

Child Care, Maternal Employment, and Children's School Outcomes. An Analysis of Italian Data

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Abstract In this paper we analyse the impact of mothers' employment status and formal child care attendance during early childhood on children's school grades later in life, controlling for socio-demographic factors. We use the year 2008 of the Italian ISFOL-PLUS dataset. The dataset provides information on each respondent's demographic characteristics, as well as a set of retrospective information on the individual's school grades at the end of junior high school, high school, and university, along with (in the 2008 wave only) information about the respondent's formal child care attendance and mother's employment status when he or she was under age of three. We estimate the effects of maternal employment and child care attendance on the probability that the respondent would have high grades at the end of high school. Since maternal employment and child care attendance are likely to be endogenously determined, we use an instrumental variable approach. Our empirical results show that while having a mother who was working (during early childhood) had no significant effect on an individual's high school grades, child care attendance had a positive and significant effect. These results have potential policy implications. As maternal employment does not seem to negatively affect the development process of children, while child care attendance appears to have a positive impact on academic achievement, policy makers should consider

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expanding the availability of child care and promoting women's participation in the labour market.

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1 Introduction

In the last few years several studies have shown that early childhood care has a large impact on a child's cognitive and non-cognitive abilities later in life (Heckman et al. 2005; Cunha and Heckman 2006; Carneiro and Heckman 2003). In this literature, the decline in educational and job performance in many advanced countries has been linked to poor strategies of public investment (schools) and private investment (families) in children's human capital. Moreover, these studies found that investments made during early childhood lead to better and more cost-effective outcomes than those made later on. These scholars have also argued that childhood is a sensitive period for brain development and language acquisition, and that early learning is crucial for later learning. This is because individual abilities are more "malleable" in the early years of life, and because early investment can have a cumulative effect over time. Their results also indicated that delays in investment can lead to relatively high costs associated with remedying negative outcomes (e.g. dropping out of school, teen-age pregnancy, welfare dependency, crime).

As families are the primary investors in the human capital of infants and children, socio-economic differences between families are often cited as important factors in explanations of the disparities in children's cognitive and non-cognitive (behavioural and emotional) outcomes. However, several studies have shown that monetary resources alone do not account for the differences in cognitive and behavioural development, and that the time and the quality of the inputs received from parents during early childhood are important (Del Boca et al. 2014). Relative to non-working mothers, mothers who work have less time to devote to their children, and child care centres often serve as substitutes for the mothers' time.

The impact of early child care experiences on short-term outcomes (such as cognitive outcomes in primary school) has been studied using data from Anglo-Saxon countries, as well as from northern European countries (Bayard and Brooks-Gunn 1991; Desai et al. 1989; Havnes and Mogstad 2015; Gupta and Simonsen 2010, among others). In these countries, the relatively high levels of participation of women in the labour market have raised concerns about the reduction in the amount of time mothers spend with their children. Less attention has been paid to the possible negative effects of maternal employment on child development in southern European countries, where female participation in the labour market has been much lower.

In our paper, we seek to contribute to the literature by exploring the longer-term effects of the early experience of child care by focusing on a southern European

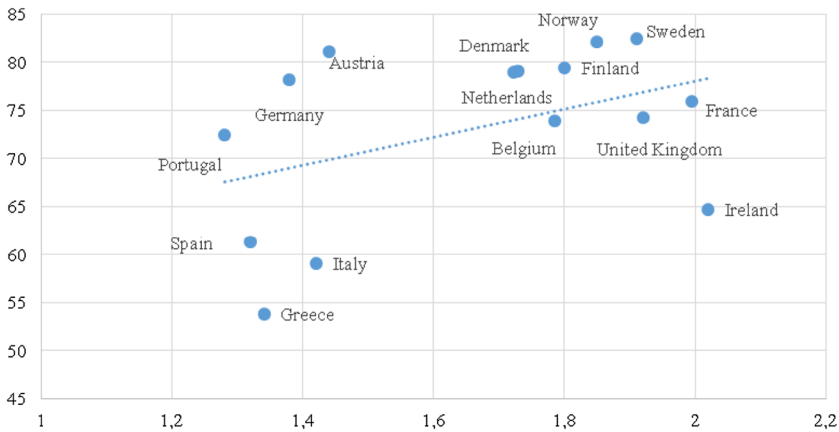


Fig. 1 Female employment rate and fertility across European countries (2012). Sources: OECD and Eurostat websites

country, i.e. Italy. Using Italian data, we explore the impact of formal child care attendance and maternal employment during early childhood on the high school grades of individuals, controlling for socio-demographic factors.

As we can see in Fig. 1, both female employment and fertility rates are high in northern European countries, but are quite low in Italy (and in Spain and Greece) (Koler et al. 2002). These trends help to explain why the concern for the possible negative effect of maternal employment on children is lower in contexts where women spend less time working outside the home and have fewer children to look after.

Given the low fertility and labour market participation rates of women in Italy, we might expect to find that Italian parents dedicate more time to their children than parents in other countries where women are more involved in the labour market and have more children, and that this additional attention would have positive effects on the children's cognitive and non-cognitive outcomes.

However, comparative data indicate that the academic results of Italian children are worse than those of their peers in other countries (PIRLS and PISA-OECD 2007, 2014). The comparatively poor academic performance of Italian children could be attributed in large part to the low levels of investment in early childhood public education and child care (Figure 1, online appendix).

Despite the potentially interesting implications of the combination of low fertility, low female labour market participation, and limited child care availability in Italy (and in other southern European countries), there is little research on the effects of these trends on child outcomes, partly because of a lack of data.

Our study contributes to this literature by providing an empirical analysis for Italy and by considering the long-term impact of both maternal employment and early child care attendance on children's high school grades.

For our analysis we use the ISFOL-PLUS survey, a panel survey that provides information on the education and work histories of almost 40,000 individuals of

working ages (18–64). Currently, seven annual waves, from 2005 to 2011, are available. Thanks to a collaboration with ISFOL,¹ whose PLUS dataset includes information on the school grades of individuals, several retrospective questions about maternal employment and the use of formal child care during early childhood (ages 0–2) were added to the 2008 wave.

The paper is organised as follows. In Sect. 2 we discuss the available literature on the impact of early child care on children's cognitive outcomes. In Sect. 3 we discuss the characteristics of child care in Italy. In Sect. 4 we describe the dataset, the variables, and the methodology we use in the empirical analysis. The results are presented in Sect. 5. The conclusions contain a discussion of our findings and the potential policy implications.

2 Literature Review

While a large body of literature has focused on the impact of maternal employment on child cognitive and non-cognitive outcomes (Bayard and Brooks-Gunn 1991; Desai et al. 1989; Vandell and Ramanan 1992; Blau and Grossberg 1992; Ermisch and Francesconi 2005), less attention has been paid to the effects of the use of formal child care as a substitute for the mother's time (Brooks-Gunn et al. 2002; Bernal 2008; Gupta and Simonsen 2010; Felfe and Lalive 2012; Havnes and Mogstad 2015), especially in southern European countries (Felfe et al. 2015).

The empirical results of the studies on the impact of maternal employment on child cognitive outcomes have been quite mixed (for a review, see Ermisch and Francesconi 2005). Some studies have shown that maternal employment has a negative impact on the language test scores of children (Bayard and Brooks-Gunn 1991; Desai et al. 1989), while other studies have found a positive and significant impact on children's math and reading achievements (Vandell and Ramanan 1992). Yet other authors have reported that maternal employment has no effect on children's development, as measured by a standardised test on pictures vocabulary² (Blau and Grossberg 1992). These results may reflect two potential effects. On the one hand, working mothers may be expected to spend less time with their children, which could have negative consequences for their children's well-being (both in socio-emotional and in cognitive terms). On the other, the income mothers earn through their work can enable them to purchase additional goods and services for their children.

The discrepancies in these results may also be attributable to the different variables considered. Some studies consider only mothers' employment as a proxy for time spent with children, while others take into account the amount of time mothers actually spend with their children. In their analysis of time use data, Mancini and Pasqua (2012) have shown that working mothers are likely to reduce the amount of time they spend on domestic activities and their own leisure before reducing the amount of time they spend with their children, especially the "quality

¹ ISFOL—Istituto per lo Sviluppo della Formazione Professionale dei Lavoratori.

² Children are asked to recognise and name pictures.

time" (e.g. reading stories, helping with homework, taking trips to a museum or to the theatre).

Other differences may be related to the mothers' personal characteristics. For example, Hsin (2009) took into account the mothers' education and found a positive and persistent effect of the amount of time mothers spent with children on their language development, but only among children with verbally skilled mothers. Her findings suggest that the effects of the amount of time mothers spend with their children may differ depending on the mothers' educational level, and that women differ in their ability to influence their children's cognitive development.

More recently, researchers have also focused on the role of formal child care as a substitute for working mothers' time. Several studies have examined the impact of formal child care attendance during the first years of life on academic outcomes later in life (Brooks-Gunn et al. 2002; Bernal 2008; Gupta and Simonsen 2010; Felfe and Lalive 2012; Havnes and Mogstad 2015; Felfe et al. 2015). Most of these studies come from the USA and northern European countries and focus on short-term outcomes. The impact of child care appears to be related to the type of child care considered. In the USA, for example, child care is mostly private and varies greatly in terms of quality. In fact, some studies for the USA (Bernal 2008) found that having attended (any) child care before kindergarten had a negative impact on cognitive outcomes (measured with a series of standardised tests) a few years later. Brooks-Gunn et al. (2002) found that children whose mothers were working by the child's ninth month of life had worse School Readiness test scores at 36 months, with the effects being more pronounced when mothers were working 30 h or more.

In Europe, where formal child care is mainly public, most analyses have found a consistent positive impact in countries where public child care is more widely available. The positive results of formal child care on child outcomes are stronger and more consistent in northern European countries. A recent analysis of the impact of a large increase in child care supply in Norway in the 1970s found strong and positive impacts on children's incomes later in life, especially among children of low-educated parents (Havnes and Mogstad 2015). Similar results have been found for western Germany by Felfe and Lalive (2012). They reported that formal child care has a positive impact on children's cognitive (language and communication skills) and non-cognitive abilities (social skills), and that the effect is stronger among children of low-educated mothers. Finally, an empirical analysis for Denmark confirmed previous findings that child care has a greater impact on reducing behavioural problems (i.e. problems related to non-cognitive skills, such as emotional symptoms, conduct problems, hyperactivity/inattention problems, and difficulties with peer relationships) among more disadvantaged children than among less disadvantaged ones (Gupta and Simonsen 2010).

To the best of our knowledge, only one study on this issue has focused on a southern European country. Using PISA data, Felfe et al. (2015) evaluated the effects on the cognitive outcomes of adolescents of a policy introduced in Spain during the late 1990s that mandated the provision of universal child care for three-year-old children. According to their estimates, there was a sizable increase in reading and math test scores following the reform.

3 Child Care Availability: International and Regional Comparisons

Compared to north-western European countries, the child care options in Italy are more limited. Specifically, parental leave is shorter and is not as well-paid, and parents are not encouraged to take it. Moreover, opportunities for part-time work are harder to find in Italy, and child care services for children under the age of three are available on a larger scale in the northern regions only.

Table 1 compares the proportion of families using “formal” (public and privately owned) child care in Italy with the shares in other European countries. We can see a considerable gap between the shares of families using formal care for children in the age ranges 0–2 and 3–5. About 90 % of Italian children aged 3–5 attend formal child care, which is a higher proportion than in some other European countries. Yet only 24 % of children aged 0–2 are enrolled in formal child care, which is a much smaller share than in other countries (with the only exception being Greece). Meanwhile, reliance on informal child care is higher for this age group than for the 3–5 age group and is the second highest among the countries considered.

The supply of child care varies across Europe. In Denmark, Sweden, Belgium, and France the percentage of children attending child care is quite high, while in countries like Italy child care provision is still limited, although it has been slowly increasing in recent decades. Three decades ago the situation in Spain was not very different from that in Italy and Greece. But starting in the 1990s the availability of publicly subsidised child care increased substantially in Spain as a result of the implementation of policies that mandated universal child care provision.

Italy has traditionally invested fewer resources in family policies than other European countries. Eurostat data show that in 2009 less than 0.2 % of the GDP was devoted to this specific sector. Spending on family policies in Italy is therefore much lower than the EU-15 average, which was 0.4 %. In 1990, the corresponding figure was less than 0.1 %, which indicates that levels of investment in early intervention and in work–family reconciliation policies, despite an increase, have

Table 1 Percentage of use of formal and informal child care (2008)

	Children aged 0–2 years		Children aged 3–5 years	
	Formal	Informal	Formal	Informal
Italy	24	20.0	90	3.0
Spain	39	16.0	91	2.0
France	42	8.0	95	2.0
Greece	13	38.0	63	13.0
Belgium	45	13.0	99	0.0
Sweden	48	0.5	92	0.2
Denmark	72	1.2	85	0.0

Informal care is generally defined as care that is arranged by the child’s parents, either in the child’s home or elsewhere, and that is provided by relatives, friends, neighbours, babysitters, or nannies. It is generally unregulated. Children who receive no formal or informal child care are looked after by their mothers

Source: EU-SILC (European Survey of Income and Living Conditions) 2007

remained low in recent decades. As the supply of child care in Italy is determined and financed at the local level, strong cross-regional differences emerged during the early development of care services. The most recent data show that enrolment rates are high in the northern and central regions, but are persistently low in the southern regions (see Table 2).

Despite the relatively low availability of child care in Italy, European rankings on quality (based mainly on the staff/child ratio) show that Italy has relatively high-quality child care services. In terms of quality, Italian child care is ranked fourth after Denmark, Finland, and France for both for the 0–2 and for the 3–5 age groups (De Henau et al. 2008).

The limitations in child care supply in Italy have been described and discussed by Del Boca and Pasqua (2005), Del Boca and Vuri (2007), and Del Boca et al. (2009). These studies demonstrated the potential importance of child care policies in supporting the reconciliation of work and family life. Del Boca and Vuri (2007) have shown that if public child care supply in Italy were to increase to the level in Denmark, the use of the public services would increase considerably, and the use of privately owned and informal services (i.e. grandparents and babysitters) would decline. The estimated effects of child care on labour market participation vary according to the level of education of the mother. Del Boca et al. (2009) indicate that a 10 % increase in the number of child care slots would increase the probability

Table 2 Enrolment rate in child care (0–2 years) by region (1992)

Italian region	Slots available for 100 children	Difference from the national mean
Piemonte	10.8	4.9
Valle D'Aosta	7.7	1.8
Lombardia	9.1	3.2
Trentino Alto Adige	5.1	−0.8
Veneto	5.5	−0.4
Friuli Venezia Giulia	5.4	−0.5
Liguria	8.0	2.1
Emilia Romagna	18.8	12.0
Toscana	7.9	2.0
Umbria	8.7	2.8
Marche	8.5	2.6
Lazio	6.6	0.7
Abruzzo	4.7	−1.2
Molise	2.1	−3.8
Campania	0.6	−5.3
Puglia	4.0	−1.9
Basilicata	3.4	−2.5
Calabria	0.9	−5.0
Sicilia	2.4	−3.5
Sardegna	3.3	−2.6
Italy	5.9	–

Authors' re-elaboration

Source: Istituto degli Innocenti (1998)

of employment among women with higher levels of education by 7 % and among women with lower levels of education by 14 %. Del Boca and Pasqua (2005) have also shown that child care availability has a positive impact not only on mothers' employment, but also on fertility decisions.

While these studies contributed to our understanding of female employment decisions, no existing studies have analysed the relationship between maternal employment, child care attendance, and the academic outcomes of older children in Italy. Yet it is essential that we gain a better understanding of this relationship, as it has important implications for policy makers as they seek to design effective family and educational policies.

4 The Empirical Analysis: Data and Methodology

In order to analyse the impact of child care attendance on child later outcomes, we use data from ISFOL-PLUS, the first Italian dataset that provides information on the educational and labour market paths of young Italians.

More precisely, the survey provides information on almost 40,000 individuals of working ages (18–64). In the 2008 wave, the survey collected retrospective information from respondents about whether they had been enrolled in child care services, and whether their mother worked during the first 3 years of their life.³ The ISFOL-PLUS has several limitations, including the fact that it provides no information on income (both of the respondents and of their families), which prevents us from exploring the potential heterogeneous effects by income found in other studies (Havnes and Mogstad 2015; Felfe and Lalive 2012; Gupta and Simonsen 2010), and that it provides poor information on primary and junior high school outcomes. However, the ISFOL-PLUS is the only Italian dataset that provides information on early child care experiences, family socio-demographic background, and educational outcomes in school.

For our empirical analysis, we reduced our sample to 12,786 individuals between the ages of 19 and 30. The choice of this age range reduced the problem of memory bias and allowed us to analyse a sample of individuals who were children at a time when Italian child care had already developed into the institutional structure we know today. We used the respondents' grades at the end of high school as a measure of their cognitive outcomes. Although the dataset provides information on their grades in junior high school, high school, and university, we focus on high school grades only. We narrowed our focus for several reasons. First, the variable that reports information on junior high school achievements splits the sample into just two groups: i.e. those who received an high average grade and those who received an low average grade. Since more than 80 % of the individuals in our sample achieved high average grades, the variable does not appear to tell us much about the level of school achievement. Second, the fact that some of the individuals in our

³ The questions included in the survey were as follows: "When you were under age three, did you regularly attend child care centres (public or private)?" "Did your mother work when you were under age three?" and "Was she working part-time or full-time?".

sample are still enrolled in tertiary education reduced the sample size and made it difficult to consider university grades in our analysis.

Our estimation is performed with a linear probability model, which is specified as follows

$$\text{High Grade in High School}_i = \beta_0 + \beta_1 \text{Child_care} + \beta_2 \text{Mother_worked} + \beta_3 Z_i + \varepsilon_i$$

where Z_i is a vector of family and individual's socio-demographic characteristics.

We define our dependent variable *High Grade in High School* for individual i as a dummy variable that equals 1 when the individual achieved the grade equal to or higher than 55/60 (for individuals who graduated before 1999), or 90/100 (for individuals who graduated after 1999, when a law changed the high school grading scale); otherwise it is zero. It is worth noting that because grades are reported in brackets in the dataset, it was not possible to construct a continuous variable for school outcomes. The choice of the threshold value defining the "high" outcome was based on the distribution of grades⁴: the respondents with outcomes in the highest 30 % of the distribution were rated as having a high outcome.⁵

The independent variables on which we focus our interest are *Child_care* and *Mother_worked*. *Child_care* is a dummy variable indicating whether the respondent attended child care in the first three years of his or her life, while *Mother_worked* is a dummy variable indicating whether the mother of the individual was working (either full-time or part-time) when he or she was 0–2 years old. The socio-demographic characteristics of the individual and the family included in Z_i are the age and the gender of the individual, and the mother's and the father's level of education. The parental level of education is defined with a dummy variable, *High/medium level of education*, which takes value 1 if the parent has more than primary education, and zero otherwise. Given the small proportion of fathers and mothers with high level of education (13 % and 11 % of our sample), we aggregate high and medium levels of education. Unfortunately, the dataset includes no retrospective data on parents' income and wealth.

In our empirical analysis we take into account the issue of endogeneity of both child care attendance and mothers' employment. Child care attendance is likely to be an endogenous variable since it is based on the parents' choice and is correlated with other unobservable variables of the model. Most existing studies have addressed the problem of endogeneity of child care attendance by using a difference-in-difference approach to determine the effect of child care on children's outcomes that compares the children's results before and after the implementation of a child care reform (Fitzpatrick 2008; Felfe and Lalive 2012). Other analyses have relied on sibling variation (Currie and Thomas 1995). We are unable to employ these strategies to solve the endogeneity problem of child care attendance because

⁴ Of the respondents, 12.6 % earned a very high grade (60/60 or 100/100), 16.3 % had a high grade (between 55 and 59/60 or between 90 and 99/100), 23.3 % earned a medium grade (48–54/60 or 80–89/100), 28.1 % had a medium–low grade (40–47/60 or 70–79/100), and 19.7 % of respondents received a very low grade (36–39/60 or 60–69/100).

⁵ As a sensitivity analysis, we also estimate the model for different thresholds.

no major reform has occurred in Italy, and there is no information on the respondents' siblings in our dataset. To address this problem, we use the instrumental variable (IV) method within our linear regression model.

We also take into account the potential endogeneity in the mother's employment status when the child was under age three. Clearly, working mothers are more likely to enrol their children in child care than non-working mothers. However, in Italy the probability of attending child care is more affected by (the limited) supply than by demand, especially among lower educated women who cannot afford the cost of private child care services (Del Boca and Vuri 2007; and data reported by Cittadinanzattiva⁶). To instrument child care attendance and maternal employment, we use the regional supply of child care and dummies for the area of residence.

To measure child care supply, we consider child care availability at the regional level, since families living in regions with greater child care availability are more likely to enrol their children in child care. To better represent the level of supply compared to the national average in the construction of our instrument, we calculated the difference from the national mean for each region. Therefore, our instrumental variable *Relative child care supply* is defined as the number of child care places available for 100 children by region in 1992, relative to the national mean. Child care availability clearly affects the probability of child care attendance, but it may also positively affect mothers' labour force participation (Del Boca et al. 2009).

To construct this instrumental variable, we use the *Istituto degli Innocenti's* regional data on the number of child care centres, the slots available, and the number of children admitted (Istituto degli Innocenti 1998). Data on public child care centres are available from 1972 onwards, but the first surveys of privately owned centres were not taken until 1992. Thus, we decided to use the 1992 data on the percentage of available places (slots available per 100 children in the relevant age range) for each region as a measure of both the private and the public child care supply. We consider both the private and the public supply because the variable on the individual's child care attendance in our dataset refers to both private and public enrolment. While this measure may not fully capture the "true" child care supply when children were between 0 and 2 years old (namely, between 1978, when the oldest group of sampled individuals were a few months old, and 1992, when the youngest group of individuals were around 3 years old), childcare availability in terms of slots per child did not change much during these years, despite the increase in the absolute number of child care places. Availability did not start to grow substantially until after 2000 (see Figure 2 in the online appendix). It therefore appears reasonable to use data for the year 1992 in our model.

Table 2 shows that the child care supply is very heterogeneous across regions: for every 100 children, there were almost 19 available slots in Emilia Romagna, but only 0.6 places in Campania. On average, a larger proportion of children were enrolled in child care services in the northern and central regions than in the south.

⁶ The website www.cittadinanzattiva.com reports for various years the results of an analysis of the demand for and the supply of child care in Italy, which show that the waiting lists to access child care services have been and continue to be long in all of the regions.

The national average was 5.9 places for every 100 children, with public child care centres providing the majority of the total slots available. Clearly, child care supply may be affected at least in part by demand, which tends to be greater in areas where women have high rates of labour market participation. However, given the small number of places available, it appears that in all of the regions the demand was greater than the supply, and the waiting lists were long (as reported by Cittadinanzattiva).

Two dummy variables indicating whether the individual was living in a northern region or in a central region (south being the excluded dummy) are also employed as additional instruments for female working status. In fact, the employment rates were (and still are) much lower in the southern regions than in the northern and the central regions. There were regional differences in terms of the resources available for child care (as well as for other services), labour market characteristics (demand and supply), and the persistence of a male breadwinner role. On the one hand, because of a lack of labour demand that affects both men and women, the employment rates were much lower in the southern than in the northern regions. On the other, because a more traditional division of labour within the family persists in the south, a much larger proportion of men relative to women were employed in the labour market in that area. These regional differences in the public and private resources available may affect the quality of school and education. However, our results show no regional differences in high school grades.⁷ This is probably due to the fact that the grades were not based on the results of a standardised test, but rather on each student's previous academic performance and the results of a final (written and oral) exam. The written exams were the same for all of the schools in the country, but because they were graded at the school level, the grades tend to reflect differences between children of the same school and not differences between students across the country.

Table 3 reports the descriptive statistics for our sample of the variables used.

The average age of the individuals in our sample was 24 (the standard deviation being 3.3), and 57 % of the respondents were women. In the sample selected, almost half of the respondents had a mother and/or a father with more than a primary education, 44 % of the sample were living in the southern or islands regions, 37 % were living in the north, and the remaining 18 % were living in the centre.

The high school grades of the respondents were clearly affected by the level of parental education: 36.4 % of the children of highly educated mothers had high grades in high school, compared to 32.7 % of the children of mothers with a medium education and 24.6 % of the children of mothers with a low education. The variability by level of paternal education was less strong: 60 % of the children of highly educated fathers earned high grades in high school, compared to 55.5 % of the children of fathers with a medium education and 54.8 % of the children of fathers with a low education.

If we look at the other relevant variables, we can see that 32 % of the respondents attended a child care centre. This percentage is much higher than the figures reported

⁷ In the northern region 28 % of respondents obtained a high grade, compared to 29.5 % in the central and southern regions.

Table 3 Descriptive statistics of the variables included in the estimation

	Mean	SD	% missing
<i>Outcomes variables</i>			
High grade in high school (dummy)	0.289 ^a	–	6.2
<i>Endogenous variables</i>			
Child care attendance (dummy)	0.324 ^a	–	32.2
Mother worked (dummy)	0.362 ^a	–	36.2
<i>Exogenous variables</i>			
High/medium level of maternal education (dummy)	0.492 ^a	–	6.1 ^b
High/medium level of paternal education (dummy)	0.496 ^a	–	8.0 ^c
Age	24.26	3.269	–
Female (dummy)	0.571 ^a	–	–
<i>Instrumental variables</i>			
Relative child care supply	–0.693	4.295	–
North (dummy)	0.371 ^a	–	–
Centre (dummy)	0.185 ^a	–	–
South (excluded dummy)	0.444 ^a	–	–

^a Portion of individuals for which the dummy takes value 1

^b % of missing values in the variable defining the level of maternal education

^c % of missing values in the variable defining the level of paternal education

by statistical sources (see the previous section). The problem with this variable, and also with the variable that refers to the mother's employment status when the individual was 0–2 years old, is the high incidence of missing values (32 and 36 %, respectively). Individuals may find it difficult to answer these retrospective questions precisely. Another possible problem with retrospective information is misreporting. We believe that misreporting is not a problem in this dataset because the questionnaires were filled in during a face-to-face interview by interviewers who were aware of the risk of misreporting on the questions related to child care attendance and the mother's employment status when the respondent was 0–2 years old, and who were instructed to be particularly careful in this part of the questionnaire.

If we compare the characteristics of the individuals who answered or did not answer the questions regarding their child care attendance and their mother's employment status during their early years,⁸ we find that the individuals who did not answer these retrospective questions were, on average, less educated and had less educated parents and lower cognitive outcomes (see Table 1 in the online appendix).

In order to correct our estimates for the potential bias associated with the high incidence of missing values, we imputed to the dummy variables *Child_care* and *Mother_worked* a value of zero when the value was missing. Furthermore, we

⁸ Note that *all* of the individuals with a missing value in the child care attendance variable also have a missing value in the variable on the mother's employment status when the individual was very young.

introduced in our specification a dummy variable called *Missing* that takes a value of 1 when the observation had a missing variable in one of the relevant variables listed above. This produces a case similar to that of a variable with three possible values: “yes”, “no”, and “do not remember”. For example, for child care attendance we have three dummy variables: *Child_care*, which takes value 1 when the individual attended child care and zero otherwise; *Missing*, which takes value 1 when the individual did not remember and zero otherwise; and *NoChild_care*, which takes value 1 when the individual did not attend child care and zero otherwise (this last variable is the excluded variable).⁹ The use of this technique is suggested in case of missing data problems (for a detailed explanation and a review of studies that have applied this technique, see Hardly and Bryman 2004).

As we will show in the next section, when the model is estimated from the full sample and the missing dummies are included, the results are similar to those from the sample that includes no observations with missing values (and hence no missing dummy either). Nevertheless, the high incidence of missing values cannot be ignored when we estimate our model, especially because they do not seem to be distributed randomly.

5 Empirical Results

Table 4 reports the estimates on the full sample. The first two columns show the results of the first-stage estimates, which are consistent with our expectations: a woman with a higher level of education is more likely than her less educated counterparts to work and to enrol her children in child care. A father's education does not have a significant effect on the probability that his children will attend child care, but it positively affects the probability that his wife will work. The availability of child care supports the mother's participation in the labour market and positively influences the probability that her children will be enrolled in child care services. A woman is more likely to work if she lives in the northern or the central region than if she lives in the southern region (excluded dummy). The first-stage F-statistics reported in the bottom part of the table show that the instruments used are not weakly defined, which means that they are capable of predicting a relevant variation of the endogenous variables, child care attendance, and maternal employment.

Column 3 reports the results of the second stage IV estimates. The probability of earning a high grade in high school (i.e. a grade greater than 55/60 or 90/100) is positively and significantly (at a 1 % level) affected by child care attendance. The results also show that having a mother who worked while her children were young does not significantly affect the respondent's performance in high school.

As expected, the coefficients associated with the level of maternal and paternal education are positive: a child whose parents have more than a primary education has, *ceteris paribus*, a higher probability of having earned a good grade at the end of the secondary school.

⁹ The same reasoning holds true for the variables *Mother_worked*.

Table 4 Results from the full sample

1st stage and IV regression assuming linear probability			
Variables	1st stage Child care attendance (1)	1st stage Mother work (2)	IV High grade in high school (3)
Child care attendance when <3	–	–	0.624*** (0.175)
Mother worked when the individual was <3	–	–	–0.054 (0.095)
Constant	0.598*** (0.034)	0.660*** (0.035)	0.281*** (0.122)
Age	–0.006*** (0.001)	–0.002 (0.001)	–0.010*** (0.002)
Female	–0.083*** (0.008)	–0.008 (0.008)	0.154*** (0.018)
High/medium level of maternal education	0.040*** (0.010)	0.164*** (0.010)	0.048** (0.024)
High/medium level of paternal education	0.007 (0.010)	0.032*** (0.010)	0.029** (0.018)
Missing	–0.293*** (0.009)	–0.548*** (0.009)	0.032 (0.087)
Relative child care supply	0.008*** (0.001)	0.007*** (0.001)	–
North	–0.105*** (0.013)	0.081*** (0.013)	–
Centre	–0.075*** (0.013)	0.056*** (0.013)	–
Observations	9447	9447	9447
First-stage F-stat	22.4***	75.2***	
Under identification test			49.4
Weak identification test			16.5
Sargan test (overidentification test of all instruments)			0.44

Standard errors in parentheses

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Finally, our results show significant gender differences: on average, girls achieve better results than boys.

While the variable *Missing* is not significant, as a robustness check we also re-estimated the coefficients on the (reduced) sample of individuals for whom we have no missing values. The results, which are reported in Table 5 in the appendix, are similar in sign to those shown in Table 4. However, the magnitude of the coefficient of child care attendance variable is reduced. The tests reported in the bottom part of

Table 4 (and of Table 5 in the appendix) confirm that the model is correctly specified. The Sargan tests rule out the endogeneity of all instruments. The F-tests confirm the relevance of the instruments chosen.

As an additional sensitivity analysis, we have also estimated our model using two different definitions of our dependent variable to prove that the results do not depend on the definition of the outcome. In Table 6 in the appendix, we report the results for the probability of obtaining a medium–high grade (greater than 48/60 or 80/100, corresponding to the top 52 % of the distribution) in high school (columns 1 and 3), and for the probability of earning a very high grade (60/60 or 100/100, corresponding to the top 13 % of the distribution) (columns 2 and 4). The results show that regardless of the definition of high school achievement we use, results do not change and only the magnitude of the effect varies.

6 Conclusions

The aim of this paper has been to explore the impact of mothers' employment and formal child care attendance during early childhood on children's high school grades. In order to empirically estimate this impact, we used data from the 2008 wave of the ISFOL-PLUS on a sample of Italian individuals that contains retrospective information on the labour market participation of mothers, the child care attendance of individuals during the first 3 years of life, and the later academic outcomes (such as high school grades) of these individuals. The results of our study on the long-term impact of maternal employment and early child care attendance on children's academic outcomes in high school constitute a new contribution to the existing literature on this topic, which has mainly looked at short-term academic outcomes using datasets from northern Europe and the USA.

In our empirical analysis we take into account the endogeneity issue in both child care attendance and maternal employment variables using an instrumental variable model. The estimates of the main regression indicate that early child care attendance increases the likelihood of obtaining high grades in high school, while maternal employment status does not have a significant effect. One explanation for these findings is that in Italy working mothers are, on average, better educated than non-working mothers and may be able to compensate for the lower quantity of time they spend with their children by spending more quality time. The labour market participation rate of highly educated women in Italy is similar to the EU average (75 %), although the participation rate of less educated women is much lower (31 %).

Indeed, the probability of obtaining good grades in high school is also directly linked to the educational level of both parents. The mother's and the father's schooling positively and significantly affect the child's probability of achieving high grades. Our results seem to confirm those of previous studies. On the one hand, our finding that formal child care has a positive impact on children's educational outcomes is consistent with studies of northern European countries where formal child care is mainly public and is considered to be of high quality (Havnes and Mogstad 2015; Gupta and Simonsen 2010). On the other hand, our finding that

maternal employment has a non-significant impact on children's educational outcomes is in line with the findings of Mancini and Pasqua (2012), who showed that working mothers "sacrifice" their own free time to spend more time with their children and, if necessary, reduce the amount of time they spend on "basic care" to have more time for "quality care". Our results are also similar to findings from the USA (Hsin 2009) that showed that highly educated mothers even when they work continue to spend time with their children in human capital accumulating activities, which positively contribute to their children academic outcomes.

In the recent public debate in Italy on this issue, policy makers and social scientists have focused on factors such as the country's low female labour force participation and fertility rates, and on the poor academic performance of Italian children (relative to that of children in other countries). Despite the intensity of the debate and the recognition of the beneficial effects of child care on subsequent child educational outcomes, no policies addressing these issues have been implemented. While the supply of public child care for children aged 0–3 has increased slightly, it is still below the Barcelona recommendations (i.e. that 33 % of children aged 0–3 have access child care), and it still fails to meet the demand, especially in the southern regions.

Our results could have implications for child care policies. The finding that child care attendance has a positive impact on child cognitive outcomes implies that child care facilities should be expanded throughout Italy so that all families (and especially less advantaged families in the southern regions) have accessed child care services. Increasing the availability of child care would also support mothers' labour market participation, which is of crucial importance to the Italian economy.

The limitations of our empirical analysis are primarily related to a lack of information on the economic situations of families and on their time allocation. This information would improve our results and should thus allow us to make more precise policy recommendations. If income and wealth data were available, we would, for example, be able to examine the different effects of child care on children from more or less advantaged families.

While no Italian dataset that is currently available allows us to combine the information used in our work with information on the economic situations of families, we can exploit the available dataset on time use for future research. To further investigate the link between maternal employment and child cognitive outcomes, we plan to explore more detailed measures of parental time investments in child development processes using data that describe time allocation in different activities, distinguishing between basic care and human capital accumulating activities.

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Appendix

See Tables 5 and 6.

Table 5 Results from the sub-sample of individuals with no missing values

1st stage and IV regression assuming linear probability			
Variables	1st stage Child care Attendance (1)	1st stage Mother Work (2)	IV High grade in high school (3)
Child care attendance when <3	–	–	0.429*** (0.155)
Mother worked when the individual was <3	–	–	–0.030 (0.080)
Constant	0.699*** (0.052)	0.450*** (0.053)	0.371*** (0.134)
Age	–0.011*** (0.002)	–0.004** (0.002)	–0.011*** (0.003)
Female	–0.115*** (0.012)	–0.013 (0.012)	0.145*** (0.022)
High/medium level of maternal education	0.060*** (0.014)	–0.248*** (0.014)	0.041** (0.031)
High/medium level of paternal education	0.012 (0.014)	0.045*** (0.014)	0.042* (0.016)
Relative child care supply	0.011*** (0.002)	0.009*** (0.002)	–
North	–0.149*** (0.018)	0.127*** (0.018)	–
Centre	–0.113*** (0.019)	0.098*** (0.019)	–
Observations	6323	6323	6323
First-stage F-stat	22.8***	82.4***	
Under identification test			43.4
Weak identification test			14.5
Sargan test (overidentification test of all instruments)			0.19

Standard errors in parentheses

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 6 Results for different definitions of the dependent variable (for the full sample and from the sub-sample of individuals with no missing values)

1st stage and IV regression assuming linear probability				
Variables	Full sample		Without observation with missing values	
	IV Medium-high grade in high school (1)	IV Very high grade in high school (2)	IV Medium or high grade in high school (3)	IV Very high grade in high school (4)
Child care attendance when <3	0.466*** (0.179)	0.322*** (0.122)	0.401*** (0.161)	0.252** (0.115)
Mother worked when the individual was <3	-0.180* (0.090)	-0.089 (0.066)	-0.129 (0.082)	-0.054 (0.060)
Constant	0.414*** (0.125)	0.182** (0.086)	0.349** (0.139)	0.221** (0.099)
Age	-0.002 (0.002)	-0.005*** (0.001)	-0.000 (0.003)	-0.007*** (0.002)
Female	0.177*** (0.019)	0.071*** (0.013)	0.170*** (0.023)	0.064*** (0.017)
High/medium level of maternal education	0.084*** (0.024)	0.042** (0.016)	0.074** (0.032)	0.042** (0.023)
High/medium level of paternal education	0.052*** (0.014)	0.004 (0.009)	0.069*** (0.017)	0.004 (0.012)
Missing	-0.104 (0.089)	-0.022 (0.061)	-	-
Observations	9447	9447	6323	6323
Under identification test	49.4	49.4	43.4	43.4
Weak identification test	16.5	16.5	14.5	14.5
Sargan test (overidentification test of all instruments)	0.13	6.31	0.16	3.48

Standard errors in parentheses

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

References

- Bayard, N., & Brooks-Gunn, J. (1991). Effects of Maternal Employment and Child Care Arrangements on Preschoolers' Cognitive and Behavioural Outcomes: Evidence from Children of the National Longitudinal Survey of Youth. *Developmental Psychology*, 27, 932–945.
- Bernal, R. (2008). The Effect of Maternal Employment and Child Care on Children Cognitive Development. *International Economic Review*, 49(4), 1173–1209.
- Blau, F. D., & Grossberg, A. (1992). Maternal Labor Supply and Children's Cognitive Development. *Review of Economics and Statistics*, 74, 474–481.
- Brooks-Gunn, J., Wen-Jui, H., & Waldfogel, J. (2002). Maternal Employment and Child Cognitive Outcomes in the First Three Years of Life: The NICHD Study of Early Child Care. *Child Development*, 73(4), 1052–1073.

- Carneiro, P. M., & Heckman, J. J. (2003). *Human capital policy*. Cambridge, MA: National Bureau of Economic Research.
- Cunha, F., & Heckman, J. (2006). *Investing in young people*. National Institute of Health and Committee of Economic Development
- Currie, J., & Thomas, D. (1995). Does Head Start Make a Difference? *American Economic Review*, 85(3), 341–364.
- De Henau, J., Meulders, D., & O'Dorchai, S. (2008). Making Time for Working Parents: Public Child Care Provision. In D. Del Boca & C. Wetzels (Eds.), *Social Policies, Labour Markets and Motherhood*. A comparative Analysis of European Countries: Cambridge University Press.
- Del Boca, D., Flinn, C., & Wiswall, M. (2014). Household Choices and Child Development. *Review of Economic Studies*, 81, 137–185.
- Del Boca, D., & Pasqua, S. (2005). Labour Supply and Fertility in Europe and the U.S. In T. Boeri, D. Del Boca, & C. Pissarides (Eds.), *Women at Work. An Economic Perspective*. Oxford: Oxford University Press.
- Del Boca, D., Pasqua, S., & Pronzato, C. (2009). Motherhood and Market Work Decisions in Institutional Context: a European Perspective. *Oxford Economic Papers*, 61(suppl. 1), i147–i171.
- Del Boca, D., & Vuri, D. (2007). The Mismatch between Employment and Child Care in Italy: the Impact of Rationing. *Journal of Population Economics*, 20(4), 805–832.
- Desai, S., Chase-Lansdale, P. L., & Michael, R. T. (1989). Mother on Market? Effects of Maternal Employment on the Intellectual Ability of Four-Year-Old Children. *Demography*, 26, 545–561.
- Ermisch, J., & Francesconi, M. (2005). Parental Employment and Children's Welfare. In T. Boeri, D. Del Boca, & C. Pissarides (Eds.), *Women at work: an Economic Perspective*. Oxford: Oxford University Press.
- Felfe, C. & Lalive, R. (2012). *Early child care and child development: for whom it works and why*. IZA Discussion Papers 7100, Institute for the Study of Labor
- Felfe, C., Nollenberger, N., & Rodríguez-Planas, N. (2015). Can't buy mommy's love? Universal childcare and children's long-term cognitive development. *Journal of Population Economics*, 28(2), 393–422.
- Fitzpatrick, M. D. (2008). Starting school at four: The effect of universal pre-kindergarten on children's academic achievement. *The B.E. Journal of Economic Analysis and Policy*, 8(1), 1–38.
- Gupta, N. D., & Simonsen, M. (2010). Non-cognitive child outcomes and universal high quality child care. *Journal of Public Economics*, 94(1–2), 30–43.
- Hardly, M., & Bryman, A. (2004). *Handbook of data analysis*. Thousand Oaks: SAGE Publications Ltd.
- Havnes, T., & Mogstad, M. (2015). Is universal child care levelling the playing field? *Journal of Public Economics*, 127, 100–114.
- Heckman, J. J., Krueger, A. B., & Friedman, B. M. (2005). *Inequality in America: What role for human capital policies?*. Cambridge, MA: MIT Press.
- Hsin, A. (2009). Parent's time with children: Does time matter for children's cognitive achievement? *Social Indicators Research*, 93(1), 123–126.
- Istituto Degli Innocenti (1998). "I 'numeri' dell'infanzia e dell'adolescenza in Italia", *Quaderni del Centro Nazionale di Documentazione ed Analisi dell'Infanzia e l'Adolescenza*, n. 5
- Koler, H. P., Billari, F., & Ortega, J. (2002). The emergence of lowest low fertility in Europe during the 1990. *Population and Development Review*, 28(4), 641–680.
- Mancini, A. L., & Pasqua, S. (2012). Asymmetries and interdependencies in time use between Italian parents. *Applied Economics*, 44(32), 4153–4171.
- OECD. (2007). *PISA 2006 science competencies for tomorrow's world*. Paris.
- OECD. (2014). *PISA 2012 results in focus. What 15-year-olds know and what they can do with what they know*.
- Vandell, D., & Ramanan, J. (1992). Effects of early and recent maternal employment on children from low income families. *Child Development*, 63, 938–949.