

PUBLIC INVESTMENTS IN CHILDREN'S HUMAN CAPITAL. EVIDENCE FROM THE LITERATURE ON NON-PARENTAL CHILD CARE

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Abstract: This paper analyzes the most recent empirical research on social investments in children's human capital, focusing on policies providing non-parental child care. The empirical findings are conceptualized in a theoretical framework showing how policy interventions can shape parents' non-parental child care choices; this framework is also used to discuss the econometric issues arising for the identification of the child care effects. The results from both European and American contributions 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, and on adult outcomes. Results also show that, in countries with scarce availability of public child care services, whether or not child care has an impact on children's development depends on the population at which the service is targeted.

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JEL classification: J13, I24, I38.

1. Introduction

In the last decades there has been a considerable growth in the body of social science research that investigates the effects of parents' behavior on children's development. This literature has focused mainly 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 mothers' 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

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children's outcomes, such as attainment at school and years of education, and report that maternal employment estimates range from being detrimental to having no effect, to being beneficial. The developmental 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, the detrimental effect can be due to the loss in mother's child care time. Rarely, this negative impact can be compensated for by a positive income effect, because of 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 children's development has emerged¹. This literature refers mainly to the United States, but results are mixed. Some studies (Bernal and Keane 2011; 2010) find that having attended child care before kindergarten is detrimental for children's cognitive development. Other studies find, instead, 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 higher Reading and Math scores. Only very recently a similar literature has evaluated the effects of non-parental child care in Europe and other countries, different from the US, and has focused more on publicly provided large-scale programs, which can be more informative for the design of public policies. The majority of them suggest positive implications of highly regulated services for children's development.

As pointed out by Haveman and Wolfe (1995), investments in children's human capital depend on two main factors²: *i*) the society or government that determines 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

¹ Throughout the paper, I refer to non-parental child care as any kind of child care service provided by people different from the parents; by formal child care arrangements I mean center-based and school-based forms of child care or preschool, while the informal ones refer to less institutionalized types of services, such as baby sitter, relatives or friends.

² Haveman 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 not discussed.

the government can influence this choice by changing the opportunity set available to them and the quality of the service they can buy.

This paper aims to discuss the importance of public investments on children's human capital, analyzing the most recent findings from the literature on the effects of non-parental child care. A theoretical framework is used to interpret the results of existing studies and to understand the main econometric issues that the researcher has to tackle for the identification of the child care effects. The results are presented taking into account the institutional context and the characteristics of the service which is analyzed, as well as the type of measure used to proxy a child's ability and the time at which the outcome is measured.

The rest of the paper develops as follows. Section 2 presents the theoretical background for the analysis of the impact of non-parental child care on child development and discusses the econometric issues arising in this context. Section 3 provides a brief description of the institutional framework under which non-parental child care policies are implemented in the countries analyzed in the literature. Section 4 discusses the results from selected studies and Section 5 concludes.

2. *Theoretical background and econometric issues for identification*

The economics literature studying the determinants of children's cognitive and noncognitive outcomes refers to the Education Production Function framework, where a child's ability is modeled as the outcome of a cumulative process of knowledge acquisition, fostered both by family and school inputs, and of a child's specific initial endowment (Todd and Wolpin 2003). Non-parental child care can be considered one of the inputs in the production of children's human capital.

The majority of studies assessing the effect of non-parental child care on children's development exploit this specification and estimate a version of the child's production function that can be simplified as follows:

$$(1) \quad A = (c, \tau, X, \mu)$$

where c is non-parental child care, τ represents parental time, X is a vector of additional inputs and a child's observed characteristics and μ represents the child's initial endowment of ability. A can represent either cognitive or noncognitive skills.

The estimation of the impact of non-parental child care in (1) is hampered by several issues; moreover, the empirical specifications adopted in the

literature rely on both theoretical and econometric assumptions, which will be discussed below.

From a theoretical point of view, the choice of using non-parental child care, made by parents according to their preferences and constraints, can be modeled following Becker and Tomes (1986); hence, the parents' decision-making process can be written as³:

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

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

$$(4) \quad C = I - pc$$

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

where (2) represents parents' utility as a function of household consumption C and the ability of their child A . Expressions (3) and (4) are the time and budget constraints: TT represents the total time endowment, which must be allocated between time with the child (τ) and time at work (b); household expenditures, including consumption and expenditure for external child care (where c is the amount of time spent by the child in external child care and p is the hourly price of child care), must be equal, in each period, to the total income available in the household (i.e., $I = w \times b$). Equation (5) represents the child's ability production function, where parental choices on non-parental child care and time with the child are the investments for the child's development process. Assuming separability of goods in the utility function and rearranging, the demand for child care is given by the following condition⁴:

$$(6) \quad \frac{U'_C}{U'_A} = \frac{A'_c}{(w - p)}$$

$$MRS_{CA} = \frac{A'_c}{(w - p)}$$

³ This specification 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 the child's initial endowment. An alternative implementation consists in assuming that there is a dictator, i.e., the mother, who makes choices based on her 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, this approach remains the unique used in this literature.

⁴ For analytical details, see Brilli (2013a).

where U'_C is the marginal utility from consumption, U'_A is the marginal utility from ability and A'_c indicates the marginal productivity of the non-parental child care input; $(w - p)$ can be interpreted as the parents' wage net of non-parental child care cost; MRS_{CA} is the marginal rate of substitution between consumption and the child's ability. Condition (6) suggests that the demand for non-parental child care can actually be manipulated by the policymaker changing the policy variables A'_c and p . In fact, both a policy subsidizing external child care, and a government intervention improving child care productivity, perceived by the parents, can affect the demand for child care. However, a change in the price of child care, or in the marginal productivity of the service, can have different effects on child care demand, depending on parental preferences over consumption and the child's ability. More precisely, these policies may determine an income or a substitution effect: 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 the child's human capital, decreasing their demand for non-parental child care. In the existing literature, assessing the effects of non-parental child care on children's outcomes, very few papers take into account the relationship between the child care input and parental preferences, either estimating structural models derived from economic theory or using reduced form approaches. Bernal (2008) and Bernal and Keane (2010) represent the first examples of structural estimation in the literature of non-parental child care. They propose a dynamic model where the mother decides how much time to work and whether to use non-parental child care in the first 5 years of the child's life. These choices represent the endogenous inputs in the child's development process. They find strongly negative effects of non-parental child care on children's cognitive development. For instance, Bernal (2008) finds that one year in external child care reduces a child's cognitive ability by 0.8%; the impact of a mother's employment and external child care is more detrimental, since, together, they decrease a child's outcome by 1.8%. Havnes and Mogstad (2012) try to take into account the interactions between non-parental child care choices and parental preferences using a reduced form approach and exploiting data from Norway, where a policy enlarging preschool supply was implemented during the Seventies. In this case, the policy offered a high-quality preschool service, homogeneously distributed in the territory. Their results suggest that, for wealthier parents, which are supposed to be already investing in their child's human capital, the income effect has prevailed, so that the demand for child care has decreased. Instead, the preschool policy has been effective for households with more stringent budget constraints for which it has enlarged their opportunity set; in this case, the substitution effect has been more likely to prevail.

From an empirical point of view, the fact that investments in children's human capital are decided by parents implies a plausible correlation between these choices and parents' and children's unobservable characteristics: in other words, parents may self-select into non-parental child care attendance according to their preferences and constraints, which are unobservable to the researcher, or may decide whether to use non-parental child care after having observed the child's unobserved ability endowment. The existing literature adopts different empirical strategies to take into account these issues. The majority of studies employ OLS estimators to assess the effects of child care attendance or child care policies. In this case, the main assumption for identification is that the unobserved component of the child's development process is not related to parents' choices. Actually, in order for an OLS estimation to provide consistent estimates of the child care effects, it is necessary to control for a sufficiently large set of individual, family and local characteristics, which may be correlated to parents' choices and also to the child's development process (Brilli *et al.* 2014; Goodman and Sianesi 2005; Hansen and Hawkes 2009), or to get rid of family or local time invariant unobserved heterogeneity (Berlinski *et al.* 2009; Dumas and Lefranc 2010). One estimator in this category is the so-called Mother fixed effects estimator (MFE, in the following), which allows to get rid of time invariant unobserved heterogeneity at the household level. While there are several studies using this strategy to assess child care effects in the US, Berlinski *et al.* (2008) exploit the variation in individual child care attendance among siblings to evaluate the impact of a child care policy in Uruguay. Several studies estimate the effects of non-parental child care exploiting the exogenous variation in child care availability induced by the implementation of a policy; according to the way in which the policy has been designed, these studies use a Differences in Differences (Diff-in-Diff, in the following) approach or exploit a Regression Discontinuity Design (RDD, in the following). The Diff-in-Diff estimator has been used to assess the effects of policies expanding preschool availability in Norway (Havnes and Mogstad 2011; 2012), Spain (Felfe *et al.* 2012) and Georgia, US (Fitzpatrick 2008), while Gormley and Gayer (2005) and Gormley (2008) adopt an RDD, exploiting the cutoff in birth date for the assignment into a pre-kindergarten program. The Diff-in-Diff estimation can provide consistent estimates of the policy effects under the assumption of a common time trend in the outcome variables in the treatment and comparison group in the absence of the reform; the RDD case, instead, relies on the assumption that there is randomness in the assignment variable⁵. However,

⁵ In the case of the policy analyzed by Gormley and Gayer (2005) and Gormley (2008), the authors exploit the cutoff in birth date, since children were qualified for attending the

neither of these estimators can control for the fact that parents may react to a child's ability when choosing whether to use non-parental child care. The only strategies robust to this issue are structural estimation and Instrumental Variables. If parents can observe their child's ability before making any decisions concerning time and child care use, they may decide to compensate for low levels of ability (investing more in the child's human capital) or to invest less, reinforcing the initial disadvantage. In this literature, only Bernal (2008) estimates the parameters of a model allowing the mother to compensate or reinforce for the initial level of a child's ability, finding that mothers find it optimal to engage in compensating behavior toward their children if the children's level of initial ability is low. There are, instead, several studies using an IV approach (Datta Gupta and Simonsen 2010; 2012; Felfe and Lalive 2012); however, very few of them can provide consistent estimates of the effects of interests, because of the difficulty to find valid instruments (Bernal and Keane 2011).

A further issue arising when the researcher wants to assess the impact of non-parental child care relates to the functional form of the child's ability production function. The majority of studies, in fact, use a linear or log-linear specification, implying that the estimated marginal productivity of child care is not related to change in parental time allocation. In the literature, only Heckman (2007) uses a CES production function for the specification of the child development process, which allows to relax the assumption of inputs separability and to estimate the elasticity of substitution between inputs. This is particularly relevant in the context of non-parental child care, since the literature is actually lacking any evidence on whether non-parental child care and parental time are complements rather than substitutes. If their degree of substitutability is high, a reduction in maternal time induced by a mother's work can be compensated for by the use of non-parental child care. If, instead, the two inputs are complements, the child may need both of them for his human capital accumulation. The identification of the elasticity of substitution is possible only when a structural estimation is implemented, but existing studies using a structural approach (Bernal 2008; Bernal and Keane 2010; Brilli 2013b) use linear or log-linear specifications for computational convenience. In a reduced-form framework, the use of linear or log-linear specification for the child's development process also has consequences for the interpretation of the estimated coefficients. Some studies (e.g., Goodman and Sianesi 2005), argue that the estimated child care effect

program if and only if they were born before September 1st, in each school year; this means that one of the main assumption required for identification, in this case, is that parents do not manipulate their fertility decisions in order to have children enrolled into the program.

may incorporate any other effect on a child's ability induced by changes in parental behavior related to the child care policy.

Finally, the estimation of the child care impact in a reduced form framework provides the effect of non-parental child care attendance *other things being equal*, i.e., keeping constant other parental investments. This interpretation neglects the endogeneity of all other parental investments, *in primis* parental child care time. Moreover, because of the lack of data on parental time allocation, the majority of studies, which try to take this issue into account, use mother's time at work as a proxy for mother's contact time (see, for instance, Bernal 2008). This is equivalent to assuming that the mother devotes all her time out of work to the child and does not have any leisure. Only very recently, data on children's and parents' time use has become available, so that there have been some studies assessing the effects of several types of time investments on children's development. Brillì (2013b) represents the first example of an analysis where maternal and non-parental child care time are considered simultaneously as investments in the child's development process: the author estimates a model where the mother decides not only how many hours to work and how much time to use non-parental child care, but also how much time to devote to the child instead of having leisure. As in equation (1), non-parental child care and maternal time are the inputs in the child's development process. The results from the estimation of this model show that the elasticity of child's ability with respect to maternal time is higher (at any child's age) than that with respect to non-parental child care, confirming the negative result found in the previous structural studies (e.g., Bernal 2008), i.e., a reduction in maternal time induced by a mother's employment cannot be compensated for by the use of non-parental child care. Comparing these results with those found by Bernal (2008), Brillì (2013b) also shows that the definition of maternal time as a residual from maternal working time underestimates maternal time productivity and, potentially, the negative effect of maternal employment. The negative effects found in these studies may be partially explained by the type of child care considered in their analysis: in fact, both of them refer to the US and define non-parental child care as any kind of non-parental care service used for the child (from nannies to relatives to formal creches), which may have different productivities for child's development.

3. *Institutional framework*

The existing literature on the effects of non-parental child care on child development has developed mostly in the United States; only very recently a similar literature has considered other countries in Europe and Latin America.

When assessing the effects of non-parental child care, it is important to recognize the diversity of types of service, which may have different productivity and effectiveness. Even if a general consensus on the type of regulation needed to have a high quality service has not yet been reached (Blau and Currie 2006), the diverse institutional context where the child care input is implemented should be taken into account when analyzing child care policies.

The first difference to note among the countries to which existing studies refer 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% 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% of children younger than 2 attend a formal facility, while in others (e.g., Spain, Italy and US) this percentage drops to less than 30. These figures are the outcome of both parental attitudes toward non-parental child care and the real availability of formal services. For instance, in Italy, public child care covers only 13% of the population aged between 0 and 2 years (ISTAT 2010), so that the remaining part of the demand must rely on private or informal services.

Moreover, the structure and characteristics of the child care systems differ significantly across these countries. In the US and the UK, 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 expenditure. In these countries, a distinction aimed to identify services with better quality and stricter regulation is that between center-based and informal arrangements. However, there are also examples of public intervention in some US 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 children⁶. 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

⁶ The «Georgia Pre-K program», started in 1995, and the «Oklahoma Universal pre-kindergarten», started in 1998, represent some examples of universal pre-kindergarten intervention. Instead, the «Perry Pre-School», «Abecedarian» and «Head Start» programs are specific programs targeted at disadvantaged families. See Almond and Currie (2011) for further details.

are regulated in order to respect minimum quality standards. The difference in both the availability and the quality of the service can also be captured looking at the levels of government spending for pre-primary education. Northern-European countries spend around 100 thousand million Euro for pre-primary education, while countries in Southern Europe spend less than 10 thousand million Euro⁷.

4. *Evaluating non-parental child care impact: evidence from the literature*

This section presents the results from selected studies evaluating the impact of child care attendance or child care policies on children's cognitive and noncognitive development. Tables 1, 2, 3, 4 and 5 describe selected papers in this literature, taking into account the time at which the outcomes are measured and whether the outcome represents a cognitive or noncognitive ability. More precisely, Tables 1 and 2 present selected studies assessing non-parental child care effects on outcomes measured during early childhood, before the child enters primary school; Tables 3 and 4 describe selected studies assessing non-parental child care impact on outcomes measured during middle childhood or adolescence; Table 5 presents studies assessing the long-run effects of non-parental child care.

The first thing to notice from these tables is how the effect changes according to the characteristics of the service or the policy which has been analyzed. Consider first the studies referring to Anglo-Saxon countries, such as the United States or the United Kingdom. As we have seen in Section 3, in these countries, child care services are mostly provided by the private sector and the quality of the service available in the market may vary crucially: it may range from very expensive formal child care centers or nannies, to cheaper informal arrangements, such as relatives or friends. Of course, different types of service may have different productivity and effectiveness for child development. This may also explain why several studies (e.g., Bernal 2008), which do not take into account this diversity, find strongly negative effects. Bernal and Keane (2010), differentiating between formal and informal care find a significant reduction in achievement due to informal child care, but not to the formal. 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. Different types of service may also have

⁷ Own elaboration on data from OECD and EUROSTAT referred to 2008.

diverse effects on cognitive or noncognitive abilities. For instance, center-based group arrangements can be more effective for the development of cognitive skills and for children's readiness for school, but may have little effect on children's vocabulary ability, for which the child may need more interaction with a single person. As reported in Tables 1 and 2, Hansen and Hawkes (2009) estimate the effects of several child care types in the UK on both cognitive and noncognitive outcomes of children measured during early childhood. They find that formal group care, while not working for the development of a child's vocabulary skills, seems more effective than both formal non-group and informal care for a child's readiness for school and for a child's behavior. Goodman and Sianesi (2005) estimate the effect of preschool attendance in the UK on both cognitive and noncognitive skills measures, assessed during middle childhood and adolescence, as well as on adult outcomes, such as education, employment status and wage. They find a positive and statistically significant effect of having attended preschool (instead of being at home or starting school earlier) on an average measure of cognitive skills (average over Language and Math test scores) at age 7 and 11 (see Table 3), as well as on adult earnings (see Table 5); instead, they do find negative effects of preschool attendance on behavioral and noncognitive outcomes, such as the proportion of bad skills and a measure of social development (see Table 4). Focusing instead on a specific policy, i.e. universal pre-kindergarten for 4-year-old children, implemented in Oklahoma (US), Gormley and Gayer (2005) and Gormley (2008) find that children who attended the program have higher Language and Vocabulary test scores at primary school entry, as well as better motor skills. Similarly, Fitzpatrick (2008) finds a positive effect of having attended the Georgia pre-kindergarten program on Math score.

Consider now the studies referred to countries different from the US or the UK and focused on public child care policies. Datta Gupta and Simonsen (2010; 2012) and Havnes and Mogstad (2011; 2012) provide the first estimates of child care and preschool effects on children's development, in countries characterized by a very high quality public service. More precisely, Datta Gupta and Simonsen (2010; 2012) estimate the effects of having attended the publicly provided child care in Denmark on children's behavioral outcomes measured at age 7 and on both cognitive and noncognitive skills measures, assessed at age 11 (see Tables 3 and 4). Havnes and Mogstad (2011; 2012) assess the effects of a preschool expansion policy implemented during the Seventies in Norway on several adult outcomes, such as years of education, college attendance, marital status and adult earnings (see Table 5). Datta Gupta and Simonsen (2010) find that having attended preschool (instead of family day care) increases the language test score of

children at age 7 by 8% of a standard deviation and decreases their behavioral problem index by 0.42 points; Datta Gupta and Simonsen (2012), instead, do not find any effects on noncognitive outcomes at 11. Havnes and Mogstad (2011) show that the preschool expansion policy has increased years of education and the probability of attending college and decreased the probability of being on welfare and the probability of being high school dropout. They also 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 an average earner. These heterogeneous impacts are further investigated in Havnes and Mogstad (2012) 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. According to the theoretical framework proposed in Section 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 from more options to invest in the human capital of their children.

The positive implications for cognitive outcomes in the medium and long run are fairly consistent across countries and methodologies, also for countries in Southern Europe or Latin America, characterized by low maternal employment rate and with less developed welfare systems. Dumas and Lefranc (2010) evaluate a preschool expansion policy implemented in France during the Sixties and the Seventies 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 3) increases test scores at grade 6 and the probability of graduation at high school; moreover, staying at preschool for 3 years (instead of 1) decreases the number of grade repetitions at age 11 and 16. The study also finds that staying in preschool for 3 years (instead of 1) increases the monthly wage by 4.6%. Interestingly, the positive effect of preschool on wage remains either controlling or not controlling for final education, implying that preschool has a direct effect on earnings in addition to the effect that it has through education. A plausible explanation for this result is that preschool favors the acquisition of noncognitive skills that are rewarded in the labor market, such as self-esteem and socialization. A similar result has been also found by Havnes and Mogstad (2012), who assess a positive effect of the preschool expansion policy in Norway on the lower part of the earnings distribution and on years of education, especially for children in low income households, but who do not find any effect on children's cognitive test scores. The authors argue that this result

points to the importance of noncognitive skill development for later outcomes of children. This conforms with evidence from targeted programs in the US, showing that, even when early childhood intervention does not boost cognitive skills, it improves the noncognitive ones, with substantial effects on labor market and behavioral outcomes (Cunha *et al.* 2006).

Only recently has the educational role of child care also been evaluated in countries characterized by a low maternal employment rate or with less developed welfare systems. If a child care policy is implemented in a country with very low maternal employment, it may substitute maternal child care time instead of other informal forms of care; hence, it may potentially hamper a child's development crowding out maternal time investments. Felfe *et al.* (2012) assess the effect of a policy expanding preschool availability to all 3-year-old children, implemented in Spain during the Nineties, on children's cognitive development at age 15 (see Table 3). They find positive and significant effects of the policy on Reading scores, ranging between 9 and 12% of a standard deviation of the scores distribution; they also find positive and significant effects on Math scores for the first cohort affected by the policy.

The authors argue that these results represent the effect of crowding out the mother's or grandmother's care in favor of formal child care, since in Spain and Mediterranean countries in general, private child care, still today, is not widespread. Finally, Berlinski *et al.* (2009) evaluate the impact of a policy expanding free and public pre-primary school places, implemented during late Nineties in Argentina (see Table 1). They find that the effect of one more place at pre-primary school increases Math and Spanish scores by 24 and 23% of a standard deviation of the scores distribution. Moreover, Berlinski *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-year-old children than for children aged 7.

Finally, the relationship between the child care policy and the parents' demand for the service has been stressed in several studies, focusing on countries where public service is scarce, such as Germany and Italy. Felfe and Lalive (2012) evaluate the effects of child care attendance in the first year of a child's life on both cognitive and noncognitive outcomes of children at age 3; they use Marginal Treatment effect and IV approaches, aimed at identifying the effects of child care for children who are indifferent between attending child care and not doing it. They argue that the relatively scarce child care supply in West Germany is not able to cover the demand of the service and it is offered on a *first come first served* basis,

so that more educated and employed parents apply first. Interestingly, the authors find greater child care effects for children with a low birth weight, low educated and young mothers and for children with more siblings and a lower income (see Tables 1 and 2); in other words, children who may benefit more from child care attendance are also less likely to be enrolled and would be able to attend child care only by increasing its availability. They find mixed results on cognitive skills, while the positive impact of child care attendance on social skills is always confirmed: they find that child care attendance decreases the probability to use short sentences by 0.032 points (corresponding to 3% of the average in the control group) and increases the probability to listen to a story by 0.076 points (corresponding to 11.8% of the average in the control group – see Table 1); they find positive effects, instead, on all their measures of social skills (play with other kids, talk about own emotions, having friends, participate in role plays – see Table 2). Brilli *et al.* (2014), instead, assess the effects of public child care availability in Italy on children's test scores in second grade at primary school (see Table 3). Also in Italy public child care is scarce and it is not able to cover the demand for the service. However, differently from Germany, the policymaker (the municipality) sets access criteria to allocate available slots in such a way to give priority to households where both parents work or belong to disadvantaged backgrounds; in this way, the policymaker is able to identify households that may benefit more from the service. The authors find a strong and positive effect of child care availability on Language test scores, while they do not find any effect on Math: a percentage change in child care availability leads to an increase in test scores corresponding to 0.85% of a standard deviation of the scores distribution. They also find the strongest effect in areas where child care availability is lower and the access criteria used by the social planner may play a stronger role. It is interesting to note that, despite the fact that both countries (Italy and Germany) are characterized by very low child care availability, rationing in child care access acts in different ways according to the criteria used to allocate available slots. When slots are given on a *first come first served* basis, only parents who value highly the educational role of the service apply for a slot, but they turn out to be the ones whose children may benefit less from the policy; this implies that the policy has no or very little effect on the targeted children. When, instead, slots are allocated according to access criteria, public child care can have stronger effects in areas where these criteria are more stringent, since, in these areas, the policymaker is able to identify households that may benefit more from the policy; even if child care supply is scarce, the policy can be effective in providing more development opportunities to the targeted children.

5. Conclusions

This paper provides an analysis of the most recent empirical research on social investments in children's human capital, with a focus on policies providing non-parental child care. The theoretical framework shows how policy interventions can shape parents' non-parental child care choices and stresses the importance of taking into account the parents' decision-making process and their child care demand when estimating child care impact.

The results show that non-parental child care can have positive effects in the short and medium run 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 intervention comes from boosting cognitive and noncognitive skills, which can have substantial effects on schooling and labor market outcomes during adulthood. According to the theoretical framework proposed in Section 2, however, not all children may equally benefit from a policy increasing child care or preschool availability. Several studies point out that child care and preschool interventions can be more effective for children living in disadvantaged backgrounds, because they can provide better educational inputs than those they would have received at home.

However, the analysis of the literature also points out that, while being informative because referred to very diverse institutional contexts, much of the studies provide consistent estimates of the child care impact under very strong assumptions. Moreover, very few of them take into account the parents' decision-making process and provide a theoretical framework, which may help in understanding the results.

Future research should focus more on the mechanisms through which early childhood policies affect children's development, analyzing in detail the interactions between public and parental investments, namely time and goods inputs, and the ways in which parents react to the implementation of such policies.

Appendix

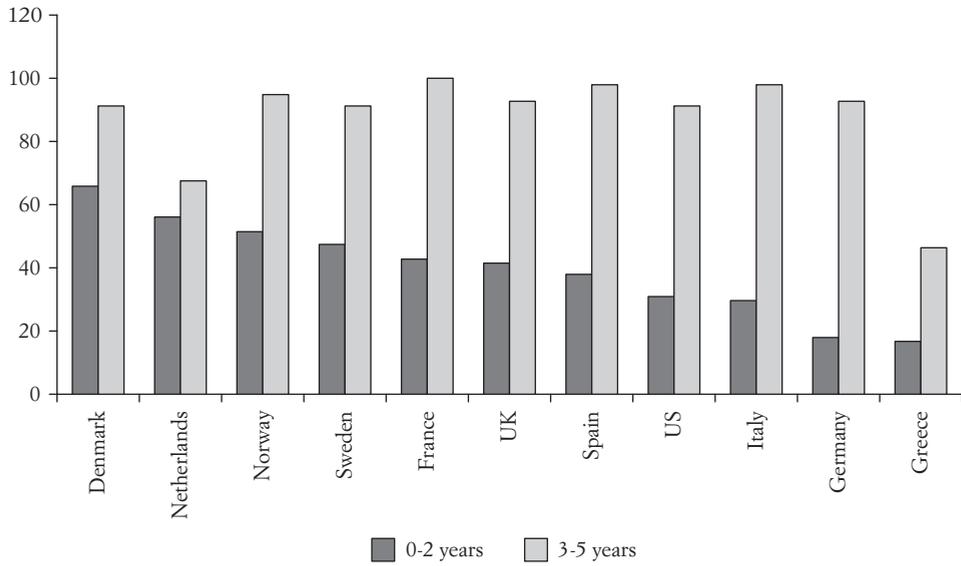


FIG. 1. Enrollment rates of children under age 6 in formal care or early education services, 2008.

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

TABLE 1. Selected studies evaluating child care impact on early childhood cognitive outcomes

Study	Country	Data	Child care inputs	Outcomes	Estimation method	Results
Hansen and Hawkes (2009)	UK	MCS (2001-02). Families with only one child, where the mother works when the child is 9 months old and her birth is higher than 16. N = 4,800.	4 child care categories: <i>i)</i> formal non-group; <i>ii)</i> formal partner care; <i>iii)</i> other informal care or grandparents' care. ^d	Vocabulary test, reading test.	OLS.	Vocabulary score: formal non-group +0.089; partner care +0.108; grandparents' care +0.193. School Readiness Score: formal non-group -0.122; partner care -0.129; grandparents' care -0.108; other informal -0.193. Reference category formal group care*.
Felfe and Lalive (2012)	Germany	GSOEP. Children aged 2-3 years who are born between 2002 and 2008 in West Germany. N = 870.	Having attended formal child care when 0-1.	Indicators for Language skills: probability to form short sentences, probability to listen to a story for more than 5 mins, etc.	Marginal Treatment Effect and IV. Instrument: local child care availability.	MTE: child care effect on language skills is stronger for children with low birth weight, for boys, and for children of married mothers. IV: -0.032 on the probability to form short sentences; +0.076 on the probability to listen to a story for more than 5 mins.
Berlinski et al. (2009)	Argentina	ONEE (1995-1997) + CENSUS 1991. N = 120,000.	Newly constructed slots of free public pre-primary school.	Math and Spanish standardized test scores.	OLS with municipality and year FE.	Effect of one more place at pre-primary school on Math score +4.694 and on Spanish score +4.761.

Tab. 1. *following*

Study	Country	Data	Child care inputs	Outcomes	Estimation method	Results
Gormley and Gayer (2005)	Oklahoma (US)	TPS (2001). Sample: children entering pre-k and kindergarten in 2001. N = 2,246.	Universal pre-kindergarten.	Cognitive and Language test scores.	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)	Oklahoma (US)	TPS (2006). Sample: Hispanic children entering pre-k and kindergarten in 2006. N = 550.	Universal pre-kindergarten.	LW, Spelling and (WJ-R) test scores.	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 LW score +2.471, AP score +1.928, Spelling test score +1.360.

Abbreviations: MCS: Millennium Cohort Survey; GSOEP: German Socio-Economic Panel; ONEE: Operativo Nacional de Evaluación Educativa; TPS: Tulsa Public Schools. OLS: Ordinary Least Squares; IV: Instrumental Variables; RDD: Regression Discontinuity Design.

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

TABLE 2. Selected studies evaluating child care impact on early childhood noncognitive outcomes

Study	Country	Data	Child care input	Outcomes	Estimation method	Results
Hansen and Hawkes (2009)	UK	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>i</i>) formal group; <i>ii</i>) formal non-group; <i>iii</i>) partner care; <i>iv</i>) other informal grandparents' care.	SDQ ^b behavioral test.	OLS.	Grandparents' care with respect to formal group care +0.121*.
Felfe and Lalive (2012)	Germany	GSOEP. Children aged 2-3 years who are born between 2002 and 2008 in West Germany. N = 870.	Having attended formal child care when 0-1.	Indicators for Social and Motor skills: probability to play with other kids, probability to refer to own emotions, probability to have friends, probability to participate in role play, etc.	Marginal Treatment Effect and IV. Instrument: local child care availability.	MTE: child care effects on social skills are stronger for children with low birthweight and with more siblings. IV: +0.058 on the probability to play with other kids; +0.068 on the probability to refer to own emotions; +0.117 on the probability to have friends; n.s. on daily and motor skills indicators.
Gormley and Gayer (2005)	Oklahoma (US)	TPS (2001). Sample: children entering pre-k and kindergarten in 2001. N = 2246.	Universal prekindergarten.	Motor skills test.	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: MCS: Millennium Cohort Survey; GSOEP: German Socio-Economic Panel; TPS: Tulsa Public Schools. OLS: Ordinary Least Squares; IV: Instrumental Variables; RDD: Regression Discontinuity Design; n.s.: not statistically significant.

Notes: ^a Formal group: nannies, 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. A positive coefficient implies a detrimental effect. 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.

TABLE 3. Selected studies evaluating child care impact on middle childhood and adolescence cognitive outcomes

Study	Country	Data	Child care input	Outcomes	Estimation method	Results
Datta Gupta and Simonsen (2012)	Denmark	DALSC & DAR N = 3,000.	Enrollment in publicly provided child care (preschool or family day care) vs home care ^a .	Several cognitive measures	OLS and IV. Instrument: dummy for living in a municipality providing universal access to preschool	OLS: effect of preschool (vs family day care) +0.414 on language test. IV: effect of preschool (vs family day care) n.s.
Dumas and Lefranc (2010)	France	DEPP & FQP. 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.	Number of grade repetitions at 11, test scores in 6th grade	OLS with school/birth-department fixed effects	No. of repetitions at 11: entry at 2 (vs entry at 3) +0.0938; test score at 6th grade: entry at 2 +0.0672, entry at 4 -0.105.
Goodman and Sianesi (2005)	UK	NCDS. N = 12,172.	Dummy for having attended preschool vs staying home or starting primary school earlier.	Average score over Math and Reading test scores at 7, 11 and 16.	OLS and Propensity Score Matching	Effect of preschool: +0.053 on cognitive development score at 7, +0.036 on cognitive development score at 11*.
Berlinski <i>et al.</i> (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.	OLS with Mother Fixed Effects	Effect of having attended at least 1 year of preschool varies with child's age at the time of the interview (7-15).

TAB. 3. *following*

Study	Country	Data	Child care input	Outcomes	Estimation method	Results
Fitzpatrick (2008)	Georgia (US)	NAEP (1993-2004). N = 600,000.	Universal pre-kindergarten program for all 4-year-old children starting from 1995.	Reading and Math test scores.	Diff-in-Diff.	Effect of the treatment only on Math score: +0.017*.
Brilli <i>et al.</i> (2014)	Italy	INVALSI SNV 2009-10. Children enrolled in 2nd grade performing both Language and Math scores. N = 33,708.	Local (province level) public child care covering children aged 0-2.	Language and Math test scores.	OLS and GLS.	GLS: +0.195 on Language score, n.s. on Math score.
Felpe <i>et al.</i> (2012)	Spain	PISA 2003-2006-2009. Children born between 1987 and 1993. N = 34,725.	1991/1992 reform providing universal access to preschool for children aged 3 years.	Reading and Math test scores.	Math Diff-in-Diff.	Reading scores: 0.476 for cohort 1990, 0.371 for cohort 1993. Math score: 0.272 for cohort 1990, n.s. for cohort 1993*.

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: Istituito Nazionale per la Valutazione del Sistema Educativo di Istruzione e di Formazione. OLS: Ordinary Least Squares; IV: Instrumental Variables; GLS: Generalized Least Squares.

Notes: ^a Preschool: center based care. Family Day Care: care provided in private homes. Home care: care provided by parents. * indicates that the study uses a standardized dependent variable, so that coefficients can be interpreted in terms of a standard deviation.

TABLE 4. Selected studies evaluating child care impact on middle childhood and adolescence noncognitive outcomes

Study	Country	Data and Sample	Child care input	Outcomes	Estimation method	Results
Datta Gupta 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.	OLS and IV. Instrument: dummy for living in a municipality providing universal access to preschool.	OLS: children in family day care (vs home care) +1.808; children in preschool (vs family day care) -0.421. IV: effect of preschool (vs family day care) n.s.
Datta Gupta and Simonsen (2012)	Denmark	DALSC & DAR. 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, drinking, dummy for vandal behavior.	OLS and IV. Instrument: dummy for living in a municipality providing universal access to preschool.	OLS and IV: effect of preschool (vs family day care) n.s.
Goodman and Sianesi (2005)	UK	NCDS. N = 12,172.	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.	OLS and Propensity Score Matching	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: DALSC: Danish Longitudinal Survey of Children; DAR: Danish Administrative Registers; NCDS: National Child Development Study. OLS: Ordinary Least Squares; IV: Instrumental Variables.

Notes: ^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. A positive coefficient implies detrimental effect. 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.

TABLE 5. Selected studies evaluating child care impact on adulthood outcomes

Study	Country	Data	Child care input	Outcomes	Estimation method	Results
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	OLS with school/birth-department fixed effects	Staying in preschool 2 years (vs staying 1 year) increases monthly wage by +0.0298, staying in preschool 3 years increases wage by +0.046*.
Goodman and Sianesi (2005)	UK	NCDS. N = 12,172.	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.	OLS and Propensity Score Matching	Effect of preschool: +0.027 on wages at 33, +0.036 on wages at 42*.
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 the kindergarten reform that increased formal preschool during the Seventies.	Outcomes: years of education, having attended some college, being high-school drop-out, being low, average, high or top earner, being on welfare.	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, -0.0511 on the probability of being on welfare.

TAB. 5. *following*

Study	Country	Data	Child care input	Outcomes	Estimation method	Results
Havnes and Mogstad (2012)	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 the kindergarten reform that increased formal preschool during the Seventies.	Adult annual earnings, years of education and cognitive test scores (measured at 18-20 years old, for males only) of children exposed to the reform.	Non-Linear Diff-in-Diff	Effect of the policy on the mean earnings n.s.. Effect of the policy on income distribution: +0.032 on the 10th percentile, +0.055 on the 20th percentile, -0.038 on the 90th percentile. ^a Effect of the policy on years of schooling +0.074; effect of the policy on cognitive test scores n.s.

Abbreviations: FQP: Education, Training and Occupation survey; NCDS: National Child Development Study. OLS: Ordinary Least Squares; IV: Instrumental Variables.

Notes: Estimates reported in this Table represent the raw coefficients presented in each study. * 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.

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