence seems to suggest that fathers are increasingly important for children's development. It seems appropriate to give fathers a more prominent role than as just being a relative to the mother and the child.

The Danish 1987 time use survey shows that there is great variation in fathers' child care time both on weekdays and on weekend days, see Figure 1 and Figure 2. These figures show the daily amount of time fathers spend with their children both in direct child care and in indirect child care on either a weekday or a weekend day, respectively. Indirect child care means that the child is present while the father is e.g. cooking or shopping, but the activity is not directly aimed at the child. It can be seen from Figure 2 that in weekends, where the flexibility of parental time must be highest, fathers choose to spend from 0 minutes to more than 10 hours with their child. There is a peak at 0 minutes, the rest of the distribution is rather flat.

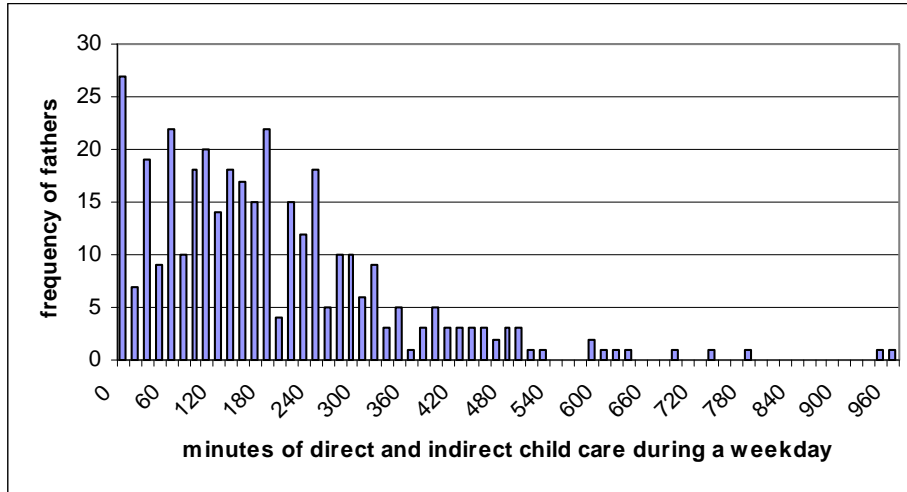


Figure 1: Distribution of father's daily time with children on a weekday in Denmark, 1987.

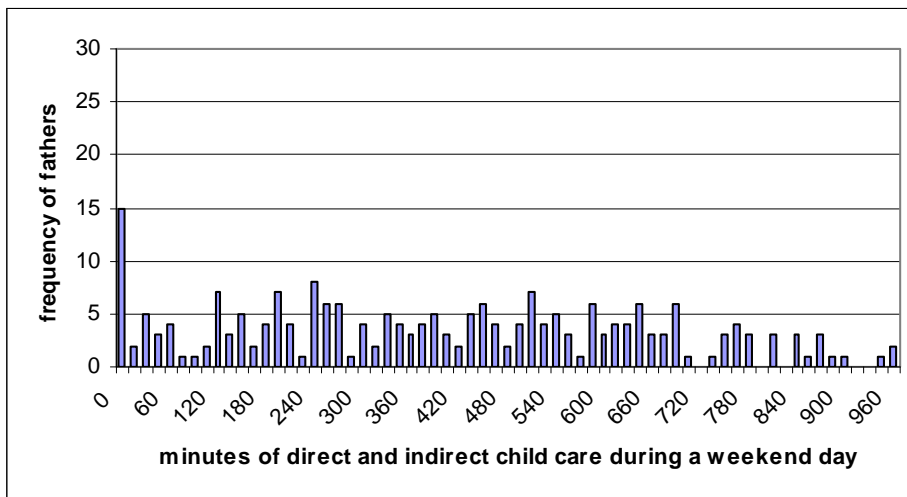


Figure 2: Distribution of fathers' daily time with children on a weekend day in Denmark, 1987.

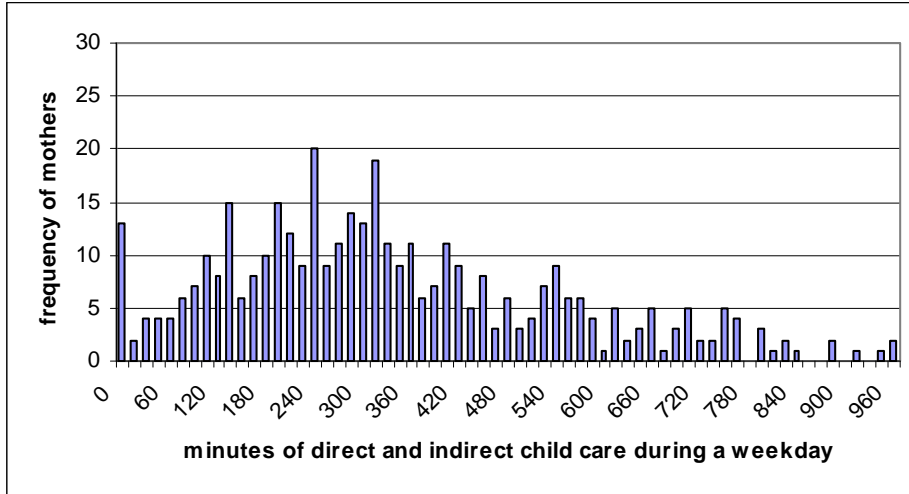


Figure 3: Distribution of mother's daily time with children on a weekday in Denmark, 1987.

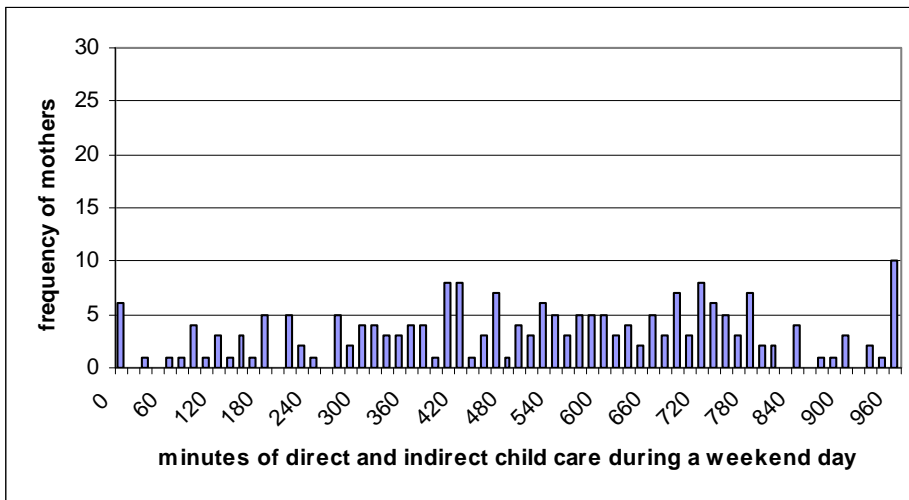


Figure 4: Distribution of mothers' daily time with children on a weekend day in Denmark, 1987.

On weekdays the pattern is a bit different since most of the fathers surveyed are working. Therefore, on weekdays there is a greater share of fathers that spend less time with their child than in weekends<sup>2</sup>. The figures for fathers are quite similar to Figure 3 and Figure 4 for mothers. For the mothers the distribution seems to be skewed a bit to the right, though, but these figures suggest that there should be looked more into both determinants and effects of fathers' time with children. Furthermore, theoretical models of children's development that do not also take fathers' child care time into account may be outdated according to the above figures.

A few studies have focused on paternal child care, for example the study by Averett et al. (2005). This study is unique in focusing on paternal child care instead of maternal child care. In this study children's development is compared across different types of childcare conditional on the mother being employed. According to Averett et al., paternal childcare compared to other types of childcare for infants does not seem to cause different development in the ages 5 to 8. On the other hand, paternal childcare compared to other modes of childcare of toddlers results in slightly worse cognitive outcomes when the children become 5 to 8 years old. The explanation for this finding is not definitive according to the study and it can be the result of both negative selection of fathers taking care of toddlers or it can be related to the timing of paternal care.

The contribution of this paper will mainly be to improve and add to the existing theoretical models of child development. The model here will follow Becker (1965) in seeing households as both consumers and producers. Furthermore, following e.g. Parcel and Menaghan (1994), Bonke (2002), Ruhm (2004), and Averett et al. (2005) the importance of the child's father will be acknowledged by including paternal childcare time explicitly in the theoretical model. The theoretical model also builds on the models by Ribar (1995) and Parera-Nicolau and Mumford (2005), Becker and Lewis (1973), and Becker and Tomes (1976, 1979, 1986) but differs from these models in several ways. The fertility decision will not be explicitly considered, for example. Instead, focus is on analysing the (long term) effect of parental time use on children's development outcome taking both mothers' and fathers' childcare time explicitly into account.

In section 2 theoretical model structures for child development will be

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<sup>2</sup>The sample consists of non-single fathers. Only fathers with children under the age of 19 are included here and there are 356 observations on weekdays and 222 observations on weekend days.

It should be noted that more than half of the fathers who spend 0 minutes with their child do not have children younger than the age of 10.

described. Section 3 will first briefly and generally present previous empirical evidence from the literature and thereafter look more into selected empirical studies. Section 4 will then describe a new theoretical model adding to the known models. The new model will especially focus on describing the link between parental time inputs, childcare quality, and children's development. Both parents' time inputs will be considered important. In section 5 some empirical tests of the model will be performed using Danish time use data, and, finally, section 6 concludes.

## **2 Theoretical Model Structures for Child Development**

When building a theoretical model of child development several different approaches can be taken. First, if short term development is in focus the roles of parental characteristics and the early home environment in producing cognitive skills should be investigated. Models concerning these short term effects are sometimes referred to as early childhood development models (ECD). Second, if focus is on longer term effects, e.g. how school-age children develop, the productivity relationship between schooling inputs and test score outcomes should be investigated. Models with this focus are called education production function models (EPF), see also Todd and Wolpin (2003) for more on these types of production function models. Finally, even longer term effects can be investigated as for example the final educational outcome, or income in the age of 30 or 40. This can e.g. be investigated in an intergenerational mobility context as done by Becker and Tomes (1986).

Models for child development should also be separated on whether they are static or dynamic. Todd and Wolpin (2003) argues that child development is the result of a cumulative process which depends on the history of family and school inputs as well as on inherited endowments. If this view is taken, a dynamic model should definitely be investigated. On the other hand, one can also argue that it is the final child development outcome that is of interest. If this view is taken child development is then seen as an outcome from one (long) period, that is, a static model is optimal for describing child development, see Blau and Hagy (1998) for an example of this kind of model.

In the following sections a selection of theoretical models of child development are described chronologically but static models are grouped together and dynamic models are grouped together.

## 2.1 Dynamic Models

A basis for many theoretical studies concerned with intergenerational mobility and transmission of earnings, assets, and consumption from parents to descendants is the work by Becker and Tomes (1976, 1979, 1986).

In the newest versions of their models Becker and Tomes use a dynamic framework where the family is assumed to maximize a utility function spanning several generations, see Becker and Tomes (1979, 1986). In these theoretical models parents' utility depend on their consumption as well as the number and the "quality" of their children. In Becker and Tomes' models parents can compensate or reinforce differences between children by investing time and money in the children. Parental time investments are not explicitly modeled, though.

A different type of model is developed in Ermisch and Francesconi (2000). Ermisch and Francesconi model a family which is assumed to consist of (two) parents and two children. The children may differ with respect to endowments relevant for educational attainment. The dynamic model is limited to three periods and describes parents' human capital investment in their children. An important assumption in this model is that children's endowments are not known in the child's first period of life, similar to the process of information revelation in Rosenzweig and Wolpin (1995). This ensures identification. The identification strategy is to use a sibling difference estimator<sup>3</sup> to identify the effect of mother's employment time on child educational attainment. Using this estimator, information on siblings is differenced to remove the possible family fixed effect, i.e. it may be that children of the same parents have inherited some common components or have common components because they are raised in the same home environment. These common components may bias results if they are not differenced away.

The model specified in Ermisch and Francesconi (2000) is what they call a non-hybrid equations model<sup>4</sup>. This means that the model is specified within a framework embedded in economic theory, i.e. the technological properties of the education production function cannot be confounded with characteristics of the household's preferences<sup>5</sup>. Therefore, there is a clear economic interpretation of the model's results.

The Ermisch and Francesconi model does not model father's time di-

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<sup>3</sup>This type of estimator is also called a within (family) estimator.

<sup>4</sup>The notion of hybrid equations is from Rosenzweig and Schultz (1983).

<sup>5</sup>It could e.g. be the case that parental attitudes about labor supply are correlated with parental investments in children, or it could be the case that the proportion of total income devoted to children vary with family background characteristics.

rectly. Further, it seems a bit implausible that parents observe their children's endowments in period one and thereafter decide in period two whether they will invest time and money in the children. Parents will most likely invest in their children no matter the level of children's endowments.

Leibowitz (2003) sketches a more comprehensive framework for building theoretical models where the behaviour of both parents are included. Focus is on expanding the household production framework to distinguish among time spent in the labor market, in leisure, in developing the human capital of children, and in other household production. Leibowitz looks at how time- and budget constrained parents (and children) divide their time between different activities so as to maximize utility. Utility is a function of parental leisure, consumption of goods and services, and human capital of the child, so one of the parents' objectives is to develop the human capital of their children. Identification and structural relationships of the model are not clear but the framework is clearly interesting.

One of the main features of the model is that "in-home-training" is compared to "on-the-job-training" since both are complementary to formal schooling. Thereby the household's production of child human capital is related to a firm's production of an employee's human capital. In this respect the model builds on Becker (1965) saying that households are both consumers *and* producers, here the household produces children's human capital.

A relatively new study is conducted by Ruhm (2004). In Ruhm's study the child's father is also considered along with the mother. Ruhm models parents as allocating resources to maximize an objective function that includes the health and development of children as one argument. He follows Becker (1991) in emphasizing the role of non-market time in household production. The child production function is dynamic and defined as

$$C_t = C(C_{t-1}, L_t, F_t, V_t),$$

where  $C_t$  is child outcomes at age  $t$ ,  $C_{t-1}$  is status in the previous period,  $L_t$  is (aggregated) non-market "leisure" time of parents<sup>6</sup>,  $F_t$  is purchased inputs, and  $V_t$  is exogenous determinants or production shocks. Parents are equipped with a time- and budget constraint where the time constraint depends on the proportion of total time spent in employment in period  $t$ ,  $H_t$ , and the proportion of total time spent in non-market activities,  $L_t$ . It is worth noticing that in this specification total time depends on the number

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<sup>6</sup>It would probably be more accurate if  $L_t$  were child related home time instead of non-market "leisure" time of parents.

of parents and children in the household which implies that total time is endogenous.

The production function for child outcomes can be rewritten to

$$C_t = C(\mathbf{H}, \mathbf{F}, \mathbf{V}), \quad (1)$$

where  $\mathbf{H}$ ,  $\mathbf{F}$ , and  $\mathbf{V}$  are vectors of current and lagged values. Maximizing (1) subject to income- and time constraints yields a reduced form demand function

$$C_t = C(\mathbf{P}, \mathbf{V}), \quad (2)$$

where  $\mathbf{P}$  is a vector of current and lagged prices and wages. Parents are actually solving a dynamic programming problem here.

The model seems both interesting and in line with e.g. the model by Leibowitz (2003) but it is difficult to find a dataset detailed enough to estimate the model.

In the next section we will take a closer look at some of the static models of child development.

## 2.2 Static Models

A lot of models for child development are static instead of dynamic. This means that the models only consider one time period, but the time period can potentially be very long. This type of models will be in focus in this section.

Becker and Tomes (1976) building in particular on the study by Becker and Lewis (1973) create a model that relates quantity and quality of children. Becker and Tomes establish a link between social interactions, family background, income and the relationship between demand for children and quality of children in a static framework. Parental expenditures are related to the children's endowments and it is shown that parents tend to invest more human capital in better-endowed children and more non-human capital in poorer ones. The models developed in this study form the basis for Becker and Tomes' dynamic models mentioned above and, furthermore, are basis and reference point for many studies of child development.

Blau and Hagy (1998) have investigated the demand for quality in child care. Their model is partly based on the quality-quantity literature, see Becker and Lewis (1973) and Becker and Tomes (1976) for example. They set up a model where the demand for quality-related attributes of child care are estimated jointly with both mother's labor supply, mode of child care, and expenditure on and hours of care. The model in Blau and Hagy is

the first to incorporate all these features into the same framework which is very important since many decisions regarding child care and labor supply are made simultaneous. The model is therefore a huge step towards fitting models with reality.

In Blau and Hagy's model a household is assumed to maximize its utility function defined as

$$U = U(Q, L, B, G, I; X, \eta_1),$$

where  $Q$  is child quality,  $L$  is leisure time,  $B$  is a vector of non-quality-related attributes of child care,  $G$  represents other consumption goods,  $I$  is a categorical variable describing the employment status of the mother, the payment status of the child care arrangement and the mode of child care. It is assumed that only one child care arrangement is used. The choice of  $I$  may affect both the utility and the child quality directly but it can also interact with the other variables in the utility function and the quality production function.  $X$  is a vector of observed exogenous variables and, finally,  $\eta_1$  is unobserved household preferences.

Child quality is produced according to a child quality production function which among other things depends on mother's child care time, which is assumed to have an exogenously given quality, and non-parental child care time. It is assumed that employment decisions of the father can be taken as given, and he is therefore not the primary care giver to the child. The household is budget constrained, and the mother and child are equipped with a time constraint as well. The child is either in mother's care or is in some sort of non-parental child care arrangement, and the mother can choose to spend time on market work, child care, or leisure.

Ermisch and Francesconi (2000) have developed a static version of their model describing parents' human capital investment in children. This model uses separable utility as described by Pollak (1971), and to simplify looks at a special case where the two children's earnings endowments are independent of resources devoted to human capital investment in children and also independent of the mother's time input into human capital production for the two children. This special case is inspired by Behrman et al. (1982) when choosing the form for the sub-utility function representing parental welfare from children's earnings, and this simplification ensures identification. The static model in Ermisch and Francesconi's study rely on a lot of assumptions to ensure identification and this is the main drawback of the model.

Parera-Nicolau and Mumford (2005) have developed a structural model of labor supply and childcare for British mothers in two parent families.

The model builds on Ribar (1995) and suggests that the major inducement for working mothers to increase their working hours is the provision of high quality formal child care. That is, the model suggests that quality of child care seems to be important for parental decisions about labor supply. In the model children can be in formal and informal child care besides the mother's care but fathers are not assumed to spend time on child care. Fathers are either working in the market or enjoying leisure time.

Finally, a very recent model presented in Wrohlich (2006) builds on Blau and Hagy (1998) and is also in some respects similar to the model described in Parera-Nicolau and Mumford (2005). Wrohlich looks at mothers' labor supply decisions and child care choices in a model where the child care market is rationed. The purpose of the study is to build (and estimate) a model that comes close to the institutional settings in Germany.

In Wrohlich's model the mother's utility function is assumed to depend on disposable household income, the mother's leisure time which in the model is interpreted as non-market work time without children, the "quality" of children, and demographic characteristics. Child quality depends on hours of maternal care, hours of formal care which is interpreted as paid care, and hours of informal care. The mother can only allocate time to three activities; market work, child care and leisure. The father is assumed not to be active in child care as in the above mentioned models. The household is budget constrained and the mother and (youngest) child are also time constrained.

The theoretical model presented in section 4 will be static since static models are simple and seem to a higher degree to allow for e.g. the effect of child care quality. The model will partly use the same setup as Parera-Nicolau and Mumford (2005), but the model will also explicitly include paternal childcare and, furthermore, some of the outcomes of the model will be tested empirically. The drawback of creating a static model is that child development as a process cannot be investigated thoroughly.

### **3 Evidence from Previous Studies**

When empirically investigating child development we optimally need information on both family and school inputs, both current and past. Then we can address the issue of specifying a child's cognitive achievement production function. Child development can be seen as a cumulative process that depends on the history of family and school inputs as well as on inherited endowments, see Todd and Wolpin (2003). As mentioned earlier, several different specifications can be used for the study of child cognitive achieve-

ment, e.g. the ECD model or the EPF model, which are both production function models. Alternatively, a static model can be specified and also for this type of model it is necessary to include as much available information as possible, see Blau and Hagy (1998).

Most economic studies attempting to relate parental time with children to child development focus on the effect of maternal employment (instead of parental employment in general) on children's cognitive development. Based on the results of these studies, the research can be divided into three main groups; studies finding a negative effect on children from maternal employment<sup>7</sup>, studies finding positive or no effects on children<sup>8</sup>, and studies finding mixed results regarding the effect on children from maternal employment<sup>9</sup>. In summary, there is no conclusive evidence for or against maternal employment, though most studies point toward a negative effect of maternal employment in the child's first year.

There are arguments both for and against (early) maternal employment. An obvious negative consequence of early maternal employment is that it is more difficult for the mother and child to bond if the mother is working in the daytime. Also breast-feeding may stop earlier if the mother is working, see Ruhm (2000). Another issue is that the mother may be tired when she returns from work and therefore have less energy for playing and interacting with the child.

A number of positive consequences of maternal employment can also be listed. An increased income may of course benefit the child and some children benefit from being in day care - especially if the mother is not particularly interested or skilled in child care. The interaction with other children in child care arrangements is beneficial for a lot of children because their social skills are developed. Furthermore, working mothers seem to substitute leisure and sleep for work time instead of child time. This means that children generally spend almost as much time with a working mother as with a non-working mother, see Bianchi (2000) and Zick and Bryant (1996), and this may diminish possible negative effects of maternal employment.

The type of child care may also be an important determinant of the effect of maternal employment on children. Some studies suggest, though, that child care characteristics on average have little association with child development, see Blau (1999) for an example.

The weakness of many studies using dynamic models is that most of them

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<sup>7</sup>See e.g. Ruhm (2004) and Bernal (2005).

<sup>8</sup>See e.g. Parcel and Menaghan (1994).

<sup>9</sup>This latter group of studies includes e.g. Blau and Grossberg (1992), Waldfogel et al. (2002), and Gregg et al. (2005).

try to estimate either ECD or EPF models but without having a dataset with enough information. In ECD studies the datasets often have very little information on institution and schools inputs, whereas in EPF models there is often little information on family inputs available in the datasets. Furthermore, there seems to be a lack of consensus over which variables to include in the different specifications. This implies that researchers working on the same data source can find completely opposite effects of e.g. maternal employment on children's cognitive achievement, see also Todd and Wolpin (2003).

A weakness in empirical studies based on static models is that most of them, except for Blau and Hagy (1998), do not simultaneously model and estimate the mother's labor supply decision, the decision to pay for care, the mode choice, and the demand for child care attributes. This means that it can be difficult to give the results an economic interpretation.

Furthermore, a weakness of most previous studies is that they focus on the mother's working hours instead of maternal hours spent on child care even though the latter is more interesting to relate to child development. Also, in many of the previous studies a control for the quality of child care has not been included. Instead it has been implicitly assumed that the mother's care is better than all other kinds of child care which may not be true. Finally, the time fathers spend with their children is neglected in virtually all studies.

In the next subsection we will look more detailed at a selection of empirical studies and their results. The studies will be described according to the country providing data for the study, the age of the child(ren) in question, and the method used in the estimation.

### **3.1 A Review of Empirical Studies**

A lot of empirical studies try to determine what affects child development. The focus has been both on infants, toddlers, pre-school and school age children. A general problem with many studies of child development is that they estimate hybrid equations, an example of this is Equation (3) in Ruhm (2004) mentioned below.

Some studies focus on simultaneously estimating (the mother's) labor supply and child care decisions whereas others only focus on estimating one of them. Most studies use American datasets for the estimations, an exception of this being the studies by Gregg et al. (2005) and Parera-Nicolau and Mumford (2005) using British data, and Wrohlich (2006) using German data.

Even though most studies use U.S. datasets they do not all use the exact same dataset. The population in question and the institutional settings will be the same in general, though. Therefore, among studies on U.S. data we will expect most differences in results to be caused by different methods of estimation, different variables included in the estimations, and different age groups of children in question.

Studies using non-U.S. data will in general not be directly comparable to results from U.S. studies because the institutional settings can differ dramatically between countries, especially between the U.S. and European countries. Therefore, in the next sections we will look at studies using non-U.S. datasets separately from the studies using U.S. datasets.

### 3.1.1 Studies using U.S. datasets

First we will take a closer look at the group of studies which focus on young American children, i.e. studies that estimate the effect of parental employment (maternal in particular) on infants, toddlers and pre-school children in general. Studies in this group include Leibowitz (1977), Blau and Grossberg (1992), Baum (2003), Blau and Hagy (1998), Ruhm (2004), and Berger et al. (2005).

The study by Blau and Grossberg (1992) mainly builds on theory by Becker (1991) and focus on understanding factors that affect the family's production of child quality. Child quality is defined as the child's score in the Peabody Picture Vocabulary Test and the score is explained by estimating reduced forms with explanatory variables as quantity of *maternal* time, quality of *parental* time, market goods and a vector of family and child demographic characteristics. Quantity of paternal time is not directly included in the model, and maternal time is measured inversely as the proportion of weeks worked during the first year after the child's birth and the proportion of weeks worked during subsequent years. Quality of parental time is described by indicators which include the mother's verbal ability and the mother's and father's education at about the time of the child's birth. Blau and Grossberg find mixed results regarding the effect on children's development from maternal employment.

The studies by Baum (2003) and Leibowitz (1977) also use simple linear reduced forms to estimate the effect of parental activities on children's cognitive development. Baum finds negative effects on children's development from maternal employment in the child's first year but also finds a positive effect on children's development from increased family income. This positive effect partially offsets the negative effects caused by maternal em-

ployment. Leibowitz, on the other hand, finds that neither full-time nor part-time work by the mother has significantly negative effects on children’s verbal development.

In the study by Ruhm (2004) equations of the form

$$C_t = C(\mathbf{H}, \mathbf{X}, \varepsilon), \quad (3)$$

are estimated where  $\mathbf{H}$  is the measured work hours<sup>10</sup>,  $\mathbf{X}$  is a vector of individual or family background characteristics, and  $\varepsilon$  is a disturbance term capturing production shifters or shocks not otherwise controlled for. Ruhm’s econometric model is a standard hybrid equations model except for the inclusion of many background variables and inclusion of production shifter variables. The latter is included in the disturbance term. The problem with estimating hybrid equations is that the economic interpretation of the coefficients is unclear since household preferences and technological properties of the cognitive achievement production function can be confounded. By including an extensive set of explanatory variables the amount of unobserved heterogeneity is reduced and this is expected to reduce the uncertainty of the results.

Ruhm control for child care but the regression estimates fail to uncover any consistent effect of day care. Moreover, Ruhm includes father’s employment and concludes that it seems likely that there is at least some substitutability between parents. The sample of fathers in Ruhm’s data is not perfect since only fathers present in the household four years after the child’s birth are included. Nevertheless, data suggest that time investments by fathers may substitute for those of mothers, so fathers’ time with children should be investigated further according to this study.

Berger et al. (2005) contribute to the literature by using better data than in most previous studies. Berger et al. argue that leave coverage impacts women’s leave usage which impacts child health and development. They then estimate traditional linear regressions or estimate propensity score matching on the effect of mothers’ early return to work on child health and development outcomes of 3 and 4 year olds. Berger et al. find that there is a negative association between early maternal employment and child health and development.

Taking employment decisions for fathers as given Blau and Hagy (1998) simultaneously estimate the employment decision of mothers, the mode of child care, and whether a paid child care arrangement will be used. The

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<sup>10</sup>In most of the estimations only maternal work hours are considered. In Table 5 in the paper, though, paternal employment is considered along with maternal employment.

econometric model builds on a static theoretical model and estimation is by full information maximum likelihood. The dataset contains households with at least one child less than 7 years old and not enrolled in school. The results suggest that parents respond to economic incentives in the child care market. If the price of one type of child care decreases, the demand for that type of child care increases and the demand for other types of care decreases. Furthermore, there is also an increase in maternal employment. The results also show that parents view quality and quantity of care as substitutes, especially for center based care. If the quality adjusted price of care decreases this implies an increase in the demand for hours of care.

Another group of studies focus on the longer term effects of early maternal employment, namely by looking at children who have started in school. Examples of this is Waldfogel et al. (2002), Ruhm (2005), and Averett et al. (2005).

Waldfogel et al. (2002) investigate the persistence of negative effects of early maternal employment on children's development. They follow children from birth and up to age 7 or 8. They also try to explain which factors affect children's development. Some persistent and adverse effects of early maternal employment are found for white children and the adverse effects seem to be explained partly by the home environment. The effect of child care mode is also investigated. When the mother is employed more than 20 hours a week in the child's first year there seems to be persistent negative effects from paternal and non-relative care. The analytical framework is estimation by OLS, family fixed effects, and hierarchical linear modeling.

Ruhm (2005) also investigates the persistence of negative effects of (early) maternal employment on children. The children in Ruhm's study are in the ages 10 and 11 and he uses an econometric model similar to the one used in Ruhm (2004) to investigate the effect of maternal employment on the children. A comprehensive set of explanatory variables are included in the analysis to reduce unobserved heterogeneity. Ruhm focuses on cognitive development, whether the children have behavioural problems, and children's health. Estimations are by OLS and probit, and robustness checks are carried out using sibling fixed-effect and propensity score models. The results show little evidence that maternal employment strongly affects the cognitive development for an average adolescent but looking only at advantaged children<sup>11</sup> there are substantial negative impacts on cognitive development and health compared to less advantaged children, especially when the mother is employed full-time. On the other hand, limited amounts of work seem to

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<sup>11</sup> Advantaged children are defined as children with a high SES.

benefit the less advantaged children, and they do not seem to be harmed if their mothers work full-time.

Opposite to almost all other studies Averett et al. (2005) examine the effect of paternal care on children’s development. This study consider two-parent families with working mothers and compare families where the father takes care of the children with families where children are in relatives’ care, non-relatives’ care or in day care centers, pre-schools, or nursery schools. The effect of child care during children’s 3 first years is examined. When children are in the ages 5 to 8 the developmental outcomes are investigated. The results show that there is little difference in children’s cognitive ability or socio-emotional functioning between children who were in father care and children who were in non-paternal care. The small differences that are found suggest that there is a different effect between infants and toddlers in paternal care. Averett et al. point out that this may result from the fact that it is a very heterogeneous group of fathers who are taking care of children in the ages 2 to 3 where slightly negative effects on children’s development are detected. Fathers taking care of toddlers appear to be different than fathers taking care of infants. Another explanation for the result could be that the timing of paternal care may be important.

### **3.1.2 Studies using non-U.S. datasets**

Most studies within the literature of child development estimate on U.S. datasets. A few recent studies use non-U.S. datasets for their analyses, and these studies offer information on other aspects of the relationship between parental decisions and children’s development than the U.S. studies. Typically, non-U.S. datasets are richer in terms of information on e.g. different kinds of child care or part-time vs. full-time employment. The different information of course mirror the institutional settings in the different countries.

Gregg et al. (2005) investigate whether early maternal employment has an adverse effect on child outcomes in a UK context. They include a lot of background characteristics as suggested by Ruhm (2004) to reduce or remove heterogeneity and then do simple linear regressions, reduced form estimations. The focus is mainly on mother’s actions, and cognitive development of children in the ages 4 to 7 is investigated. As one of three key issues child care is explicitly considered in this study, and 8 different types of non-maternal child care are defined. Child care by the father(/partner of the mother) is categorized as informal unpaid care along with care provided by grandparents, other relatives, friends and neighbours. The exact impor-

tance of the father is therefore hard to determine but Gregg et al.'s results show a negative effect on children from maternal full-time employment combined with informal care. The effects are not large, though. For children with mothers employed part-time or full-time but where the children are in more formal care substitution, there is no evidence of any adverse outcomes according to Gregg et al.'s study. This study therefore suggests that the type of child care is crucial.

Parera-Nicolau and Mumford (2005) build their econometric model on a static theoretical model setup. The econometric model describe two parent families' decisions about labor supply and child care when there is at least one child aged under 5 in the household. Both parents' labor supply decision are modelled but only the mother is assumed to take care of the children if they are in parental care. Structural estimates of the theoretical model are found using a British dataset. According to the estimation results, an increase in hourly wages do not imply that employed mothers increase working hours, instead they seem to reduce working hours. The decision to increase mothers' working hours is highly dependent on the quality of child care in the market. Therefore, this study suggests that there should be more focus on child care quality in future research.

As can be summarized from this review of selected empirical studies, different types of datasets and different explanatory variables are used to explain the relationship between parental decisions and child development. In some cases only maternal decisions and activities are taken into account whereas fathers are also included in other studies. No clear results emerge regarding the effect of parental decisions on children's development. This may partly be because different specifications are used, but also because it is problematic to compare studies using U.S. datasets with studies using non-U.S. datasets when the institutional settings differ. Finally, it is interesting that recent studies suggest that the timing of child care as well as types of child care may be important. More research is needed to confirm these results.

## **4 Theoretical Model of the Relationship between Parental Decisions and a Child's Development**

Evidence from previous studies show us that more research is needed within the literature of child development since the effect of parental decisions on child development are rather unclear. The previous studies may differ in their results because the underlying theoretical models do not fit today's

households. The allocation of home time and market work within households have become more equally distributed during the latest decades and fathers seem to be an increasingly important part of children's daily life as shown in Bonke (2002) and Figures 1 and 2, but there seems to be great variation in the amount of time fathers spend with their children. Based on this information it seems natural to consider fathers as more than "non-mothers" in a household context and maybe hypothesize that the father is as important for a child as the mother in "modern" households. If this hypothesis is correct fathers should be included on same terms as mothers in theoretical models of the household. A theoretical model where it is attempted to link parental decisions to children's development, and where both parents are explicitly included along with child care bought in the market, is to my knowledge not yet developed.

The theoretical model presented in this section will model households with children, and there will be equal focus on mothers and fathers. The model builds on Becker (1965) in considering households as both consumers and producers. Especially the household's production of and concern about child "quality" is in focus here<sup>12</sup>. Fertility decisions will not be considered in the model though they may also subsequently have an effect on child quality. The model is also inspired by Becker and Lewis (1973) and Becker and Tomes (1976, 1979, 1986) but their models are extended or changed in several directions. For example, in this study the importance of fathers will be emphasized as studies by Parcel and Menaghan (1994), Ruhm (2004), and Averett et al. (2005) suggest. Contrary to Becker and Tomes (1979, 1986) only one generation will be considered so that parents are not maximizing utility with their grandchildren in mind. This assumption seems acceptable since parents cannot foresee how many grandchildren they will have and therefore do not take this into account when maximizing utility. Finally, the model also builds on the models in Ribar (1995) and Parera-Nicolau and Mumford (2005) but their models are extended by including child care by both parents instead of only considering child care from the mother. Both parents' labor supply will also be considered.

The model specified in this section will answer the following hypotheses regarding the relationship between mothers' and fathers' labor supply, the availability and quality of child care and children's outcome.

**Hypothesis 1** The mother's labor supply decision is affected by the availability and quality of child care bought in the market.

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<sup>12</sup>Child "quality" is the common used term in the literature for a child's development or later education and income. It should not be thought of as a ranking of children.

**Hypothesis 2** The availability of paternal child care affects the mother's labor supply decision.

**Hypothesis 3** The father's labor supply decision is affected by the availability and quality of child care bought in the market.

Assume that we have a household consisting of two adults and one child. We want to explain how household decisions affect this child's development. By making a simplifying one-child-assumption we avoid problems with endogeneity of parents' total time available for the child, since the total time available depends on the number of children among other things. We also ignore the question of birth order effects since all children considered here are first born, see e.g. Black et al. (2005) for a recent study on birth order effects. We may encounter other problems, though, since families with one child may be a selected group.

Parents maximize utility and since they care about their child's "quality" and well-being in general they take child quality as one argument in the utility function. Quality will be interpreted as the child's development within cognitive skills which will be measured as the educational level accomplished. Instead of using completed education as the measure of quality, we could use income as Becker and Tomes (1979)<sup>13</sup>.

Child quality is produced according to the following production function for child development,

$$D = D(T_C, X, P, G),$$

where  $T_C$  is parental time inputs and  $X$  is goods bought in the market and which are expected to promote child development, for example publicly provided child care.  $P$  is characteristics of the parents thought to affect both the quality of child care given and also the parents' perception of child care quality, and  $G$  is the genetic inheritance (endowments) of the child.  $D$  is increasing in all arguments but it seems plausible to assume that this is at a diminishing rate. The child development function does not depend on the status of child development in the previous period because, following Becker and Tomes (1976), we only consider one period of time, i.e. we have a static model<sup>14</sup>. The child's development in this model will be an outcome and not the dynamic process leading to the outcome, though it is noted that

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<sup>13</sup>It should be noted that parental caring about quality and caring about welfare is not the same, but it seems to have similar implications for the distribution of income, see Becker and Tomes (1979).

<sup>14</sup>One of the drawbacks of this static model is that the timing of parental time with children cannot be assessed. We leave this question for further research.

some studies consider child development as a dynamic process, see Todd and Wolpin (2003). The distinction between static and dynamic models is discussed in section 2.

Parents' time inputs in the child development function can be further specified as

$$T_C = T_{Cm} + T_{Cf},$$

where  $T_{C,i}$  is time inputs of the mother ( $i = m$ ) and the father ( $i = f$ ). Time inputs from the child itself will be ignored since the main interest in this study is the effect of parents' time inputs on the development of their child.

Child care is taken into account as something you can purchase in the market at an exogenously given price and with a good quality. Such an assumption is definitely reasonable for Scandinavian countries but may be more questionable for example in the U.K., Southern Europe and the U.S.<sup>15</sup> That is, in this model the price of high quality child care is exogenously given, and it is relatively cheap because it is assumed that there is a public subsidy. The price of child care is therefore not the same as the mother's cost of time, i.e. her hourly wage rate if employed<sup>16</sup>. Furthermore, the amount of child care purchased in the market is not restricted<sup>17</sup>.

Parents are time and budget constrained. The time constraint for each parent  $i$ ,  $i = m, f$ , can be specified as

$$T_{M,i} + T_{C,i} + T_{O,i} = T_i,$$

where  $T_M$  is time devoted to market work,  $T_C$  is time devoted to the child, and  $T_O$  is time spent in other activities than market work or with children, e.g. leisure time. We can normalize each individual's time constraint to 1, i.e.  $T_m = T_f = 1$ . The child is also time constrained and the child's time constraint is specified as

$$T_{Cm} + T_{Cf} + CC = 1,$$

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<sup>15</sup>Even though the assumption of publicly provided high quality child care may not be applicable to e.g. U.K. right now, it may be the case in just a couple of years. In U.K. the government has announced an ambitious ten year child care strategy, 'Choice for parents, the best start for children: a ten year strategy for childcare', and one of the aims of this strategy is exactly to provide high quality public child care, see HM Treasury (2004).

<sup>16</sup>This assumption is important since it has been shown that family labor supply responds to child care costs and child care quality, see Blau and Robins (1988), Parera-Nicolau and Mumford (2005), and Wrohlich (2006).

<sup>17</sup>A study on child care and parental leave in the Nordic countries supports the assumption of a wide spread public provision of child care in the Nordic countries, see Datta Gupta et al. (2006).

where  $CC$  is the amount of time the child is in publicly provided child care or similar child care bought in the market. Time in which both parents are with the child is divided equally to both parents so that the child's time constraint is also 1. We ignore that some children are in informal unpaid care, e.g. care provided by family members or the parents' friends. This type of care is not dominating in for example the Scandinavian countries, see Datta Gupta et al. (2006). On the other hand, informal unpaid care may be more popular in the U.S. as suggested in Ribar (1995). Including informal care in the model and assuming that parents will use as much of it as provided will not change the results of the analysis, though, since informal care can be treated as a fixed parameter as in the study by Parera-Nicolau and Mumford (2005).

The household budget constraint is specified as

$$T_{Mm}w_m + T_{Mf}w_f + Y = CCp_{CC} + y$$

where  $w_i$  is individual  $i$ 's wage rate,  $i = m, f$ ,  $Y$  is the household's non-labor income,  $y$  is the money value of parents' private consumption of goods, and  $p_{CC}$  is the price of one unit of market provided child care.  $p_{CC}$  is exogenously given since it is assumed to be determined by the local municipality.

In summary, parents' utility,  $U$ , depends on their own consumption of goods, their time spent in different activities, and the developmental outcome of their child. The utility function maximized by parents is then specified as

$$U = U(D, y, T_{Om}, T_{Of}),$$

where it seems plausible to assume that utility is increasing in all arguments. Parents maximize utility subject to the time and budget constraints. The exogenous determinants in the model are given as the price of market provided child care, the parents' wage rates, the non-labor income, and the characteristics of the parents and the child. The model is a unitary type of model, since it is assumed that the two parents act as one unit to maximize the household's total utility. This assumption may be too restrictive, see e.g. Browning et al. (1994) and Browning and Chiappori (1998), but in this setting where the focus is on modelling the child's development the unitary model seems appropriate.

We can state the utility maximization problem as follows

$$\begin{aligned} \max U &= U(D, y, T_{Om}, T_{Of}) \\ &s.t. \end{aligned}$$

$$D = D(T_C, X, P, G) \quad (4)$$

$$y + CCp_{CC} = T_{Mm}w_m + T_{Mf}w_f + Y \quad (5)$$

$$1 = T_{Mm} + T_{Cm} + T_{Om} \quad (6)$$

$$1 = T_{Mf} + T_{Cf} + T_{Of} \quad (7)$$

$$1 = T_{Cm} + T_{Cf} + CC \quad (8)$$

To simplify, we can assume that  $X$  is equal to  $CC$  so that goods bought in the market to promote child development is given solely as child care bought in the market. The genetic endowments of the child,  $G$ , and  $P$ , parental perception of child quality are assumed exogenously given. They are therefore regarded as fixed parameters in the maximization problem. The decision variables are the mother's and father's amount of market work and the amount of child care purchased in the market. The outcome is parental utility which encompasses child development as one of the components.

Substituting for  $T_{Cm}$  from Equation (8) into Equation (6), for  $T_{Cf}$  from Equation (8) into Equation (7), and for  $T_{Cm} + T_{Cf}$  from Equation (8) into the child development function, the utility maximization problem faced by parents is rewritten to

$$\begin{aligned} \max U &= U(T_{Mm}, T_{Mf}, CC) \\ &= U(D(1 - CC, CC), \sum T_{Mi}w_i + Y - CCp_{CC}, \\ &\quad T_{Cf} + CC - T_{Mm}, T_{Cm} + CC - T_{Mf}) \end{aligned}$$

The first order conditions are then given as

$$\frac{\partial U}{\partial T_{Mm}} = 0 \implies \frac{\partial U}{\partial y}w_m - \frac{\partial U}{\partial T_{Om}} = 0 \quad (9)$$

$$\frac{\partial U}{\partial T_{Mf}} = 0 \implies \frac{\partial U}{\partial y}w_f - \frac{\partial U}{\partial T_{Of}} = 0 \quad (10)$$

$$\frac{\partial U}{\partial CC} = 0 \implies -\frac{\partial U}{\partial D} \frac{\partial D}{\partial T_C} + \frac{\partial U}{\partial D} \frac{\partial D}{\partial CC} - \frac{\partial U}{\partial y} p_{CC} + \frac{\partial U}{\partial T_{Om}} + \frac{\partial U}{\partial T_{Of}} = 0 \quad (11)$$

From Equation (9) we see that the mother's wage can be written as

$$w_m = \frac{\frac{\partial U}{\partial T_{Om}}}{\frac{\partial U}{\partial y}} \quad (12)$$

which means that in optimum the mother's wage is the ratio of her marginal utility of other time to the marginal utility of consumption. Her wage (if she is working) in optimum is therefore the shadow value of her time spent on other activities than market work or child care. The mother's reservation wage is found at the point where she is indifferent between working in the market and not working ( $T_{Mm} = 0$ ), so the reservation wage determines the lowest wage she will accept. We can see from Equation (12) that the reservation wage is increasing in the marginal utility of other time and decreasing in the marginal utility of consumption which is quite intuitive and in line with standard economic theory.

Same results for the father as for the mother is found, since Equation (10) is similar to Equation (9) but with mother replaced by father.

Equation (11) gives us information about the relationship between parents' marginal utility of other time, the price of market provided child care as well as the tradeoff between parental child care time and market provided child care time for the child's development. We can rewrite Equation (11) to

$$\frac{\partial U}{\partial T_{Om}} + \frac{\partial U}{\partial T_{Of}} = \frac{\partial U}{\partial D} \left( \frac{\partial D}{\partial T_C} - \frac{\partial D}{\partial CC} \right) + \frac{\partial U}{\partial y} p_{CC}, \quad (13)$$

which shows that the sum of marginal utilities of parents' other time, that is, leisure time, is equal to the disutility of lost consumption caused by costs to market provided child care, in addition to the marginal child development cost or benefit from parental child care compared to market child care.

We can rearrange terms and isolate  $p_{CC}$ ,

$$p_{CC} = \frac{\frac{\partial U}{\partial T_{Om}}}{\frac{\partial U}{\partial y}} + \frac{\frac{\partial U}{\partial T_{Of}}}{\frac{\partial U}{\partial y}} - \frac{\frac{\partial U}{\partial D}}{\frac{\partial U}{\partial y}} \left( \frac{\partial D}{\partial T_C} - \frac{\partial D}{\partial CC} \right). \quad (14)$$

Equation (14) provides information on the reservation marginal cost of market provided child care. The higher the shadow value of parents' other time, the higher the probability of using (more) market provided child care since parents will care less about the price of market child care. We also see, that the reservation marginal cost of market child care depends on the value of  $\frac{\partial D}{\partial T_C} - \frac{\partial D}{\partial CC}$ . The parental decisions about child care depends crucially on the relationship between the quality of parental child care compared to the quality of market provided child care. Assuming, for example, that the quality of the two alternatives is the same, i.e. that  $\frac{\partial D}{\partial T_C} = \frac{\partial D}{\partial CC}$ , then parents can substitute between the two alternatives without consequences for child

development. If this is the case, we can further simplify Equation (13) to

$$\frac{\partial U}{\partial T_{Om}} + \frac{\partial U}{\partial T_{Of}} = \frac{\partial U}{\partial y} p_{CC}.$$

Under this assumption we get the simple and straightforward result in optimum that the sum of each parent's marginal utility of other time is equal to the marginal disutility of market provided child care.

If, on the other hand, the quality of parental child care is higher than the quality of child care bought in the market so that the marginal developmental effect on children will be higher from parental than market child care, then the marginal utility of parents' other time will be higher than the marginal disutility of one more unit of market provided child care. This result is also quite intuitive since....

Analysis of the model has confirmed that Claim 1 and 3 are true, i.e. both the mother's and the father's labor supply decision are affected by the availability and quality of child care bought in the market. The tradeoff between marginal child development caused by either parental or market provided child care seems to be an important determinant of parental decisions, so parents care about child care quality. On the other hand, Claim 2 is not directly supported according to the model. So the availability of paternal child care does not directly affect the mother's labor supply decision. This is a bit puzzling but may be attributed to the possibility of a heavy use of relatively cheap market provided child care, which makes paternal child care unimportant in relation to the mother's labor supply decision.

The actual effect on child development from either parental child care or market provided child care seems to be an empirical question. We will therefore take a closer look at this in section 5.

## 5 Empirical Evidence

In this section the data used for empirical studies is presented, and thereafter we look at the empirical analysis.

### 5.1 Data

The data used for studying the relationship between parental time use and children's development is the Danish 1987 time use survey (TUS) coupled with register information. The sample consists of individuals who have participated in the Danish time use survey in 1987 so they have filled out a

time diary of what they did on either a weekday or a weekend day in 1987. All activities are then coded into 15 minutes intervals<sup>18</sup>. The Danish TUS dataset is precise in defining which activities parents participate in with their children, so it is possible to generate a measure of the amount of daily direct and indirect child care. Indirect child care means that the child is present while the parent is doing e.g. housework, but the activity is not directly aimed at the child. Total amount of daily direct and indirect child care will be referred to as child care in this section.

The survey consists of an initial random sample of about 3600 Danish people aged 16 to 76. The response rate in the survey is above 60% which indicates that there are no serious sample selection problems. A response rate above 60% is normally considered satisfying.

Information from the survey is coupled with information from the Danish tax and income register collected in the IDA-database created by Statistics Denmark<sup>19</sup>. The register information consists of information on marital status, residence, education, income, wage, labor market activities, children, and the partner if one is present. The register variables makes it possible to follow the same individuals over time. We have yearly register information from 1986 to 2002. Especially the children are followed and their educational outcome traced and therefore the long term effect of parental time use can be identified which is crucial for this study.

For investigating child development in a framework similar to the theoretical model described earlier, certain restrictions are placed on the TUS data. First, we restrict the dataset to include only respondents who have children and, furthermore, we only keep families where the respondent report having a spouse or cohabitor in 1987. The child is the main person in our studies, therefore only children between ages 0 and 18 at the time of the TUS are kept in the dataset<sup>20</sup>. The children are roughly equally distributed across ages, except for the group of 15 year olds but this is expected since the survey is not conducted in January 1987, see Figure 5.

After these restrictions the sample is reduced to 2022 observations on "children" in 2002. These children all have (at least) one parent who participated in the TUS in 1987. Some of the individuals come from the same family and to simplify it is assumed that the parent spend equally long time with each child. Therefore, the amount of time spent on child care and

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<sup>18</sup>See Bonke et al. (2005) for a description of the 39 main activities recorded in the TUS.

<sup>19</sup>The IDA-database is the Integrated Database for Labour Market Research.

<sup>20</sup>To avoid losing too many observations the dataset is not restricted to include only families with one child. This is of course contrary to the theoretical model.

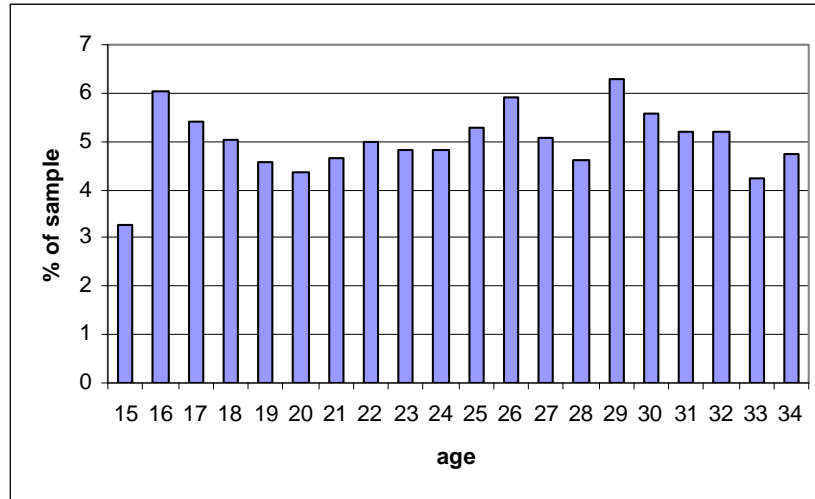


Figure 5: Children's age distribution in 2002.

reported in the TUS is assigned to all children from the same family.

## 5.2 Empirical Analysis

It is of general interest to explain what affects children's development. In this study we focus on investigating how parental time use affect children's long term development, that is, children's ability to complete a certain level of education. Therefore, we first look at how parental child care time (either mother's or father's time) affects the child's level of completed education. Secondly, it is interesting to see whether it is possible to directly substitute between paternal and maternal time with the child or whether the mother's time with the child is "better" than the father's time in the sense that time with the mother reinforces the child's later development. The latter is often implicitly assumed in the literature, and therefore we will take a closer look at the assumption in this section. We cannot investigate this assumption thoroughly but can give an indication on the degree of substitutability<sup>21</sup>.

Since only one of the parents have filled out a time diary in the TUS

<sup>21</sup>We would also like to test whether parental child care can be (perfectly) substituted with publicly provided child care purchased in the market since this is of interest in relation to the theoretical model and also of interest in itself. This latter cannot be tested with the TUS data, though.

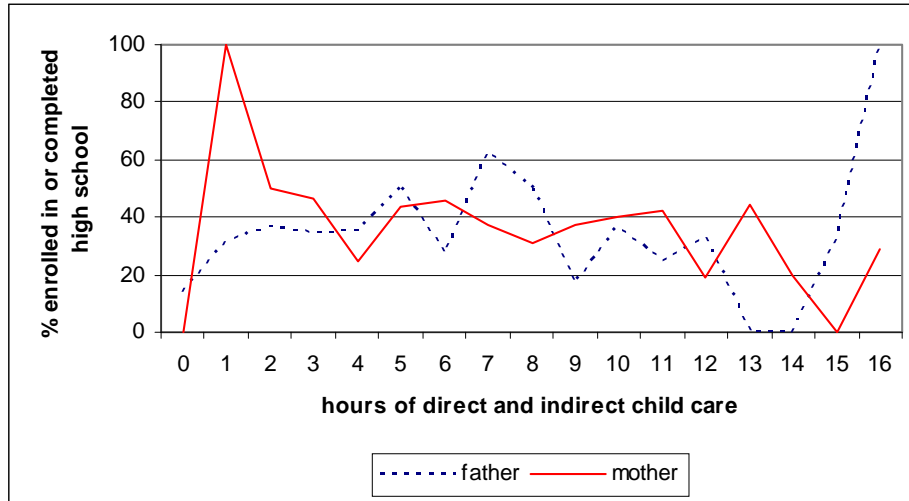


Figure 6: Percent of children aged 18 or younger in 2002 who are enrolled in or has completed high school, separately by mother’s or father’s child care time in 1987.

dataset, we will look at mothers and fathers separately throughout the whole empirical analysis. We will first take a look at some descriptive statistics.

Figure 6 shows how many percent of the children aged 18 or younger in 2002 has completed high school or is still enrolled in high school. This is shown separately for mothers and fathers for the different hours of parental child care time in 1987. It is suggested from the figure that the effect of mother’s child care time is different than the effect of father’s child care time. There actually seems to be a negative slope in mothers’ child care time suggesting a negative effect of increasing maternal child care time. This effect might disappear when controlling for the child’s age and family background variables.

When looking only at older children, that is children aged 25 or above in 2002, we see that the effect from mother’s and father’s child care time in 1987 is almost the same on children’s average years of education, see Figure 7. Surprisingly, we can also see that the effect from parents spending a lot of time is almost the same as the effect from parents spending little time on child care. Again, controlling for family background characteristics and children’s age might change the results.

Table 1 shows raw correlations between parents’ child care time in 1987

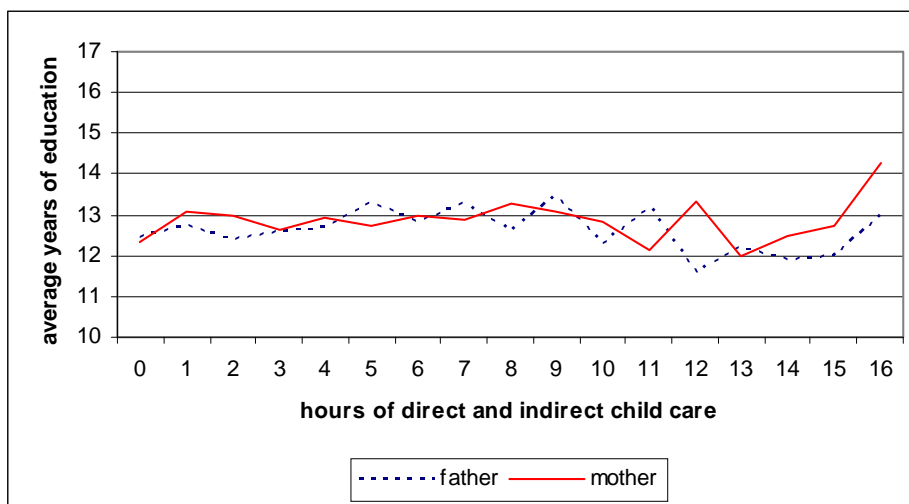


Figure 7: Average years of education for children aged 25 or older in 2002, separately by mother’s or father’s child care time in 1987.

and children’s education length in 2002. All the correlations are negative, indicating a negative effect of (more) parental child care time. The correlations are negative for child care time in weekends and on weekdays, and both for child care time provided by the mother and the father. There seems to be a greater negative effect of mother’s than father’s child care time, which is very surprising. This may be the result of not checking for any background characteristics of either the child or the parent.

**Table 1.** Correlation between parents’ child care time in 1987 and children’s education length in 2002, separately for weekdays and weekend days.

	Father’s child care time	Mother’s child care time
Weekday	-0.0726	-0.1368
Weekend day	-0.0126	-0.1574
Observations	960	1049

To check the descriptive results we use OLS estimation to address the relationship between the child’s educational outcome,  $E$ , and the parent’s time input on a random diary day,  $T_{Ci}$ ,  $i = m, f$ . We will assume that this day is representative for the time parents and children usually spend together in the family. Furthermore, in the estimations we will in each specification

include more exogenous variables to control for family characteristics,  $X$ . The equation to be estimated is the following

$$E = \alpha + \beta T_{Ci} + \gamma X + \varepsilon,$$

where  $\varepsilon$  is the "error" term which is assumed not to be correlated with either  $T_{Ci}$  or  $X$ . This is to ensure consistency of the OLS estimator but the assumption may be too strict since we have not controlled for individuals' unobserved heterogeneity. Including endogenous explanatory variables can cause biased OLS estimates.

**Table 2.** OLS estimation results, 2002.

	(1)	(2)	(3)	(4)
Father's time	0.0124 (1.07)	0.0129 (1.15)	0.0129 (1.16)	0.0130 (1.16)
Mother's time	0.0163 (1.87)	0.0215 (2.56)	0.0248 (2.91)	0.0247 (2.90)
Parent's educ. length		0.1717 (9.84)	0.1770 (9.91)	0.1767 (9.87)
Gross income			0.3136 (2.57)	0.3123 (2.56)
Copenhagen				0.0118 (0.15)
Observations	2022	2022	2018	2018

Table 2 summarizes OLS estimation results. The dependent variable is children's length of education in 2002 and in each estimation we have controlled for the child's age and age squared. In specification (1) we see that the effect of parental child care time on the child's level of education is positive opposite to what is suggested by the descriptive results. None of the coefficients are significant on a 5% level, though, as indicated by the t-statistics in parentheses. Throughout all four specifications the coefficient on father's child care time is positive and insignificant. In specifications (2)-(4) the coefficient on mother's child care time is positive and significant and about twice the size of the coefficient on father's child care time. This suggests that parental child care time cannot be substituted one-to-one but that the effect of mother's child care time is larger than the effect of father's child care time.

As expected we see in specification (2) that the effect of the parent's own length of education has a significantly positive effect on the child's level of education. Furthermore, the parent's gross income also has a significantly

positive effect on the child's education length as shown in specification (3) but it does not seem to influence the child's level of education to be living in the capital area as indicated by the Copenhagen dummy included in specification (4).

## 6 Conclusion

A lot of studies have tried to determine what affects child well-being and development. Most economic studies focus on the effect of mothers' employment on the child's cognitive development but recently more focus is shifted to the effect of fathers' decisions as well. Most previous studies have focused on the cognitive development of pre-school children instead of looking at the cognitive development of older children or grown up children. Furthermore, no clear conclusion regarding the effect of parental employment on children's development has emerged from the existing studies.

This study argues that both mothers and fathers should be included in a theoretical model of children's long term development in "modern" households. A structural model is presented and new in the model is that both parents' child care time is taken explicitly into account as well as child care bought in the market. The framework is a household consisting of two adults and one child. The model shows that both parents' labor supply decisions are affected by the availability and quality of child care bought in the market. Parents care about the quality of child care and they respond to the difference in marginal child development given by parental and market provided child care. According to the model, the availability of paternal child care does not seem to directly affect the mother's labor supply decision. This result is a bit puzzling but may be attributed to a potentially heavy use of child care bought in the market which may imply that fathers' child care time is unimportant for mothers' labor supply decisions.

The empirical analysis focuses on the long term effect of parental child care time in 1987. It shows that there is a negative correlation between parental child care time in 1987 and children's length of education in 2002. OLS regression results reveal that after controlling for the child's age and family characteristics parental child care time has a positive effect on the child outcome. The effect of mother's child care time is significant and about twice as large as that of father's child care time. The coefficient on father's child care time is not significant in the estimations. This suggests that mother's and father's child care time cannot be substituted one-to-one.

The model investigated in this paper is static and a nice extension of

the model would be a dynamic version. The model would then be more in line with child care models described by e.g. Todd and Wolpin (2003) and more focus could be on child development as a process and not just as an outcome. Furthermore, the timing of parental child care could also be taken into account. The timing of parental child care has not yet been thoroughly investigated but it provides an interesting path for future research and may further explain the relationship between and effect of mothers' and fathers' child care time.

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