

Public and parental investments in children. Evidence from the literature on non-parental child care*

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December 2012

Abstract

This paper summarizes the most recent empirical research on parental and social investments in children, with a focus on policies providing non-parental child care. The empirical findings are conceptualized in a simple theoretical framework showing how parents' decisions and policy intervention interact in contributing to child's development. The results from these studies are presented taking into account the institutional context where the policy has been implemented and the timing of the intervention. The majority of large-scale policies providing non-parental child care have positive effects on children's cognitive outcomes, both in the short and in the medium run. Early childhood policies can have long-lasting effects on adult outcomes, also boosting the development of noncognitive skills, that are used and rewarded in labor market and social life.

JEL Classification: J13, I24, I38

Keywords: child care, child development, review, public intervention

*This paper is part of my PhD dissertation. I thank my advisor Daniela Del Boca for her constant encouragement during these years and Chiara Pronzato for her useful comments. Hospitality and financial support from Collegio Carlo Alberto are gratefully acknowledged.

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1 Introduction

In the last decades there has been a large growth in the body of social science research that investigates the effects of parents' behavior on children's development. This literature has mainly focused on maternal employment and on the consequences of externalizing child care activities, especially during the child's first years of life.

Despite the concerns related to the mother's participation in the labor market, findings from this literature are mixed. Ermisch and Francesconi (2005) summarize existing studies evaluating the impact of maternal employment on several child's outcomes, as children's attainments and years of schooling, and report that maternal employment estimates range from being detrimental (Baydar and Brooks-Gunn, 1991; Belsky and Eggebeen, 1991; Bernal, 2008; Chase-Lansdale et al., 1989; Ruhm, 2004) to having no effect (Blau and Grossberg, 1992; Chase-Lansdale et al., 2003; James-Burdumy, 2005) to being beneficial (Parcel and Menaghan, 1994; Vandell and Ramanan, 1992). The development psychology literature suggests that if the mother works, insecure mother-child attachments might be formed in the first years of a child's life; in other words, a detrimental effect can be due to the loss of time the mother spends with the child. Rarely, this negative impact is compensated by a positive income effect, due to the higher household income related to the mother's participation in the labor market. Almond and Currie (2011) argue that maternal employment really matters for child development, as long as it changes the inputs combination chosen by parents, and according to what are the alternative forms of care used for the child. The issue is then whether non-parental child care can have positive or negative impacts for child development when the mother works.

Recently, a related literature assessing the impacts of non-parental child care on child's development has emerged. These studies consider very different outcomes and do not provide homogeneous results. Some of them referred to the United States (Bernal and Keane, 2011, 2010) find that having attended (any) child care before kindergarten induces a reduction in children's test scores by 2 to 3 percent, while Baydar and Brooks-Gunn (1991) find a more detrimental effect if non-parental child care is used during the child's first year of life. Other studies, referred to the same country, find positive results. For instance, Loeb et al. (2007) find that children who attended a center-based arrangement, compared to children cared for by their parents, have reading scores higher by 1.1 points and Math scores higher by 2 points. Currie and Thomas (1995, 1999) and Deming (2009) evaluate the effect of having attended Head Start and find positive differences in test scores between those who attended the program and those who did not.

The reasons for these disparate findings are multiple, and range from the different child's outcome measure that is used, to the diverse data source considered and to the different empirical strategy handled to estimate the parameter of interests. More importantly, the variation in these estimates can also depend on the different institutional

context and the characteristics of the service that is analyzed.

Only very recently a similar literature has evaluated non-parental child care impacts in Europe and other countries, different from the U.S.. These studies focus more on publicly provided large-scale programs and the majority of them suggests positive implications of highly regulated services for children's development, especially for children belonging to the most disadvantaged backgrounds. The present survey aims to present an overview of these newly available results, focusing more on studies evaluating large-scale child care and preschool programs and stressing the importance of institutions and government intervention for child care to have an effect on child development.

As pointed out by Haveman and Wolfe (1995), investments in children's human capital depend on two main factors:¹ (i) the society or government that determine the opportunities available to both children and their parents (*social* investment), and (ii) the choices made by the parents regarding the family time and resources devoted to children (*parental* investment). This distinction is particularly suitable for non-parental child care, where the choice of whether to use external forms of care remains up to parents, but the government can influence this choice changing the opportunity set available to them and the quality of the service they can buy.

The countries to which existing studies on non-parental child care refer are characterized by very different institutional frameworks, especially in terms of government intervention in child care policies. The first difference to note is on the ground of formal child care and preschool enrollment. As shown in figure 1, enrollment in formal (public and private) preschool is higher than 60 percent in almost all countries, but enrollment in nurseries is more differentiated. There are countries, such as Denmark, the Netherlands and Sweden, where more than 50 percent of children younger than 2 attend a formal facility, while in others (e.g., Spain, Italy and U.S.) this percentage drops to less than 30. These figures are the outcomes of both parental attitudes toward external child care and the real availability of formal services.

Moreover, the structure and characteristics of the child care systems differ significantly across these countries. Government intervention can imply the direct provision of the service, its regulation or just its subsidization. In U.S. and U.K., the child care market is characterized by a large participation of the private sector, while government intervenes through subsidies in order to assist poor households to afford child care expenditures. In these countries, a distinction aimed to identify services with better quality and stricter regulation is the one between center-based and informal arrangements. However, there are also examples of public intervention in some U.S. states. For instance, pre-kindergarten services are universally provided to children with at least 4 years of age in several states; there are also programs targeted to poor and disadvantaged families and children.² In Europe, instead, governments are more involved in the provision and regulation of the service and the supply from the private sector is very limited. There are also differences across European countries: countries in Northern Europe - such as Sweden, Denmark and Norway - are characterized by universal public

child care services, while countries in Southern Europe - such as Italy - are moving toward a mixed child care supply, where both private and public sectors are involved, and all providers are regulated in order to respect minimum quality standards. This difference can also be captured looking at the levels of government spending for pre-primary education. Northern-Europe countries spend around 100 thousands Million Euro for pre-primary education, while countries in Southern Europe spend less than 10 thousands Million Euro.³

The differences in the institutional contexts and in the features of the child care systems should be taken into account when evaluating the impacts of external child care on subsequent child's development. It is widely recognized that child care should be of high-quality in order to be effective for child development, even though it is not clear which characteristics of the service should be regulated to respect this requirement.⁴ Non-parental child care may also have different implications for the development of cognitive and noncognitive skills, since diverse features may affect differently each type of ability. For example, center-based group arrangements, characterized by stricter regulation, may be more effective for the development of cognitive skills and child's readiness to school; however, in case of higher child-staff ratio, they may fail in contributing to the child's vocabulary and language skills, for which the child needs more interactions with only one person. Finally, formal child care is likely to reduce the importance of family background for child development by serving as a substitute for parental care or informal care arrangements, contributing to reduce inequalities and providing better opportunities to children living in low socio-economic backgrounds (Almond and Currie, 2011).

This survey builds on three previous studies that have reviewed part of the broad literature on child development. Haveman and Wolfe (1995) provide an excellent survey on the determinants of children's attainment focusing on family and neighborhood investments. They consider studies evaluating the determinants of economic mobility, high school graduation, years of schooling, out-of-wedlock fertility during adolescence and adult earnings. However, they do not explicitly deal with the role of public policies and school and do not consider non-parental child care as an input in the production of child's human capital. Almond and Currie (2011) provide an extensive review of studies evaluating child care impacts focusing on investments made during the first 5 years of life of the child. Specifically, they analyze both non-experimental studies, where the child care treatment encompasses every type of non-maternal child care, and experimental analyses, where specific programs targeted toward disadvantaged children and families are considered. All these studies refer to the United States, while the authors, as well as Blau and Currie (2006), recognize the importance of reviewing also studies referred to other countries. Moreover, results from both experimental and non-experimental studies can provide limited information to the policy maker as long as it is not possible to identify precise features of the input, and results from targeted programs can rarely be extended to other contexts. Also Cunha et al. (2006) provide

a survey of existing studies evaluating the impacts of targeted programs implemented in the U.S.. They also present a framework modeling the child's development process and based on the idea that agents possess a vector of skills of two types: cognitive and noncognitive. They suggest that cognitive ability, although necessary for success in life, it is not sufficient and that noncognitive skills also matter for education and labor market outcomes (Heckman et al., 2006).

This review considers the impact on child's development of a specific input, i.e., non-parental child care, and, in this view, it is complementary to Ermisch and Francesconi (2005). The contributions to the existing surveys are multiple. First, it provides a unique description of studies mostly referred to countries different from the U.S.. To the best of my knowledge, a comprehensive literature review dealing with child care impacts for countries different from the U.S. is lacking. This point, together with the inclusion of more recent analyses, allow to present the non-parental child care impacts taking into account the institutional framework where the policy is implemented. Moreover, considering different contexts allows to test the consistency of the results across countries. Second, the results are presented according to the timing of the investments and in such a way to take into account the contribution to both cognitive and noncognitive skills. In fact, the studies analyzed here use different outcomes, measured in diverse stages of the child's life. The structure of this survey takes into account the fact that non-parental child care impact may change over time and may influence in a different manner the development of cognitive and noncognitive abilities. Among the surveys above mentioned, only Cunha et al. (2006) recognize the importance of early childhood intervention for noncognitive skills.

The rest of this paper develops as follows. Section 2 presents the theoretical background for the impacts of child care policies on child's development: section 2.1 describes the economic rationals under which government participation in the child care market is justified; section 2.2 presents a theoretical model where the parents decide the non-parental child care input for their children and discusses the plausible patterns of the child care impacts over time. Section 3 presents the empirical issues arising for the estimation and identification of non-parental child care impacts. Section 4 presents the results from selected studies, distinguishing between outcomes measured during early childhood (section 4.1), middle-childhood and adolescence (section 4.2) and adulthood (section 4.3). Section 5 concludes.

2 Theoretical background

Child's development may depend on two main factors: (i) the government or social intervention, that determines the opportunities available to parents and children, and (ii) the parents, who decide their investments on child's human capital. This distinction is particularly important for the non-parental child care decisions, since the actual choice of the parents depends on their opportunity set, that can be manipulated through government intervention. Although not being a pure public good, public intervention in the provision, regulation or subsidization of the child care service is justified by the presence of several market failures that prevent parents from optimally investing in the human capital of their children. Subsection 2.1 discusses the economic framework under which government intervention in child care policies is justified. Subsection 2.2 presents a model describing the parental decisions to use external child care and the plausible patterns with which this investment can affect child's development over time.

2.1 Rationals for government intervention in the child care market

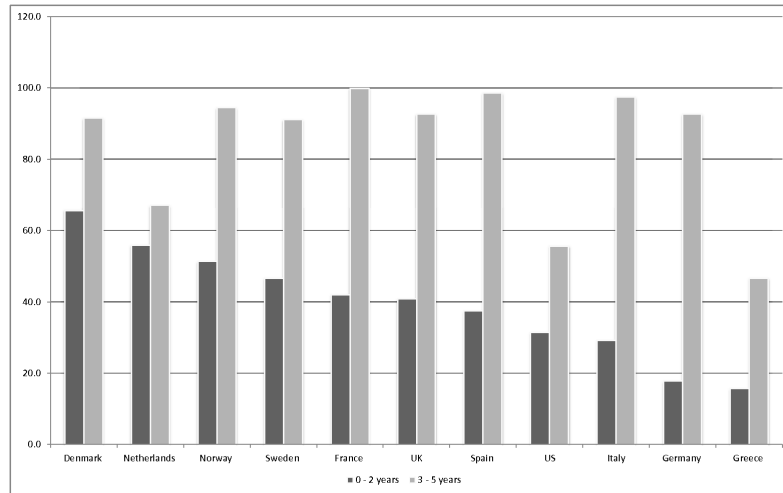
The first justification for government intervention in child care provision is on the grounds of equity. A government that is concerned with equity can compensate for differences in final outcomes, attempt to equalize initial endowment or both. However, investing in early childhood programs can be more cost-effective and impede the moral hazard problem that may arise when society attempts to compensate people with poor outcomes (Blau and Currie, 2006). Moreover, as suggested by Cunha et al. (2006), human capital accumulation has a dynamic feature that has implications on how investments in human skills should be distributed over the life cycle. Heckman (2008) shows that the rate of return of human capital investments during early years is higher than the one of investments made later on. Equalizing this rate of return to a fixed rate representing the opportunity cost of funds in the capital market yields the optimal investment level across child's life: the optimal investment in the child's human capital should be higher when the child is in preschool age and decreasing over time (Carneiro and Heckman, 2003). The same reasoning justifies public child care as a remediation for children living in poor socio-economic conditions. In fact, living in disadvantaged conditions in the first years of life can be detrimental for children's future development; public child care may provide them with better educational opportunities with respect to the ones they could get at home (Bennet, 2008).

The second argument according to which government should intervene in child care provision and regulation is on the grounds of efficiency. In fact, public intervention serves to compensate for the existence of market failures, such as liquidity constraints, credit market imperfections and asymmetric information.

Liquidity constraints of the household where the child resides may prevent parents from investing in the human capital of their children and from choosing high-quality child care services; in fact, if only private child care is available, only parents highly

Figure 1

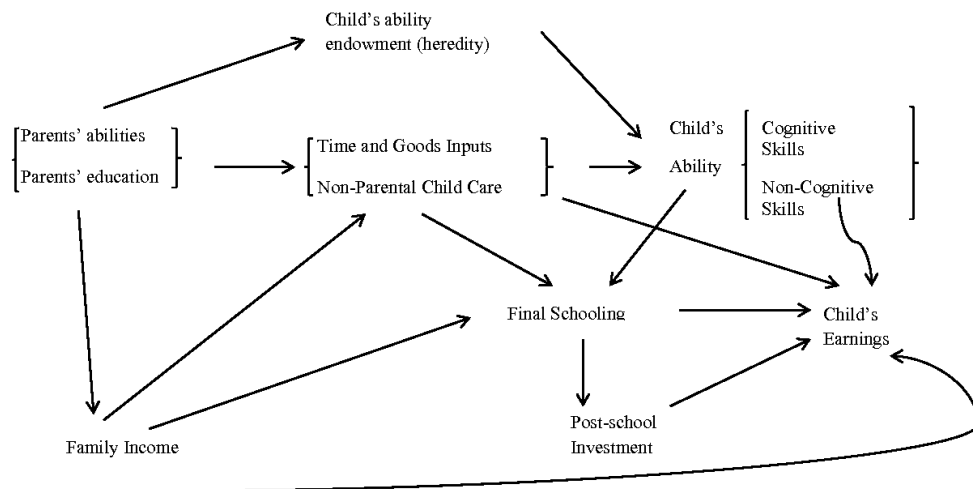
Enrollment rates of children under age 6 in formal care or early education services, 2008.



Sources: OECD Education database. Formal care and early education services include both public and private facilities.

Figure 2

Non-parental child care inputs for child's development.



Notes. Figure adapted from Leibowitz (1974).

valuing the educational purpose of child care and with higher willingness to pay can use it. Carneiro and Heckman (2003) show that liquidity constraints may have worst effect for child development if they occur in the first years of the child's life and these negative impacts may persist in the long-run.

Similar patterns are related to the inefficiency and imperfection of capital markets. In fact, if capital markets are efficient and the endowed ability of children is observed by the parents, parents could borrow against the future earnings of their offspring, in such a way to achieve the optimal level of human capital during early childhood. Since credit markets are imperfect and there is no commitments on the offspring to give back their earnings to their parents, parents can invest in their children's human capital only reducing their actual consumption; hence, parental income becomes a determinant of children's attainments (Haveman and Wolfe, 1995).

The existence of both liquidity constraints and inefficiency in capital markets justifies government intervention in terms of subsidization of the services, but do not say nothing about public provision and regulation. However, Bergmann (1996) argues that traditional arguments in favor of cash transfer over in-kind services do not apply to merit goods, such as external child care: in fact, parents may spend the cash grant received by the government in services different from child care or they would not be able to choose the better option for their children. Instead, government provision or, at least, regulation of the service ensures homogeneous standards and well regulated options for the parents.

Finally, public involvement in child care supply is also justified by the existence of asymmetric information of the parents, that leads to inefficient demand and supply of the service. As several studies argue (see, for instance, Blau and Currie (2006) for the U.S. or Bosi and Silvestri (2008) for Italy), parents may not fully account for the benefits of high-quality child care for children; this implies, on average, a lower willingness to pay of the parents and an higher incentive for the child care provider to offer a low-quality service. In order to ensure higher and more homogeneous quality, the government can directly provide the service or establish minimum requirements that should be respected by all child care providers (both private and public).

2.2 Non-parental child care choices and child's development

The majority of existing studies evaluating the impact of child care attendance on subsequent child's outcomes interprets child care as an input in the Education Production Function (EPF) framework. Child's ability is the outcome of a cumulative process of knowledge acquisition, fostered both by family and school inputs, and of child's specific initial endowment (Cunha and Heckman, 2008; Todd and Wolpin, 2003). Non-parental child care, as well as the time and goods the parents spend for their child, are the inputs chosen by parents. This relationship can be summarized by the following expression:

$$A = A(c, \tau, g, \mu) \tag{1}$$

where child's ability is a function of non-parental child care c , parental time τ , the goods bought for the child and effective for his own development (g) and μ , that represents the child's initial endowment. For the purposes of this survey, A represents both cognitive and noncognitive skills. The majority of studies estimate (1) or an approximation of that, without taking into account that the inputs c, τ, g are chosen by parents. However, the parents' decision making process should be taken into account when interpreting the empirical results.

The economic modeling explaining how the c, g, τ choices are made derives from the model developed by Becker and Tomes (1986), where the members of the household produce a commodity, i.e., child's ability, by combining inputs of goods and time, as in a firm production process. In this framework, the household maximizes a unitary utility function with child's ability as an argument, and subject to a production function for child's ability with inputs including time of family members, purchased goods and non-parental child care.⁵

The model can be written as:

$$\max_{h,c,\tau,g} u(l, C, A) \quad (2)$$

$$s.t. \quad TT = l + h + \tau \quad (3)$$

$$C = HI - pc - g \quad (4)$$

$$A = A(\tau, c, g) \quad (5)$$

where (2) represents parents' utility as a function of their leisure time l , their consumption C and the ability of their child A . Expressions (3) and (4) are the time and budget constraints. Notice that household expenditures include consumption, expenditure for external child care (where p is the price of child care) and for the goods bought for the child g , whose price is normalized to 1. Finally, (5) represents the child's ability production function. In this model the parents decide their own labor supply h , how many hours to spend with the child τ , how many hours of child care to use c and how many goods g to buy for the child; TT is the total time endowment, HI is total household income, including mother's and father's labor income as well as non labor income.

Assuming separability of goods in the utility function and of inputs in the child's ability production function, the FOC for the demand of child care is given by:

$$-U'_C p + U'_A A'_c = 0 \quad (6)$$

where U'_C represents the first-order derivative of the utility function with respect to consumption, U'_A represents the first-order derivative of the utility function with respect to ability and A'_c indicates the marginal productivity of non-parental child care input.

After some rearrangements, the demand for child care is given by the following

condition:

$$\frac{U'_C}{U'_A} = \frac{A'_c}{p}$$

$$MRS_{CA} = \frac{A'_c}{p} \quad (7)$$

where MRS_{CA} is the marginal rate of substitution between consumption and child's ability. Condition (7) states that parents will invest in their child's human capital choosing non-parental child care up to the point where the marginal rate of substitution between consumption and child's ability is equal to the ratio between child care productivity and the price of external child care. In this framework, the child care productivity A'_c represents the opportunity cost of choosing one more unit of consumption instead of investing in one hour more of child care.

Notice that the ratio on the right-hand side in (7), i.e., $\frac{A'_c}{p}$, is composed by variables that can be manipulated by the policy maker. In fact, a child care subsidization policy can decrease the price of child care p , while government regulation can improve the child care productivity perceived by the parents. A change in the price of child care or in the marginal productivity of the service can determine both an income or a substitution effect, depending on parental preferences over consumption and child's ability. If non-parental care represents an investment in child's human capital, an increase in its marginal productivity implies an higher opportunity cost of consumption. If the substitution effect prevails, the demand for child care increases, yielding an increase in the child's human capital; instead, if the income effect prevails, parents may decide to invest less in child's human capital, decreasing their demand for external child care. This simple example shows how the interactions between child care policy and parental preferences can lead to different child care demand and different effects on child's ability. As suggested by Havnes and Mogstad (2010), for wealthier parents, that are supposed to be already investing in their child's human capital, the income effect would be prevailing and the demand for child care decreases. Instead, a policy increasing the child care productivity or decreasing its price can be effective for households with more stringent budget constraints for which it may enlarge their opportunity set; in this case, a substitution effect is more likely to prevail.

The model presented so far is static and assumes that parents decide their own investments during the child's first years of life. The structure of the model is still valid if one wants to test whether child care impacts last over time.

In order to understand the plausible mechanisms through which non-parental child care can influence child's development in the short, medium and long-run, consider a rearranged version of the framework proposed by Leibowitz (1974). In the original model, parents' abilities and education are transmitted to children genetically. They also jointly determine the level of family income and the quantity and quality of both time and goods inputs that parents devote to their children. Children's ability and

the levels of parental income and home investments in time and goods determine the schooling attained by children and, through schooling, the level of postschool investment. All of these affect children’s earnings and income. Figure 2 represents a version of this model, where non-parental child care is included among the investments made by parents and child’s ability is composed by both cognitive and noncognitive skills. Both these types of skills are used in later developmental stages, both in education and in the labor market (Heckman et al., 2006).

The part of the figure on the left, where parents decide their investments (time and goods, as well as non-parental child care), reproduces the parents’ decision making process previously described. Notice that each investment choice has a multiplicative effect on subsequent (cognitive and noncognitive) skills that may affect long-term outcomes. In fact, parental investments during early childhood affect the level of child’s ability immediately after the investments took place and during middle childhood. This short-run effect can be identified if a noisy measure of child’s ability during early or middle childhood is available. In the long-run, parental decisions can have an effect on both schooling and earnings. The effect on schooling can come either directly or through the effects of the investments on ability in early and middle childhood. Instead, the final effect on earnings can be due to three channels: a direct effect on child’s productivity when the child is an adult, induced by the investments themselves and long-lasting over time; an indirect effect that they have through schooling, since additional schooling determines higher wages; an indirect effect due to the impacts of the investments on middle childhood cognitive and noncognitive skills, so that these skills do not influence final schooling but have an effect on other personal traits and behavior that affect the productivity in the labor market.

3 Empirical issues for the estimation of child care impacts

The majority of existing studies estimate a reduced-form version of the child’s ability production function defined by (1), where also observable characteristics of parents and children are included. The estimation of the coefficient of interests in (1), i.e., for non-parental child care, is hampered by two main issues: (i) the difficulty to gather data on all relevant inputs for child development, and (ii) the selection problem due to the correlation of input choices with unobservables of both parents and children (Bernal and Keane, 2010).

Due to the absence of available data on all relevant inputs, the majority of studies does not estimate directly (1) but an approximation of that, given by the inclusion of proxy variables for omitted inputs. Often this issue arises for the inputs τ and g that cannot be available or precisely measured in survey data. The information on the amount of time spent by the child with the parents has been substituted with the amount of working time of both parents, assuming a specific relationship between parents’ child care and working time (Keane, 2010). Only very recently information on

the amount of time spent by the parents with the child has become available in time use surveys, so that a direct measure for τ can be included in the estimation.⁶ Concerning the information g , Del Boca et al. (2010) argue that, even if explicitly asked to report their expenditure for the child, parents may underestimate their true spending, not considering common goods, such as food and housing. Household income can be used as a proxy, under the assumption that a constant proportion of income is devoted to the child. However, as pointed out in several empirical applications (Rosenzweig and Wolpin, 1995; Todd and Wolpin, 2003; Wolpin, 1997) the use of this proxy has implications for the interpretation of parameters, since it is related to the household decision rules.

The second issue refers to the endogeneity of the investment choices with respect to parents' and child's unobserved heterogeneity. Consider the following ability production function:

$$A = A(c, \tau, g, X, \mu) \quad (8)$$

where all inputs can be observed and the unique unobservable component is μ . The selection issue arises if non-parental child care choices are influenced by parents' or child's unobservables in a way that the researcher cannot control for. The component μ can be defined as:

$$\mu = \mu_p(t) + \mu_c(t) \quad (9)$$

where μ_c represents the child's unobservables component independent from parents' unobservables μ_p , and both of them can be varying over time. Estimating the child care impact from (8) without controlling for this selection may lead to underestimation or overestimation of the true effect; the direction of the bias depends not only on the selection but also on the different characteristics of the service and on the way they may affect child development.

Suppose that there is a positive selection of parents in external child care use, so that $\text{corr}(c, \mu_p) > 0$. This may happen if parents that provide a home environment that fosters child development are also more likely to select child care arrangements that do so as well. These parents may have an higher willingness to pay for the service and would be more likely to choose a center-based arrangement instead of an informal one. Estimating the coefficient for c without taking into account this selection would overestimate the true child care impact. However, the bias may be reversed if parents have a limited choice set and, for example, they can use only a service with an average quality lower than the quality time they can offer to their child at home. This happens in Felfe and Lalive (2010) that evaluate the impact of enrollment in public nurseries in Germany. The authors argue that when the availability of child care is scarce only highly-educated parents use public nurseries that are also characterized by lower quality; hence, their children do not benefit from child care attendance, since they would have received better inputs at home. Without controlling for this positive selection, in fact, the authors find a null impact of child care attendance on subsequent

outcomes, implying a plausible underestimation of the true effect. Finally, there may be a correlation between the parental decision and the child's unobservables, that the parents can (partially) observe. Suppose, for instance, that there is a positive selection of children enrolled in child care attendance: $\text{corr}(c, \mu_c) \geq 0$. This may happen if the mother prefers to send her extrovert child to (center-based) child care, in order to improve his social and communicative skills. This choice reflects a reinforcing behavior of the mother, since she is investing more in her high-skilled child. Estimating the child care impact without controlling for this selection leads to a plausible overestimation of the true effect.

Hence, the bias depends not only on the selection of parents and children in individual child care use but also on the characteristics of the service offered by the market or by institutions. Also this point underlines the importance of public intervention, especially in the definition of homogeneous standards that, at least, can help understanding the baseline characteristics of the service.

Existing studies evaluating non-parental child care impacts adopt different strategies to handle these issues. Some of them try to overcome the omitted variables bias arising because of missing data using very rich set of control variables. Some examples are Hansen and Hawkes (2009) and Goodman and Sianesi (2005) who evaluate the effect of several child care categories in U.K., or Leuven et al. (2010) that assess the impact of early entry at school in the Netherlands. Basically, they estimate a child's ability production function of the form:

$$A = A(c, X, Z) \tag{10}$$

where Z is a vector of control variables and the component μ is not taken into account. Even with a large set of control variables, it is very likely that the selection arising in this framework does not depend on observables only, but also on unobservable characteristics. The control variable approach cannot be sufficient to take into account the selection of parents and children in individual child care attendance.

Other studies, mostly referred to the United States, use Mother (MFE) or Siblings (SFE) fixed effects that take into account time invariant unobserved heterogeneity at the household level. The unique example using this approach not referred to the U.S. is Berlinski et al. (2008), who evaluate the impact of a child care policy in Uruguay. With this approach, the component μ_p in (9) cancels out under the assumptions that it is time-invariant and that parents' behavior does not depend on children's unobserved ability, i.e., $\text{corr}(\mu_c, c) = 0$. However, the "MFE estimates [...] could still be biased if there is child-specific unobserved heterogeneity or time-varying family-specific unobserved heterogeneity" (Blau, 1999, p.806).

If it can be assumed that parents do not react to policy changes or instruments taking into account their child's ability, the Instrumental Variables (IV) and Differences-in-Differences (Diff-in-Diff) estimators provide consistent estimates of the effects of

interests. Both of them rely on the existence of an exogenous variation in child care use, due, for instance, to child care policies. The IV strategy has been used in several studies referred to European countries, even though it is very difficult to find enough powerful instrument in this framework. The main problem is that many variables at individual level that could be plausible instruments for child care use should also be included as determinants for child's development, so that the exogeneity assumption is very likely to fail. Other variables at aggregate level that have been used as instruments (for instance, local child care supply) turned to be very weak. This approach has been adopted by Datta Gupta and Simonsen (2010, 2011) and Felfe and Lalive (2010): the first studies refer to Denmark and use municipality features in child care provision as exogenous variation, while the second estimates the impact of public child care in Germany using, as exogenous variation, the large differentials in child care availability across German local areas. The Diff-in-Diff approach, instead, exploits the exogeneity of child care policies to evaluate their impact on child's subsequent attainments. Havnes and Mogstad (2010, 2011) provide two excellent examples, evaluating the impacts of a preschool expansion policy implemented in Norway during the 1970s.

All the approaches summarized here mostly follow the EPF framework and provide estimates from a production function of the form defined by (8), or an approximation of that. However, when interpreting the results from these studies it should be kept in mind that each input (not only child care) is the result of a decision made by parents. As already stated, both the interpretation of the coefficients estimates and the identification of the effect strongly depend on the decision-making process of the parents. Then, the interpretation of the results requires the knowledge of how these inputs are chosen. Among all the studies that will be presented in the following sections, only few of them provide a theoretical framework for the parents' decision making process that may help interpreting the results (for instance Havnes and Mogstad (2010) or Felfe and Lalive (2010)).

4 Review of selected studies evaluating child care impacts

This section presents the results from selected studies evaluating the impacts of child care attendance or child care policies on several outcomes. Since the outcomes considered by the literature are multiple and range from early childhood cognitive to adolescence noncognitive to adulthood labor market outcomes, the following subsections present the results for each timing, i.e. early childhood vs middle childhood and adolescence vs adulthood. Early childhood outcomes refer to noisy measures of child's ability assessed immediately after the child care inputs have been implemented, up to the time when the child is enrolled in grade 1 of primary school. Middle childhood and adolescence outcomes include those measured when the child is in the age range 7-16. Adulthood outcomes refer to education or labor market experience, as final education and wage, as measured when the child is an adult. The first two categories also

distinguish between cognitive and noncognitive outcomes: this distinction may help in understanding whether child care attendance can have different effects for specific developmental skills of the child.

4.1 Non-parental child care and early childhood cognitive and noncognitive outcomes

The studies evaluating the impact of child care or preschool on cognitive outcomes measured during early childhood are presented in tables 1 and 2. Tables 3 and 4 describe the studies evaluating short-term impacts on noncognitive outcomes. These outcomes are measured immediately after the input has been implemented, i.e., at kindergarten or primary school: the outcomes considered are school readiness and vocabulary tests as well as behavioral index or outcomes referred to habits at school. Measuring these effects is important, since it allows to test whether child care or preschool are effective in preparing the child for subsequent experience at school. However, it is not clear which type of service could have more influence on cognitive and noncognitive measures in the short-run. For instance, Hansen and Hawkes (2009) test the effectiveness of four child care categories (formal group, formal non-group, partner care and other informal care) on a vocabulary test and a school-readiness test, as well as on a noncognitive score, measuring the presence of behavioral problems. They find that formal group arrangements are more effective than other categories for the school readiness score and in decreasing the child's behavioral problems, while having attended a formal group child care has detrimental effect for the child's vocabulary abilities. Children who attended formal group child care get vocabulary score lower by 9 percent of a standard deviation than those who attended a formal non-group arrangement; however, those enrolled in formal group child care get a behavioral index lower than 12 percent of a standard deviation with respect to those cared for by their grandparents.

Felfe and Lalive (2010) provide, instead, estimates from the evaluation of the public child care system in Germany after the German reunification. The German case is very peculiar, since the private child care supply is almost absent and the government is involved in the support of conciliation between work and family through maternal leave rather than child care policies (see, for instance, Dustmann and Schnberg (2008)). As already stated in the previous section, the authors argue that the service can not be effective for child development if children come from wealthier households with more-educated parents. In fact, they find a very little impact when estimating their model using Ordinary Least Squares and higher effect when correcting for the selection using Instrumental Variables. They find positive effects of both having attended child care and the local supply of the service at childbirth on both cognitive and noncognitive skills: having attended child care increases the language skills index by 1.14 standard deviations and the noncognitive skills index by 0.9 standard deviations.

Comparing the results from Hansen and Hawkes (2009) and Felfe and Lalive (2010)

Table 1
Selected studies evaluating child care impacts on early childhood cognitive outcomes. Description.

Study	Country	Data and Sample	Inputs/Policy	Outcomes	Timing
Hansen and Hawkes (2009)	U.K.	MCS (2001-02). Families with only one child, where the mother works when the child is 9 months old and her age at child birth is higher than 16. N=4,800.	4 child care categories: i) formal group; ii) formal non-group; iii) partner care; iv) other informal care or grandparents' care ^a	Vocabulary test, school-readiness test.	Inputs are measured when the child is 9 months old; outcomes are measured when the child is 3 years old.
Felfe and Lalive (2010)	Germany	GSOEP. N=762.	Having attended child care in 0-2 age range & local public child care supply at child-birth	Standardized index of language skills	Inputs are measured in 2002-2005 (the child is in age 0-2); outcomes are measured when the child is 24-47 months old.
Leuven et al. (2010)	The Netherlands	PRIMA Survey (1994-95, 1996-97, 1998-99, 2000-01, 2002-03). Sample of pupils enrolled in grade 2 and never retained. Separate analysis for non-disadvantaged (N=28,942) and disadvantaged (N=23,893) children.	Early entry at primary school after the completion of the 4th birthday and before the 5th birthday.	Arithmetic and language test scores.	Inputs are measured when children are 4 years old; outcomes measured in grade 2 when the child is 6 years old.
Berlinski et al. (2009)	Argentina	ONEE (1995-1997) + CEN-Sus 1991. Sample size changes with the outcomes. On average N=120,000.	Newly constructed slots of free pre-primary school	Math and Spanish standardized test scores	Inputs measured in 1995-1997 when the child is 4/5 years old; outcomes measured when the child is in grade 3.
Gormley and Gayer (2005)	Oklahoma (U.S.)	TPS (2001). Sample: children entering pre-k and kindergarten in 2001. N=2246	Universal pre-kindergarten	Cognitive and Language test scores.	Input measured when children are 4 years old; outcomes measured in kindergarten (5 years old).
Gormley (2008)	Oklahoma (U.S.)	TPS (2006). Sample: hispanic children entering pre-k and kindergarten in 2006. Sample size changes according to the outcomes: on average N=550.	Universal pre-kindergarten	LW, Spelling and AP (WJ-R) test scores.	Input measured when children are 4 years old; outcomes measured in kindergarten (5 years old).

Abbreviations: MCS = Millennium Cohort Survey; GSOEP = German Socio-Economic Panel; PRIMA = Primary Education survey; ONEE = *Operativo Nacional de Evaluación Educativa*; TPS = Tulsa Public Schools.

^a Formal group = nurseries, creches; formal non-group = child-minders, nannies; partner care = child's father or mother's partner; other informal = relatives, friends.

Table 2

Selected studies evaluating child care impacts on early childhood cognitive outcomes. Results.

Study	Estimation technique	Coefficients
Hansen and Hawkes (2009)	OLS	Vocabulary score: formal non-group +0.089; partner care +0.108; grand-parents care +0.193. School Readiness Score: formal non-group -0.122; partner care -0.129; grand-parents care -0.108; other informal -0.193. Reference category formal group care.*
Felfe and Lalive (2010)	OLS, IV and RF. Instrument: local child care supply at childbirth.	OLS (effect of having used child care): +0.18 on language skills. RF (child care supply impact): +0.0118 on language skills. IV: +1.141.*
Leuven et al. (2010)	OLS	Effect of one more month of schooling on disadvantaged +0.061 on language score and +0.06 on arithmetic score.
Berlinski et al. (2009)	OLS	Effect of one more place at pre-primary school on Math score +4.694 and on Spanish score +4.761.
Gormley and Gayer (2005)	RDD. Treatment: having attended Tulsa pre-k in 2000; Controls: 1) not having attended Tulsa pre-k in 2000; 2) waiting for pre-kindergarten admittance in 2001	Treated children have cognitive score +0.756 and language score +0.817.
Gormley (2008)	RDD. Treatment: having attended Tulsa pre-k in 2005; Controls: 1) not having attended Tulsa pre-k in 2005; 2) waiting for pre-kindergarten admittance in 2006	Treated children have LW score +2.471, AP +1.928, Spelling test score +1.360.

Abbreviations: OLS = Ordinary Least Squares, IV = Instrumental Variables, RF = Reduced Form, RDD = Regression Discontinuity Design.

Notes. Estimates reported in this table represent the raw coefficients presented in each study. * indicates that the study uses a standardized dependent variable, so that coefficients can be interpreted in terms of a standard deviation. + indicates that the dependent variable is log-transformed and that coefficients multiplied by 100 can be interpreted as percentage change.

Table 3

Selected studies evaluating child care impacts on early childhood noncognitive outcomes. Description.

Study	Country	Data and Sample	Inputs/Policy	Outcomes	Timing
Hansen and Hawkes (2009)	U.K.	MCS (2001-02). Families with only one child, where the mother works when the child is 9 months old and her age at child birth is higher than 16. N=4,800.	4 child care categories: i) formal group; ii) formal non-group; iii) partner care; iv) other informal care or grandparents' care ^a	SDQ ^b behavioral test.	Inputs are measured when the child is 9 months old; outcomes are measured when the child is 3 years old.
Felfe and Lalive (2010)	Germany	GSOEP. N=762.	Having attended child care in 0-2 age range & local public child care supply at childbirth	Standardized indexes for: i) independence skills; ii) social skills; iii) behavior; iv) personality; v) motor skills.	Inputs are measured in 2002-2005 (the child is in age 0-2); outcomes are measured when the child is 24-47 months old.
Gormley and Gayer (2005)	Oklahoma (U.S.)	TPS (2001). Sample: children entering pre-k and kindergarten in 2001. N=2246	Universal pre-kindergarten	Motor skills test	Input measured when children are 4 years old; outcomes measured in kindergarten (5 years old).

Abbreviations: MCS = Millennium Cohort Survey; GSOEP = German Socio-Economic Panel; TPS = Tulsa Public Schools.

^a Formal group = nurseries, creches; formal non-group = child-minders, nannies; partner care = child's father or mother's partner; other informal = relatives, friends.

^b SDQ = Strength and Difficulties Questionnaire. Higher score indicates more behavioral problems.

Table 4

Selected studies evaluating child care impacts on early childhood noncognitive outcomes. Results.

Study	Estimation technique	Coefficients
Hansen and Hawkes (2009)	OLS	Grandparents care with respect to formal group care +0.121. ^{a*}
Felfe and Lalive (2010)	OLS, IV and RF. Instrument: local child care supply at childbirth.	OLS (effect of having used child care): +0.203 on noncognitive skills, +0.176 on independence, +0.325 on social skills, +0.195 on motor skills. RF (child care supply impact): +0.0087 on noncognitive skills, +0.0078 on independence, +0.0105 on social skills, +0.00765 on behavior, +0.0071 on motor skills. IV: +0.901 on noncognitive skills, +0.807 on independence, +1.086 on social skills, +0.792 on behavior, +0.742 on motor skills. [*]
Gormley and Gayer (2005)	RDD. Treatment: having attended Tulsa pre-k in 2000; Controls: 1) not having attended Tulsa pre-k in 2000; 2) waiting for pre-kindergarten admittance in 2001	Treated children have motor skills index +0.413.

Abbreviations: OLS = Ordinary Least Squares, IV = Instrumental Variables, RF = Reduced Form, RDD = Regression Discontinuity Design.

Notes. Estimates reported in this table represent the raw coefficients presented in each study. * indicates that the study uses a standardized dependent variable, so that coefficients can be interpreted in terms of a standard deviation. + indicates that the dependent variable is log-transformed and that coefficients multiplied by 100 can be interpreted as percentage change.

^a Since an higher outcome means more behavioral problems, a positive coefficient implies a detrimental effect.

gives an idea of the effectiveness of a privately provided center-based arrangement in U.K. with respect to the publicly provided one in Germany. In U.K., attending a center-based group facility has negative impacts on vocabulary scores, but also positive effects on behavioral outcomes. In Germany, instead, public child care has greater positive effects on language skills. This difference may be due to the stricter regulation of the publicly provided service in Germany than that of the service in the U.K..

Berlinski et al. (2009) evaluate the impact of a policy expanding free and public pre-primary school places, implemented during late 1990s in Argentina. Their estimates lay in between the U.K. and the German cases. In fact, the effect of one more place at pre-primary school on Math score is equal to +4.694, while for Spanish score it is equal to +4.761. Standardizing these coefficients, it yields that one more place at pre-primary school increases the Math and the Spanish scores by 0.24 and 0.23 standard deviations, respectively.⁷

Finally, two studies refer to a public intervention aimed to offer universal pre-kindergarten in Oklahoma (U.S.). Differently from the majority of studies in the U.S., they consider a public preschool policy. Both Gormley and Gayer (2005) and Gormley (2008) evaluate the Tulsa Pre-Kindergarten program, started in 1998, using a Regression Discontinuity approach and exploiting the age cutoff for children to be enrolled in the program. Gormley and Gayer (2005) find that having attended high-quality preschool increases children’s cognitive, language and motor skills scores by, respectively, 0.76, 0.82 and 0.41 points. Moreover, full-day treatment has stronger effects on the outcomes for black children. Gormley (2008) evaluates the same policy five years later only on Hispanic children and finds positive and statistically significant effects on both the LW and the AP test scores. Furthermore, he finds stronger effects for children whose parents were born in Mexico and for Spanish speaking children, who may need more help to compensate their linguistic disadvantage.

From these studies, it is possible to draw some conclusions concerning the short-term impacts of non-parental child care. The study referred to the U.K., comparing the effect of different child care categories, confirms that the distinction between center-based and informal services plays a significant role. All other studies evaluating specific child care policies, although referring to very different countries, consistently find positive effects of formal child care or preschool on both cognitive and noncognitive outcomes.

4.2 Non-parental child care impacts on middle-childhood and adolescence outcomes

There are several studies evaluating the impacts of child care attendance on medium-term outcomes, measured when children have between 7 and 11 years of age. The majority of them considers cognitive attainments assessed at school, but there are also examples of noncognitive outcomes, such as scores and indexes based on the factorization of several variables providing information on the acquisition of diverse skills.

Table 5 describes the main features of studies considering cognitive outcomes, while table 6 presents their results; instead tables 7 and 8 show the main findings concerning noncognitive medium-term outcomes.

Measuring the effect of child care and preschool policies in the medium run is crucial to see whether the positive impacts of these policies remain or, instead, dissipate over time. For instance, for the U.S., Currie and Thomas (1995, 1999) evaluate the effect of having attended the program Head Start on children aged more than 6. They still find a positive impact of the program on both PPVT test score and the probability of not being retained on white and Hispanic children, but for black these effects dissipate over time. The authors explain this finding arguing that black children are less likely to receive high-quality investments in human capital at primary and secondary schools, so that the positive effect of the program is more likely to vanish (Almond and Currie, 2011).

In the European literature, apart from Goodman and Sianesi (2005), all the studies evaluate the impact of a child care or preschool policy. Datta Gupta and Simonsen (2010, 2011) consider the high-quality preschool service in Denmark and find that having attended preschool (with respect to family day care) increases the language score of children at age 7 by 8 percent of a standard deviation and decreases their behavioral problem index by 0.42 points; instead, they do not find any effect on noncognitive outcomes at 11. Felfe and Lalive (2010) consider a child care policy in Germany and find that having attended child care in the first years of life increases grades at school by 1.4 percent of a standard deviation and noncognitive skills by 1.68 standard deviations. Similar results are found in Brilli et al. (2012), that estimate the effects of public child care coverage for children aged 0-2 in Italy. In this country, the availability of public child care is lower than in other European countries, such as France, Denmark or Sweden. As in Felfe and Lalive (2010), the authors find a positive effect of the additional child care slot on Language, while the effect is not significant for Math score. Comparing the estimates from Denmark and Germany or Italy, it seems that having attended the high-quality and strictly regulated preschool in Denmark has stronger effect than the child care policy in Germany and Italy. However, the stronger effect of the Danish case may also be due to timing issues, since that study refers to a preschool policy, while Felfe and Lalive (2010) and Brilli et al. (2012) evaluate a policy for children aged 0-2: the longer distance between the time when the input is implemented and the one when the outcome is measured can also determine the smaller effect that is found.

The positive implications for cognitive outcomes in the medium-run are fairly consistent across countries and methodologies. Dumas and Lefranc (2010) evaluate a preschool expansion implemented in France during the 1960s and the 1970s and estimate both the effects of the age of entry at preschool and the effect of preschool duration. They find that entry at 2 years (instead of at 3) increases test scores at grade 6 and the probability of graduation at high school; moreover, staying at preschool 3 years (instead of 1) decreases the number of grade repetitions at age 11 and 16. Berlin-

Table 5

Selected studies evaluating child care impacts on middle childhood and adolescence cognitive outcomes. Description.

Study	Country	Data and Sample	Inputs/Policy	Outcomes	Timing
Datta Gupta and Simonsen (2011)	Denmark	DALSC & DAR. Sample size changes according to the outcome, on average N=3,000.	Enrollment in publicly provided child care (preschool or family day care) vs home care. ^a	CHIPS ^c score, dummy for having repeated a grade, self-evaluated school performances. ^d	Inputs measured at age 3-6; outcomes measured at 11.
Dumas and Lefranc (2010)	France	DEPP & FQP. Sample size changes according to the dataset: DEPP on average N=20,000, FQP on average N=8,000.	Age of entry at preschool (3, 4 or 5 years old) from DEPP, duration of preschool (1, 2 or 3 years) from FQP.	Outcomes from DEPP data: number of grade repetitions at 11 and at 16, test scores in 6th grade, dummy for high school graduation; outcomes from FQP data: number of grade repetitions at 11 and at 16, dummy for high school graduation.	Inputs measured at age 3-6; outcomes measured at ages 11 and 16.
Felfe and Lalive (2010)	Germany	GCP. N=686.	Having attended child care in age 0-2 & local child care supply at childbirth	School grade. ^e	Inputs measured at age 0-2 for children born in 1996-1997; outcomes measured between 5-10 years.
Goodman and Sianesi (2005)	U.K.	NCDS. N=12,172.	Dummy for having attended any pre-compulsory education ^f ; dummy for having attended preschool vs staying home or starting primary school earlier.	Overall cognitive development score ^g at 7, 11 and 16; dummy for having needed special education at 7.	Inputs measured when the child is 4 years old (born in 1958); outcomes measured when the child is 7 (1965), 11 (1969) and 16 (1974) years old.
Berlinski et al. (2008)	Uruguay	ECH (2001-2005). Sample: individuals aged 7-15 living in 2 parents households and children of the household head. N=23,402.	Having attended at least one year of preschool.	Current school attendance and years of schooling completed.	Inputs measured in the age 3-6; outcomes measured in the age 7-15.
Fitzpatrick (2008)	Georgia (U.S.)	NAEP (1993-2004). Sample size changes according to the outcomes. On average N=600,000.	Universal pre-kindergarten program for all 4 years old children starting from 1995.	Reading and Math test scores, dummy for being on grade.	Policy intervenes when children are 4 years old; outcomes measured when children are in grade 4.
Brilli et al. (2012)	Italy	INVALSI SNV 2009-10. Sample: children enrolled in grade 2 performing both Language and Math scores. N=33,708.	Local (province level) public child care coverage for children aged 0-2	Language and Math test scores	Child care coverage measured in 2005; outcomes measured in 2009-10 when children are in grade 2.

Abbreviations: DALSC = Danish Longitudinal Survey of Children; DAR = Danish Administrative Registers; DEPP = French Ministry of Education Panel; FQP = Education, Training and Occupation survey; NCDS = National Child Development Study; ECH = *Encuesta Continua de Hogares*; NAEP = State National Assessment of Educational Progress; INVALSI SNV = *Servizio Nazionale di Valutazione - Istituto Nazionale per la Valutazione del Sistema Educativo di Istruzione e di Formazione*

^a Preschool = center based care. Family Day Care = care provided in private homes. Home care = care provided by parents.

^b SDQ = Strength and Difficulties Questionnaire. Higher score indicates more behavioral problems.

^c CHIPS = Children's Problem Solving Test with non-math logic questions.

^d Self-evaluated school performances are constructed as dummy variables indicating whether the child has excellent academic performances, likes school very much, is good at most things at school, is good in Math, is good in Danish.

^e Final grade attained in the most recent grade transcript as reported by the mother.

^f Pre-compulsory education includes any form of education (preschool or early entry) before the compulsory starting age of 5.

^g Average (standardized) score over Math and Reading test scores for any age.

Table 6
Selected studies evaluating child care impacts on middle childhood and adolescence cognitive outcomes. Results.

Study	Estimation technique	Coefficients
Datta Gupta and Simonsen (2011)	OLS and IV. Instrument: dummy for living in a municipality providing universal access to preschool (GAPS). ^a	OLS: effect of preschool (vs family day care) +0.414 on language test. IV: effect of preschool (vs family day care) n.s. for all outcomes but +0.107 for the dummy indicating whether the child likes the school very much.
Dumas and Lefranc (2010)	OLS with school/birth-department fixed effects	No. of repetitions at 11: entry at 2 +0.0938, entry at 4 +0.0843; test score at 6th grade: entry at 2 +0.0672, entry at 4 -0.105; no. of repetitions at 16: -0.142, entry at 4 +0.106; entry at 2 has positive and significant impact on the probability of graduation; ref. cat. entry at school at 3 years old. No. of repetitions at 11: staying at school 2 years -0.036, staying in preschool 3 years -0.068; no. of repetitions at 16: staying in preschool 2 years -0.066, staying in preschool 3 years -0.098; ref. cat. 1 year of preschool.
Felfe and Lalive (2010)	OLS, IV and RF. Instrument: local child care supply at childbirth.	OLS (effect of having used child care): -0.193 on grades (core courses), -0.179 on grades (liberal courses). RF (child care supply impact): +0.0142 on grades (core courses), +0.0157 on grades (liberal courses).*
Goodman and Sianesi (2005)	OLS	Effect of any pre-compulsory education: +0.09 on cognitive development index at 7, +0.067 on cognitive development index at 11, +0.048 on cognitive development score at 16. Effect of preschool: +0.053 on cognitive development score at 7, +0.036 on cognitive development score at 11.*
Berlinski et al. (2008)	MFE	Effect of having attended at least 1 year of preschool varies with child's age at the time of the interview (7-15). Effect on the probability to attend school: +0.043 when children are 7 years old, +0.274 when children are 15 years old. Effect on years of schooling: -0.341 when children are 7 years old, +0.788 when children are 15 years old.
Fitzpatrick (2008)	Diff-in-Diff	Effect of the treatment only on Math score: +0.017.*
Brilli et al. (2012)	GLS and OLS with province fixed effects	GLS: +0.195 on Language score, n.s. on Math score. OLS with province fixed effects: +0.482 on Language score, n.s. on Math score.

Abbreviations: OLS = Ordinary Least Squares, IV = Instrumental Variables, RF = Reduced Form, MFE = Mother Fixed Effects, GLS = Generalized Least Squares. Notes. Estimates reported in this table represent the raw coefficients presented in each study. * indicates that the study uses a standardized dependent variable, so that coefficients can be interpreted in terms of a standard deviation. + indicates that the dependent variable is log-transformed and that coefficients multiplied by 100 can be interpreted as percentage change.

^a GAPS = Guaranteed Access to Pre-School.

Table 7

Selected studies evaluating child care impacts on middle childhood and adolescence noncognitive outcomes. Description.

Study	Country	Data and Sample	Inputs/Policy	Outcomes	Timing
Datta and Simonsen (2010)	Denmark	DALSC & DAR. N=4,343.	Enrollment in publicly provided child care (preschool or family day care) vs home care. ^a	SDQ ^b behavioral test.	Inputs measured at age 3-6; outcomes measured at age 7.
Datta and Simonsen (2011)	Denmark	DALSC & DAR. Sample size changes according to the outcome, on average N=3,000.	Enrollment in publicly provided child care (preschool or family day care) vs home care. ^a	SDQ ^b behavioral test at age 11, dummy for smoking, dummy for drinking, dummy for vandal behavior.	Inputs measured at age 3-6; outcomes measured at age 11.
Felfe and Lalive (2010)	Germany	GCP. N=686.	Having attended child care in age 0-2 & local child care supply at childbirth	Standardized indexes for: i) independence skills; ii) social skills; iii) behavior; iv) personality; v) motor skills.	Inputs measured at age 0-2 for children born in 1996-1997; outcomes measured at 5-10 years.
Goodman and Sianesi (2005)	U.K.	NCDS. N=12,172.	Dummy for having attended any pre-compulsory education ^c ; dummy for having attended preschool vs staying home or starting primary school earlier.	Overall social development at 7 and 11; proportion of very bad self-control skills at 7. ^d	Inputs measured at 4 years old for the cohort of children born in the first week of March 1958; outcomes measured in 1965, 1969 and 1974 (when the child is 7-11 years old).

Abbreviations: DALSC = Danish Longitudinal Survey of Children; DAR = Danish Administrative Registers; GCP = German Child Panel; NCDS = National Child Development Study; ECH = *Encuesta Continua de Hogares*; NAEP = State National Assessment of Educational Progress.

^a Preschool = center based care. Family Day Care = care provided in private homes. Home care = care provided by parents.

^b SDQ = Strength and Difficulties Questionnaire. Higher score indicates more behavioral problems.

^c Pre-compulsory education includes any form of education (preschool or early entry) before the compulsory starting age of 5.

^d Proportion of very bad self-control skills out of: destructive, irritable, difficulty concentrating, upset by many situations, miserable, etc. The higher the proportion, the worse the outcome.

Table 8

Selected studies evaluating child care impacts on middle childhood and adolescence noncognitive outcomes. Results.

Study	Estimation technique	Coefficients
Datta Gupta and Simonsen (2010)	OLS and IV. Instrument: dummy for living in a municipality providing universal access to preschool (GAPS). ^a	OLS: children in family day care (vs home care) +1.808; children in preschool (vs family day care) -0.421. ^b IV: effect of preschool (vs family day care) n.s.
Datta Gupta and Simonsen (2011)	OLS and IV. Instrument: dummy for living in a municipality providing universal access to preschool (GAPS). ^a	OLS and IV: effect of preschool (vs family day care) n.s.
Felfe and Lalive (2010)	OLS, IV and RF. Instrument: local child care supply at childbirth.	RF (child care supply impact): +0.0137 on noncognitive skills, +0.0129 on independence, +0.0105 on personality. IV: +1.687 on noncognitive skills, +1.592 on independence.*
Goodman and Sianesi (2005)	OLS	Effect of any pre-compulsory education: -0.053 on social development index at 7, +0.008 on very bad self-control skills at 7, ^b +0.006 on very bad self-control skills at 11. ^b Effect of preschool: +0.014 on very bad self-control skills at 7, +0.01 on very bad self-control skills at 11. ^{b*}

Abbreviations: OLS = Ordinary Least Squares, IV = Instrumental Variables, RF = Reduced Form, MFE = Mother Fixed Effects.

Notes. Estimates reported in this table represent the raw coefficients presented in each study. * indicates that the study uses a standardized dependent variable, so that coefficients can be interpreted in terms of a standard deviation. + indicates that the dependent variable is log-transformed and that coefficients multiplied by 100 can be interpreted as percentage change.

^a GAPS = Guaranteed Access to Pre-School.

^b Since an higher outcome means more behavioral problems, a positive coefficient implies a detrimental effect.

ski et al. (2008) find that the positive child care impact increases as the child ages, instead of dissipating over time: having attended at least one year of preschool in Uruguay increases both the probability of attending school and the number of years of education; further, the coefficients are higher for 15 years old children than for children aged 7. Finally, for the U.S., Fitzpatrick (2008) finds a positive effect of having attended the Georgia pre-kindergarten program on Math score.

Child care and preschool policies, both in European and in Latin American countries, seem to have positive effects also on outcomes measured some years later their implementation. This result is in contrast with the Currie and Thomas' findings concerning the program Head Start and black children. A plausible explanation for this difference can be the institutional contexts characterizing these countries, not only with respect to the child care policy, but also with respect to subsequent policies investing in children's human capital (e.g., primary and secondary school).

4.3 Long-term adult outcomes of early non-parental child care

In the U.S. literature, there exist several studies evaluating the long-run impacts of child care programs targeted toward disadvantaged households and children. For instance, Currie et al. (2002) find that having attended the program Head Start increases the probability that the child attends high school and college and increases adult earnings by 19 percent. Barnett and Masse (2002) assess the impacts of the Carolina Abecedarian Program on children at 21 years of age and find positive effects on the probability of attending college, while the impacts on criminal behavior and grade retention are negative. Heckman et al. (2010) estimate a rate of return of the Perry Pre-School program after 40 years ranging between 7 and 8 percent.

Recently, there have been several studies assessing the long-run effects of child care policies implemented in European countries during the 1960s and 1970s. They are summarized in table 9, while their main findings are reported in table 10.

Dumas and Lefranc (2010) report the effects of preschool duration in France on monthly wage, while Goodman and Sianesi (2005) estimate the impact of having attended preschool in U.K. on educational attainments and hourly wage at 33 and 42 years. Results from these studies are very similar, confirming that a long-lasting positive effect of preschool attendance is consistent across countries. The former study finds that staying in preschool 3 years (instead of 1) increases monthly wage by 4.6 percent, while the latter finds that having attended preschool increases hourly wage by 2.7 percent at age 33 and by 3.6 percent at age 42. To see the magnitude of these effects, consider an adult with an hourly gross wage of 13 Euro, working 8 hours a day for 20 days in a month. According to the Dumas and Lefranc (2010) paper, the change in the monthly wage due to 3-years preschool attendance, other things being equal, is equivalent to almost 95 Euro;⁸ instead, using the estimates from Goodman and Sianesi (2005), the change in the hourly gross wage at 42 due to preschool attendance

Table 9

Selected studies evaluating child care impacts on adulthood outcomes. Description.

Study	Country	Data and Sample	Inputs/Policy	Outcomes	Timing
Dumas and Lefranc (2010)	France	FQP. Sample of birth cohorts 1950-1973. N=5,843.	Duration of preschool (1, 2 or 3 years)	Monthly wage	Inputs measured when children are 3-6; outcome measured in 1993 when children are 20-43
Goodman and Sianesi (2005)	U.K.	NCDS. N=12,172.	Dummy for having attended any pre-compulsory education ^a ; dummy for having attended preschool vs staying home or starting primary school earlier.	Dummy for having obtained any qualification above Level 1 by age 42, dummy for having obtained any qualification at Level 4 or 5 (higher education) by age 42, employment status and hourly wage at 33 and 42.	Inputs measured at 4 years old for the cohort of children born in the first week of March 1958; outcomes measured in 1991 and 2000 when children are aged 33-42 years.
Havnes and Mogstad (2011)	Norway	Statistics Norway (1967-2006). Sample of children born in 1967-1976, living in Norway in 2006 and whose mother was married at the time of the kindergarten reform (1975). N=499,026.	Impact of a kindergarten reform that increased formal preschool during the '70s.	Outcomes: years of education, having attended some college, being high-school drop-out, being low, average, high or top earner, ^b being on welfare, ^c .	Input measured when children were at kindergarten age; outcomes measured in 2006 (aged between 30-39 years).
Havnes and Mogstad (2010)	Norway	Statistics Norway (1967-2006). Sample of children born in 1967-1976, living in Norway in 2006 and whose mother was married at the time of the kindergarten reform (1975). N=498,956.	Impact of a kindergarten reform that increased formal preschool during the '70s.	Adult annual earnings (Million NOK) of children exposed to the reform.	Input measured when children were at kindergarten age; outcomes measured in 2006 (aged between 30-39 years).

Abbreviations: FQP = Education, Training and Occupation survey; NCDS = National Child Development Study.

^a Pre-compulsory education includes any form of education (preschool or early entry at primary school) before the compulsory starting age of 5.

^b Low earner = earnings lower than 2 basic amounts; average earner = earnings equal at least to 4 basic amounts; high earner = earnings equal at least to 8 basic amounts; top earner = earnings equal at least to 12 basic amounts. 1 basic amount = 10,500\$.

^c Being on welfare = receiving more than 1 basic amount as public cash transfer.

Table 10
Selected studies evaluating child care impacts on adulthood outcomes. Results.

Study	Estimation technique	Coefficients
Dumas and Lefranc (2010)	OLS with school/birth-department fixed effects	Staying in preschool 2 years increases monthly wage by +0.0298, staying in preschool 3 years increases wage by +0.046. ⁺ Ref. cat.: staying in preschool 1 year.
Goodman and Sianesi (2005)	OLS	Effect of any pre-compulsory education: +0.018 on probability of employment at 33, -0.038 on probability of needing special education, +0.029 on probability of any qualification above level 1 at 33; +0.027 on wages at 33, +0.022 on wages at 42. ⁺ Effect of preschool: +0.027 on wages at 33, +0.036 on wages at 42. ⁺
Havnes and Mogstad (2011)	Diff-in-Diff	+0.3523 on years of education, +0.0685 on the probability of attending college, -0.0584 on the probability of being high-school drop-out, -0.0359 on the probability of being low earner, +0.0514 on the probability of being average earner, -0.0337 on the probability of being high earner, -0.0511 on the probability of being on welfare.
Havnes and Mogstad (2010)	Non-Linear Diff-in-Diff	Effect of the policy on the mean n.s.. Effect of the policy on the income distribution: +0.032 on the 10th percentile, +0.055 on the 20th percentile, 0 on the 68th percentile, -0.038 on the 90th percentile. ^a

Abbreviations: OLS = Ordinary Least Squares.

Notes. Estimates reported in this table represent the raw coefficients presented in each study. * indicates that the study uses a standardized dependent variable, so that coefficients can be interpreted in terms of a standard deviation. + indicates that the dependent variable is log-transformed and that coefficients multiplied by 100 can be interpreted as percentage change.

^a The dependent variable is the probability that post-reform earnings are higher than a certain percentile in the pre-reform earnings distribution. Reported coefficients represent Treatment on the Treated (TT) effects.

is equivalent to 75 Euro.⁹ The magnitude of these impacts is substantial.

Dumas and Lefranc (2010) also provide a very interesting result: the positive effect on wage remains either controlling or not controlling for final education; it seems that preschool has a direct effect on earnings in addition to the effect that it has through education. This issue has been raised by other studies in this literature (Chetty et al., 2011); a plausible explanation is that preschool favors the acquisition of noncognitive skills that are rewarded in the labor market, such as self-esteem and socialization. This mechanism has been already presented in figure 2 that shows how the parental decisions and the child's noncognitive skills developed during early childhood affect directly child's earnings in addition to the effect that they have through final schooling. As suggested by Cunha et al. (2006), even when early childhood intervention do not boost cognitive skills, it improves the noncognitive ones, with substantial effects on labor market and behavioral outcomes.

Finally, Havnes and Mogstad (2010, 2011) estimate the long-term effects of a policy implemented in Norway during the 1970s, aimed to increase formal preschool attendance. Havnes and Mogstad (2011) evaluate the impact on several outcomes referred to both the educational perspectives of children when adults and to their labor market experience: years of education, having attended some years of college, being high-school drop-out, earnings and being on welfare. Their results have the expected signs, confirming that the policy has increased years of education and the probability to attend college and decreased the probability of being on welfare and being high-school dropout. However they find negative effects of the policy on the probability of being low and high earners, while the effect is positive on the probability to be average earner. These heterogeneous impacts are further investigated in Havnes and Mogstad (2010), that evaluate the impact of the policy on the entire earnings distribution. They find that the policy has been more effective for children in the lower and median part of the distribution, up to the 70th percentile, while it has been detrimental for those in the higher part of the distribution, that would have got higher earnings without the policy implementation. According to the theoretical framework provided in section 2.2, these children did not benefit from the policy since their parents were already investing in their human capital. Instead, the policy has been effective for those with a low initial level of (investments in) human capital: for those people the policy has enlarged their parents' opportunities frontier, since they could choose among more options to invest in the human capital of their children.

5 Conclusions

This survey provides an analysis of existing studies evaluating non-parental child care impacts, posing particular attention to contexts different from the U.S. and focusing more on child care policies rather than on heterogeneous child care services. The aim of the survey is to show the importance of institutions in modeling the opportunity sets

available to parents when they make their non-parental child care decisions.

Existing literature on the impacts of non-parental child care on child's outcomes do not provide homogeneous results. The differences can be mostly explained by the diverse institutional context considered and by the characteristics of the service that is analyzed. In fact, when similar child care policies (or formal well-regulated arrangements) are considered, these differences cancel out and all the studies provide evidence of positive child care impacts.

All the studies evaluating the impacts of non-parental child care in the short- and medium-run find positive effects on cognitive outcomes, while the implications for the noncognitive ones are mixed. As pointed out by Cunha et al. (2006), much of the effectiveness of early childhood interventions comes from boosting cognitive and noncognitive skills, that can have substantial effects on schooling and labor market outcomes during adulthood. Positive effects of preschool attendance and preschool policies on adult earnings are found in both U.K., France and Norway, and the magnitude of the impacts is similar across countries. According to the theoretical framework proposed in section 2.2, however, not all children may equally benefit from a policy increasing child care or preschool availability. In fact, the final outcome depends on the interaction between the policy and parents' preferences and budget constraint. While positive long-run effects of child care policies have been found, on average, by Goodman and Sianesi (2005) in U.K. and Dumas and Lefranc (2010) in France, Havnes and Mogstad (2010) report a positive impact of a preschool policy implemented in Norway only for children in the lower part of the earnings distribution, while children in the upper part of the distribution did not benefit from the policy. This result also confirms that child care and preschool intervention can be more effective for children living in disadvantaged backgrounds, because it can provide better educational inputs than those they would have received at home.

The studies presented in this survey has one main limitation. Very few of them provide a theoretical framework that may help in understanding the results and no one takes into account that the inputs are actually chosen by parents: only the child's ability production function is estimated. This issue prevents also from understanding some of the mechanisms through which non-parental child care affects child's development.

Further research can help in identifying the mechanisms through which preschool and child care attendance have an impact on child development, especially in the long-run. For instance, it should be investigated further the relationship between the child care input and the development of noncognitive skills, that may have a direct effect on earnings in addition to the one through education.

Notes

¹Haveman and Wolfe (1995) consider a third factor influencing children's attainment, i.e., the decisions made by the child himself once he reaches adolescence. Since this review deals with non-parental child care choices that are mostly taken by parents when the child is in preschool ages, this factor is neglected. However, as the child grows up, the decisions made by the child himself play a stronger role. Cardoso et al. (2010) and Del Boca et al. (2012) analyze this topic.

²Concerning universal pre-kindergarten, the Georgia Pre-K program, started in 1995, and the Oklahoma Universal pre-kindergarten, started in 1998, represent some examples. Instead, the Perry Pre-School, Abecedarian and Head Start programs are targeted toward disadvantaged families and imply different degree of involvement for both parents and children. See Almond and Currie (2011) and Cunha et al. (2006) for further details.

³Specifically, Norway spends 50 thousands Million Euro per year, while Sweden have the highest expenditure level of 170 thousands Million Euro. France expenditure is about 13 thousands Million Euro, while Italy and Spain spend only 6 thousands Million Euro for pre-primary education. Own elaboration on data from OECD and Eurostat referred to 2008.

⁴For instance, Blau (1999) studies the effect of several child care features, usually regulated by the policy maker (e.g., group size, child-staff ratio, teacher education and training, etc) on child's cognitive development and find no statistically significant effects for any of them. Blau and Currie (2006) argue that there may be two dimensions of quality: one characterized by these observable features, and the other, mostly unobservable, related to the quality of interactions between the provider and children. The latter seems more effective for child's development than the former.

⁵This approach assumes that the household maximizes a unitary utility function, implying that all members in the family share the same preference patterns and have a common knowledge of inputs productivities and child's initial endowment. An alternative implementation consists of assuming that there is a dictator, i.e., the mother, who makes choices based on his own preferences. Even though several criticisms to these assumptions have been made by those viewing family decisions as the outcome of bargaining within the household (see Vermeulen (2002) for a review on collective household models), this approach remains the unique used in this literature.

⁶However, to the best of my knowledge, only Brilli (2012) evaluate the impacts of maternal employment and external child care taking into account the actual time spent by the mother with the child. Instead, there are studies evaluating the impact of maternal and paternal time on child development, such as Del Boca et al. (2010, 2012) and Hsin (2009).

⁷As reported in Berlinski et al. (2009, table 4), the standard deviations of the score measures are, respectively, 19.70 for Math and 20.41 for Spanish. The standardized effects are then: $4.694/19.70=0.24$ for Math and $4.761/20.41=0.23$ for Spanish.

⁸The monthly gross wage is given by $13 \times 8 \times 20 = 2,080$. 4.6 percent of 2,080 is equivalent to 95.68 Euro.

⁹3.6 percent of 13 Euro is equivalent to 0.468 Euro. Measuring this change on a monthly basis, it yields $74.88 = 0.468 \times 8 \times 20$.

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