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Research Paper

Can early universal preschool reduce socioeconomic inequalities in child development? The role of duration and intensity of preschool attendance in the French birth cohort, *Elfe*[☆]

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ABSTRACT

High quality early childhood education and care programs can foster the development of cognitive and noncognitive skills. We estimate the effects of the duration of attending free universal preschool (*école maternelle*) in France between age 3 and 4 on children's cognitive skills and global development, leveraging differences by birth month to identify plausibly exogenous variation in duration of preschool exposure. Using nationally representative data from the French *Elfe* (*Etude Longitudinale française depuis l'Enfance*) birth cohort and a large sample of more than 12,000 children, we measure cognitive skills and global development via the British Ability Scale and the Child Development Index, respectively, when children were approximately 3.5 years of age. Our results provide evidence that universal preschool programs have the potential to foster children's early cognitive skills and global development, and may help reduce early socioeconomic inequalities. Children from disadvantaged families, in terms of parental education and income, and those attending a disadvantaged school, appear to reap particularly large benefits in early cognitive skills and global development from a longer duration in preschool than their more advantaged peers. While months spent at school play a positive role in child development, we find no effect of greater intensity (hours per day) of attendance, or of attending after-school and/or lunch sessions.

1. Introduction

Early childhood education and care (ECEC) programs have the potential to foster child development and decrease socioeconomic inequalities, thereby contributing to the reduction of population-level inequalities in cognitive, social, and emotional skills and promoting human capital development and wellbeing (Blau, 2021; Burger, 2010;

Currie & Rossin-Slater, 2015; Elango, Garcia, Heckman & Hojman, 2016). A substantial number of studies have assessed whether preschool programs—usually defined as early education programs for 3- to 6-year-old children—positively impact child development, with a particular focus on effects for disadvantaged children. Much of this literature stems from the US, which is characterized by heterogeneous settings, program qualities, pedagogical approaches, funding structures,

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accessibility, and target populations. The European context, in which preschool is often universal, free or inexpensive, and attended by most children, has been studied less frequently (see, e.g., [Blau 2021](#); [Duncan et al., 2023](#); [van Huizen & Plantenga, 2018](#)). In part, this reflects limited opportunities to identify counterfactuals against which to estimate plausibly causal effects of universal preschool. Yet, further studying the effects of universal programs in the European context can be informative for developing similar initiatives elsewhere.

Prior studies in the European context find modest-to-large benefits of preschool for disadvantaged children, whereas the evidence is mixed for higher socioeconomic status (SES) children ([Blau 2021](#); [van Huizen & Plantenga, 2018](#)), suggesting that such programs may decrease socioeconomic inequalities in child development. Whereas program quality is often highlighted as a key driver of positive effects, particularly for disadvantaged children, there is less conclusive evidence regarding other program elements, such as intensity and duration of participation. Whereas a few studies find that longer preschool duration is associated with greater benefits ([Burger, 2010](#); [Domitrovich et al. 2013](#); [Harshini et al. 2017](#)), others do not ([Sammons et al., 2008](#)). Evidence on program intensity, such as the number of hours attended per day, is also not clear cut, with prior research producing mixed results ([Belsky, 2006](#); [Landvoigt, Mühler, Pfeiffer, 2007](#)).

In this study, we estimate the effects of attending universal education-focused preschool (*école maternelle*) in France, which targets 3- to 6-year-old children, on early childhood development. To assess these effects, we leverage nationally representative data from the French *Elfe* (*Etude Longitudinale française depuis l'Enfance*) birth cohort and exploit plausibly exogenous variation in duration of exposure to *école maternelle* to employ an instrumental variables (IV) approach that allows us to estimate whether longer exposure (in months) to preschool has a plausibly causal impact on early cognitive skills and global development. In descriptive analyses, we also assess whether intensity of exposure (attending on a full-time or half-time basis and attending wraparound care) is associated with child development. Finally, we explore whether these effects vary by family SES, other child and family characteristics, and ECEC program characteristics.

2. Background

2.1. ECEC and child development

ECEC programs have been advocated for a variety of reasons: to promote female employment, gender equity, to improve work-family balance, and to support child development. With respect to the latter, there is scholarly consensus that the early years are particularly important for the development of cognitive and noncognitive skills and overall school readiness. High-quality ECEC can foster children's human capital development, that is, in turn, linked to later development ([Elango et al., 2016](#)) and long-term wellbeing ([Cunha, Heckman, Lochner, & Masterov, 2006](#)). ECEC is an umbrella term for a heterogeneous set of programs for children prior to primary school entry. Programs may be universal or targeted (typically to disadvantaged children) and, in some cases, access to a universal program may depend on local program capacity. Programs may serve younger (0-3 year old) children, usually in a childcare setting, or older (3-6 years old) children, often in a preschool setting. Moreover, there may be considerable heterogeneity in program delivery both within (by program site) and between programs. Thus, in assessing the effects of ECEC, it is important to consider specific program types based on their content and delivery, as well as the developmental needs of the children they serve.

We focus on the French universal preschool program serving children roughly 3- to 6-years old. Assessing causal links between preschool attendance and child outcomes in a universal setting is complex given the difficulty of identifying appropriate counterfactual conditions ([Fennol, Campaniello & Monzon, 2019](#)). As such, much of the literature on ECEC program effectiveness has focused on small-scale, high-quality,

and intensive targeted interventions for disadvantaged children, evaluated via randomized experiments, predominantly in the United States (see [Duncan et al., 2023](#), for a recent review). The evidence from these studies indicates that high-quality preschool yields large benefits for disadvantaged children, thereby reducing social and economic inequalities ([Barnett & Jung, 2021](#); [Cascio, 2021](#); [Currie, 2001](#); [Elango et al., 2016](#)).

Evidence on the effects of larger-scale programs for disadvantaged children, such as the Head Start Program in the United States, has been considerably more mixed, suggesting heterogeneous effects by (site-specific) program quality, developmental domain, and family SES ([Bitler, Hoynes & Domina, 2014](#); [Cascio, 2021](#); [Elango et al., 2016](#); [Garces, Thomas & Currie, 2002](#); [Walters, 2015](#)). Notably, most US studies have focused on targeted programs because the US lacks universal preschool. However, in recent decades, a few US states have introduced universal programs. Using difference-in-differences approaches to compare changes in test scores over time between states that implemented universal preschool and those that did not, several studies suggest that universal preschool positively impacts test scores for disadvantaged but not advantaged children ([Cascio & Schanzenbach, 2013](#); [Fitzpatrick, 2008](#)).

In contrast to the US, the European context is characterized by widespread universal access to public preschool in many countries. To evaluate these programs, studies have leveraged exogenous variation generated by policy reforms and applied quasi-experimental methods. On the whole, findings have been somewhat mixed, but most studies find universal preschool to positively impact development for disadvantaged children and modest benefits for their more advantaged counterparts (see [Blau, 2021](#) for a review). This may reflect that universal programs focus on skills that more advantaged children would learn at home, anyway ([Duncan et al., 2023](#)), or that counterfactual care would be of lesser quality for more disadvantaged children ([Havnes & Mogstad, 2015](#)). However, the studies reviewed span a range of programs that vary by child age (0-2 versus 3-6), geographic availability (local versus national), program intensity (full- versus half-day), and program focus (childcare versus education). In a meta-analysis taking these factors into account, [van Huizen and Plantenga \(2018\)](#) concluded that the positive effects of ECEC are concentrated among disadvantaged children, whereas the effects of universal preschool for children, on the whole, vary by program quality, intensity, and structure. [Nores et al. \(2024\)](#)'s review concluded that participation is positively associated with short- and long-term gains in cognitive skills and achievement.

[Duncan and colleagues \(2023\)](#) caution that many studies evaluating universal programs leverage policy reforms that led to a rapid expansion in preschool provision and that the quality of care in new programs might not equal the care provided by more established centers and providers. Yet, program quality is often highlighted as a key driver of the effects of ECEC, such that attending high-quality preschool is particularly salient for disadvantaged children's subsequent development ([Sammons, Toth & Sylva, 2015](#)). High-quality programs provide both directed teaching activities and child-directed play, and tend to have well-qualified staff who have been trained in child development ([West, 2016](#)). Moreover, programs that emphasize literacy, math, and science, and cater to children of different genders, backgrounds, and abilities, tend to produce the largest impacts ([Sammons, et al., 2008](#); [Sylva, et al., 2012](#)).

The French *école maternelle* program, the focus of this study, is a universal preschool program offered to all children from about age 3 until entry into primary school at approximately age 6. *Ecole maternelle* is education-focused and high-quality ([Eurydice, 2025](#)). Program quality is ensured, in part, via high spending per child (which matches spending in primary school); centrally set program standards and curriculum; and teachers receiving the same pay and training as primary school teachers. Despite widespread attendance, however, children's experiences may vary by whether they attended formal childcare prior to entering *école maternelle*, the age at which they entered *école*

maternelle, and the intensity at which they attended. Moreover, *écoles maternelles* can be public or private, and public programs may be eligible for supplemental resources under an initiative prioritizing programs in disadvantaged neighborhoods. Whether there may be heterogeneity in the effects of *école maternelle* on child development by these policy-relevant factors has not been examined.

2.2. Age at ECEC entry

Research on age at school entry, on the whole, has produced mixed results. Some evidence suggests that children who enter formal schooling (typically defined as entering kindergarten, at about age 5, or primary school, at age 6 or 7) at an older age do better on a range of subsequent outcomes (Bedard & Dhuey, 2006). Other studies, however, have found that short-term effects of older age at entry fade over time (Datar & Gottfried, 2015; Fletcher & Kim, 2016), or that earlier age at entry, and thus greater school exposure, positively impacts child development (Black, Devereux, & Salvanes, 2011; Passaretta & Skopek, 2021). Only a small group of studies has specifically evaluated the effects of age at preschool entry, which typically occurs at about age 3 or 4, and is the focus of our study. Among these, Kuehnle and Oberfichtner (2020) found no benefits of earlier entry into universal preschool in Germany; Cornelissen and Dustmann (2019) found short-term benefits of earlier universal preschool entry in England for both cognitive and noncognitive development (the cognitive benefits faded by middle childhood); and Melo et al. (2024) found a positive association of exposure to the Head Start program in the US with self-regulation in kindergarten.

We are aware of three studies that focus specifically on the French case, which broadly find that early age at program entry is associated with positive outcomes (Caille, 2001; Dumas & Lefranc, 2012; Filatriau, Fougère & Tô, 2013). Dumas and Lefranc (2012) examined the expansion of preschool in the 1960s and 1970s and found lowering the eligibility age from 4 to 3 to be associated with greater subsequent educational attainment. Both Caille (2001) and Filatriau et al. (2013) focused on very early preschool entry, at age 2, among more recent cohorts. Caille (2001), using standard regression methods, found a positive association between earlier entry and subsequent academic achievement. Filatriau et al. (2013) leveraged variation in the ratio of young children in a neighborhood to the capacity of local preschools to enroll them, and employed an instrumental variables strategy to identify effects of preschool entry at age 2 (rather than 3) on cognitive and noncognitive skills at age 6, and achievement from grades 3 to 9. They found positive effects on cognitive and noncognitive skills at age 6 and positive effects on math and literacy that persisted through about age 10. However, none of these studies carefully assesses potential heterogeneity in the effects of *école maternelle* by factors such as program intensity, school type, family SES, or children's earlier childcare experiences.

2.3. ECEC intensity

Program intensity—the amount of time a child spends in preschool per day or week—can vary across and within programs. Whereas some earlier research suggested that more intensive program participation produces larger benefits (Ramey & Ramey, 1998), more recent evidence from a universal program for children aged about 3- to 6-years old in Germany does not support this finding (Landvoigt et al., 2007). Some early evidence from the US further also suggested that longer hours in childcare (though not necessarily preschool) may be associated with adverse socioemotional development, at least in the short term (Belsky, 2006). However, subsequent work suggests that such effects are modest in magnitude, primarily associated with low-quality settings (McCartney, et al., 2010), and concentrated among advantaged White children (Huston, Bobbitt & Bentley, 2015). The evidence for Head Start suggests no association of hours of attendance with socioemotional skills

at kindergarten entry (Melo, et al., 2024). We are aware of no direct evidence on associations of program intensity and child development in the context of universal ECEC in France.

2.4. Heterogeneity in effects by socioeconomic background

Inconsistent findings regarding the average effects of universal preschool on child development may reflect heterogeneous effects across population subgroups. A priori expectations, here, are ambiguous. On one hand, complementarity between parental and preschool investments (Cunha & Heckman, 2007) may suggest larger effects for children from more advantaged families. Conversely, effects may be largest for children who are more likely to receive high-quality investments in preschool rather than at home, thus favouring less-advantaged children. The empirical literature, summarized in a recent systematic review of quasi-experimental studies exploring the long-term outcomes of universal preschool programs, indicates support for the second hypothesis, such that disadvantaged children benefit more than advantaged children (Dietrichson, Kristiansen & Nielsen, 2020). Moreover, some studies have found positive impacts for children from low-SES families and negative impacts for those from high-SES families (Baker, Gruber & Milligan, 2019; Haeck, Lebihan & Merrigan, 2018; Havnes & Mogstad, 2015). Evidence from two French studies that explore heterogeneity by SES in associations of age at preschool entry with child development points to greater positive effects of preschool for disadvantaged than advantaged children (Caille, 2001; Dumas & Lefranc, 2012), but this evidence is correlational rather than plausibly causal in nature.

3. The French context

ECEC is universally available in France during the academic year for children between approximately ages 3 (sometimes 2) and 6 via publicly funded *écoles maternelles*. The right to *école maternelle* was initiated in 1833 and enshrined in 1881. Today, all children are entitled to *école maternelle* from September of the calendar year in which they turn 3 until they enter primary school (at about age 6). Initiation of formal education at age 3 (rather than age 6) has been mandatory since 2019, although parents can apply for a derogation to home school. The primary aim of *école maternelle* is educational, whereas providing care to enable work-family reconciliation is a secondary aim.

Ecole maternelle is integrated within the French education, rather than childcare (*crèche*), system, and shares the same guiding principles, opening hours, and administration as elementary schools. Curricula are nationally designed and regulated, and programs are funded by the Ministry of Education, whereas wraparound services are delivered and funded by local municipalities. There are no tuition fees to parents, although relatively small fees, scaled by household income, are charged for wraparound services including lunch and afterschool sessions. Children may participate part- or full-day, at least in the first year. Schools may be public or private, and public schools in disadvantaged areas can be eligible for extra resources, such as additional funding per pupil and a higher teacher-student ratio to decrease class size. In addition, a 2005 law encouraged schools in disadvantaged areas to extend programming to 2-year-olds. Thus, some programs accommodate children as young as 2, either in their own classes or in 3-year-old classes, although mixed age grouping is less common.

The *école maternelle* curriculum is organized around five morning and four afternoon classroom-based teaching sessions per week. Wednesday afternoons have no teaching sessions, although optional activities are provided for a small fee. Instruction is delivered by highly-trained staff (with qualifications identical to those required for primary school teachers, including a 5-year university level degree, regular mandatory continuing professional development training, and a 3-year induction period with extra checks and support) in classrooms ranging from 20 to 30 children (24, on average), with the assistance of an *agent spécialisé des*

écoles maternelles (teaching assistant) at certain times of the day. Wraparound options include five two-hour lunchtime sessions, as well as unstructured supervised play, in communal spaces such as the school's playground or gym; five afterschool sessions, usually from about 4:30–6:30 p.m., including a snack and structured and unstructured activities; and a Wednesday afternoon session, usually from 1:30–6:30 p.m. Because wraparound services are delivered by local municipalities, their offerings, content, and cost can vary considerably.

On the whole, *école maternelle* offers high-quality ECEC in terms of both formal instruction and informal socialization (Eurydice, 2025; European Commission, 2014; Fagnani, 2014; OECD 2015). The nationally standardized curriculum includes language acquisition, group interactions, psychomotor development, creativity, “learning to learn,” and managing the transition from preschool to primary school. Program quality and capacity monitoring is carried out centrally, based on site visits, while individual teacher and school evaluations are self-administered. Spending per child during *école maternelle* is the same as spending per child during primary school, including that for teacher salaries (Eurydice, 2025).

Attendance at *école maternelle* beginning at age 3 has long been normative, with near universal uptake, despite not being mandatory prior to 2019. The enrollment rate in 2014, roughly when *Elfe* cohort children entered, was 96.7% at age 3, and almost 100% by age 5. Participation of 2-year-olds is by parental request, subject to space availability, and conditional on the child being toilet trained. Only 11.6% of 2-year-olds were enrolled in 2013, though this went up to 20% in designated disadvantaged neighborhoods (Abdouni, 2014). Intensity of program participation varies by child and household characteristics. Younger children are more likely to attend part time than full time (Legendre, 2011), and disadvantaged children experience less intensive participation than their more advantaged counterparts (Thierry, et al., 2020), potentially reflecting fees associated with wraparound sessions.

The empirical identification strategy used in our analyses relies on variation in age of entry into preschool. As most children in France enter *école maternelle* in September¹ of the calendar year in which they turn 3, a new cohort will include children born January through December of the same birth year. Thus, children born in December are the youngest within each school cohort, while those born in January are the oldest. This enrollment threshold provides plausibly exogenous variation in age of entry and, thus, in preschool exposure.

4. The current study

This study has two objectives. First, we examine whether duration of *école maternelle* participation, as measured by age of entry, impacts child cognitive skills and global development at approximately age 3.5, all else equal. To address this aim, we leverage nationally representative *Elfe* data and exploit plausibly exogenous variation in participation based on age at entry, given birthdate-conditioned eligibility, to employ an instrumental variables (IV) approach intended to estimate the causal impact of duration of attendance on early childhood cognitive skills and global development. We also examine whether this impact varies for subgroups of children defined by family SES (parental education, household income, immigrant status), child and family characteristics (family structure, sibship size, child sex), and child ECEC experiences (childcare participation at age 1 and *école maternelle* type (standard public, public with disadvantaged school initiatives, private). We hypothesize, based on developmental theory and prior empirical evidence, that greater duration of *école maternelle* exposure will be linked to greater cognitive skills and global development, particularly for less socially and economically advantaged children.

Second, we examine whether greater intensity of participation (full-

time versus half-time attendance, lunch attendance, extend hours/ afterschool attendance) is associated with greater developmental gains, as well as whether associations between participation intensity and development vary by family SES, child and family characteristics, and a child's prior ECEC experiences. Given that prior research has produced inconsistent findings in these domains, we have no *a priori* hypotheses regarding the magnitude or direction of these associations, nor with respect to variation between population subgroups.

5. Data and sample

We use data from *Elfe*, the first nationally representative French birth cohort study, comprising a representative sample of over 18,000 children born in 345 hospitals in France in 2011. Births were sampled and initial interviews conducted in four intervals: April, June–July, September–October, and November–December 2011. Interviews were conducted in-person with the mother in the maternity unit shortly after her child(ren)'s birth, and by telephone with both parents (or primary caregivers) when children were about 2-months, 1-year, 2-years and 3.5-years of age. Age-3.5 data collection also included an in-home assessment of the focal child. Detailed information about the study can be found in Charles, et al. (2020).

From the initial *Elfe* sample of 18,329 births, we retained 12,236 children whose families were interviewed at age 3.5. Only 132 sample children (around 1% of our sample) were reported to not be attending *école maternelle* at the time of the age 3.5 interview. We exclude these children as well as 32 children who had missing data on *école maternelle* attendance, and 69 children with missing data on age at school entry. We also exclude children who had missing data on the outcomes of focus, resulting in samples of 9,156 children who had non-missing data on cognitive skills and 10,618 who had non-missing data on global development. Finally, we drop children with more than 10 months of *école maternelle* participation because they had already spent more than one school year attending and had entered prior to the calendar year they turn 3, probably at age 2, potentially for reasons we do not observe. Our final analysis samples for cognitive skills and global development consisted of 7,778 and 9,079 children, respectively. We use different analytical samples for each outcome to retain the largest sample of children. Table A1 provides descriptive statistics for the full *Elfe* sample, the *école maternelle* sample, and each of our analytic samples.

Missing values for our covariates were 1% or less, with the exception of general health reported at age 2 (3–4%), household income (1–2%), and preschool type (7%). As such, we constructed indicators for missing values of the covariates and include them in our regression models. Given low rates of missing data, our results are not sensitive to this strategy, which we prefer given that excluding all children with missing data on any covariate would reduce the sample size and potentially bias our estimates. As in most surveys, disadvantaged families were disproportionately lost to follow-up (Thierry, Pilorin & Lanoë, 2018), such that disadvantaged children are underrepresented in our analytical samples compared to the initial sample. Thus, while we retain large enough samples of disadvantaged families to conduct subgroup analyses, our findings may not be fully generalizable to the most disadvantaged children and could potentially underestimate the effects of *école maternelle* duration for these children.

6. Measures

6.1. Child development

Our primary outcomes include child cognitive skills and global child development at the age-3.5 *Elfe* interview. The British Ability Scale Picture Similarities (BAS) module was administered to the focal child by a trained interviewer during a home visit to assess their cognitive skills. The BAS is a validated and widely used scale that tests thinking, problem solving, and reasoning ability (Elliott, 1983, 1997); the Picture

¹ The school year runs from the beginning of September until end of June or the start of July of the next calendar year.

Similarities module assesses problem solving and nonverbal reasoning abilities. The Child Development Inventory (CDI), which the mother (primary caregiver) was administered during the age-3.5 phone interview, provides a global assessment of child development based on 44 items tapping multiple domains: socialization, autonomy, language (expression and comprehension), and (fine and gross) motor skills (Ireton & Glascoe, 1995). Both assessments were administered to all children at approximately the same age (3.5 years), rather than at the same calendar date, as a consequence of four *Elfe* interview periods (October 2014 and January, March, and June 2015) determined by the child's birth month. There were no attempts by the *Elfe* study team to systematically assign interviewers (who conducted the child assessments) to children based on birth month, age at the 3.5-year assessment, or other child or family characteristics, with the exception of region for the face-to-face interview, for which we control using either region or hospital-of-birth fixed effects (described below).

6.2. Duration of attendance

Our primary predictor of interest is duration of *école maternelle* attendance. Mothers (primary caregivers) reported at the age-3.5 interview whether the focal child was attending *école maternelle* and, if so, the age—in 6-month increments—at which they began.² From this information, we calculate exposure, considering that children enter either in September (the vast majority) or, more rarely, in January. As such, we are able to leverage variability in age of entry and, thus, duration of exposure at the time of outcome measurement, which is based on child age. As shown in Fig. 1, there is considerable variation in exposure by birth month. Most notably, whereas the majority of children born in November/December experienced 6–9 months of preschool by their age-3.5 assessment, the majority of children born in April had experienced only 1–4 months. The majority of children born in June/July and September/October had experienced 2–5 and 5–8 months, respectively.

6.3. Instruments

We use exogenous variation in birth month to predict duration of *école maternelle* attendance and, thereby, estimate plausibly causal effects of duration of attendance on child development. Our instruments consist of indicators that the child was born in June/July, September/October, or November/December, with April serving as the reference period. These four groups are used to predict the number of months spent in school by about 3.5 years of age.

6.4. Intensity of attendance

Despite that we cannot estimate plausibly causal effects of *école maternelle* intensity, given our inability to identify a source of exogenous variation thereof, we descriptively examine its potential mediating role vis-à-vis the relation of duration of *école maternelle* attendance with child development. We focus on whether the child attends on a full-time basis (4.5 days per week); whether the child eats at the canteen at least once a week; whether the child attends after-school sessions at least once a week; and whether the child attends extended Wednesday afternoon sessions. Particularly in the first year of attendance, parents can choose to send their children for only the morning teaching sessions and forgo afternoon teaching sessions (more than 70% of children attend both), with agreement by the teacher. The intensity of participation thus differs

² The *Elfe* survey did not ask parents the exact age at which children began *école maternelle*. Although we have no reason to suspect this to result in systematic variation in measurement error by birth month in reported *école maternelle* exposure, we recognize that it is a relevant, albeit unavoidable, limitation of our data.

on these dimensions (see Table A1). Of those that attended preschool, most did so quite intensively, attending an average of 7.7 teaching sessions (of 9 available sessions) per week. Wraparound services are also extensively used, with 69% of children using the canteen and 37% attending after-school activities at least once a week. Wednesday afternoon care is less common, with 17% of our sample participating.

6.5. Covariates

Our regressions control for a range of covariates, which are entered sequentially into nested models. Child and family characteristics include child sex, whether the child was born prematurely (before 37 weeks gestation), whether the child was part of a multiparous birth, the mother's report of the child's overall physical health at age 3.5 (indicators for good, rather good, rather poor, or poor health), family structure at age 3.5 (two biological or adoptive parents, single mother, parent and stepparent, shared custody), whether at least one of the coresident parents is not French-born, number of siblings (0, 1, 2, 3 or more), household employment (at least one household member not working), highest parental education (low, medium, high), and equivalized household income quintile. Previous childcare experiences include primary childcare used at age 1 (parents, grandparents, child-minder/nanny, center-based care, other arrangement, or missing) and type of *école maternelle* (standard public, public with disadvantaged school initiatives, private)³. Finally, we include in some models the four indicators of intensity of school attendance as well as either region of residence or birth hospital fixed effects. The region fixed effect indicates which of the 10 French regions the family lives in. The birth hospital fixed effect adjusts for unobserved factors that are consistent for children born in the same hospital, who are likely exposed to similar local environments.

7. Empirical strategy

We first estimate ordinary least squares (OLS) regressions taking the form:

$$DEV_i = \beta_0 + \beta_1' emdur_i + \beta_2' CHFAM_i + \beta_3' CC_i + \beta_4' ECINT_i + \varepsilon_i \quad (1)$$

where DEV_{im} is an age-3.5 developmental outcome for child i ; $emdur$ is months of *école maternelle* attendance at the assessment; $CHFAM$, CC , and $ECINT$ are vectors of child and family characteristics, early childcare experiences, and *école maternelle* intensity; and, ε is the error term. The child and family characteristics, early childcare experiences, and *école maternelle* intensity measures are added into the model sequentially. In additional models, we include either a region of residence or birth hospital fixed effect. The OLS estimates provide descriptive evidence of associations between *école maternelle* duration and child development, net of the covariates. However, they may be biased by unobserved factors associated with both.

To identify plausibly causal impacts of *école maternelle* on child development, we employ an IV approach. IV is a statistical method used to estimate plausibly causal relations when standard regression estimates will be biased because the key explanatory variable (here duration of *école maternelle*) is potentially endogenous. The method leverages only exogenous variation in duration of *école maternelle* participation resulting from a relevant “instrument” (exogenous determinant of duration of participation), here the child's birth month—which determines when the child turns age 3 and is thus eligible for *école maternelle*—to estimate the unbiased local average treatment effect (LATE) of duration of attendance on child development. Specifically, we use a two-stage least squares (2SLS) regression approach to first estimate

³ Information about school type was merged to *Elfe* survey data from external administrative data.

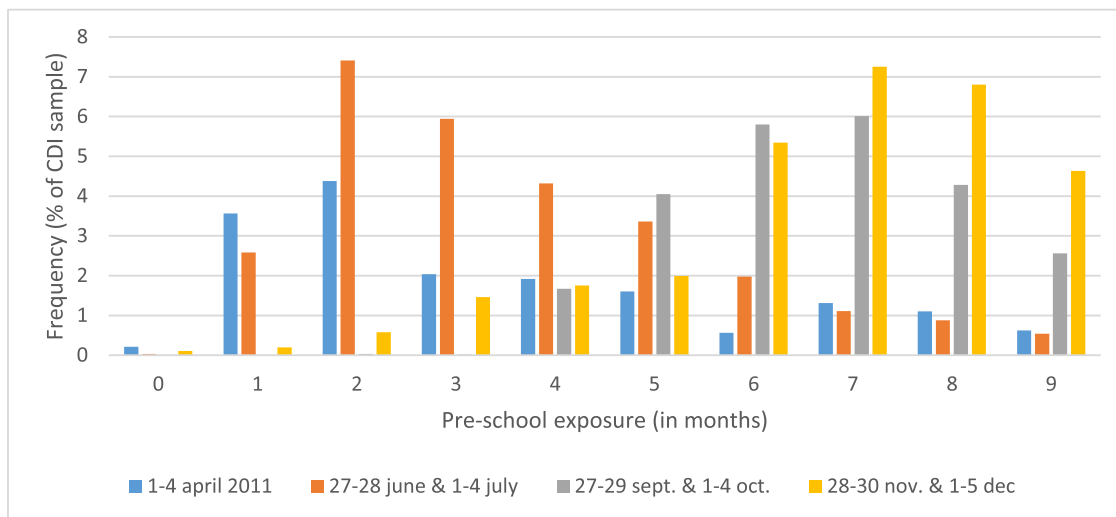


Fig. 1. Duration of *école maternelle* attendance (in months) at the 3.5-year survey, by period of birth.

duration of *école maternelle* attendance as a function of birth month (i.e., leveraging only exogenous variation in duration, as determined by entry age), net of the covariates, then forward the predicted duration of attendance to a second stage regression to predict the unbiased LATE of duration of attendance on child development. The first-stage equation takes the form:

$$'emdur_i = \beta_0 + \beta_1 \mathbf{BRTHM}_i + \beta_2 \mathbf{CHFAM}_{im} + \beta_3 \mathbf{CC}_i + \beta_4 \mathbf{ECINT}_i + \varepsilon_i \quad (2)$$

where \mathbf{BRTHM} is a vector of birth month indicators (June/July, September/October, November/December, with April serving as the reference month).

The second stage equation takes the form:

$$DEV_i = \beta_0 + \beta_{1i} + \beta_2 \mathbf{CHFAM}_i + \beta_3 \mathbf{CC}_i + \beta_4 \mathbf{ECINT}_i + \varepsilon_i \quad (3)$$

where $'emdur$ is predicted months of attendance. We estimate White-Huber heteroscedasticity robust standard errors for all models. Again, we enter each block of covariates into the model sequentially, with our final models including either a region or birth hospital fixed effect.

The IV strategy requires that two assumptions be met. First, the instruments must be highly predictive of duration of *école maternelle* attendance. Second, they must be uncorrelated with the error term in the second stage equation, such that they only affect child development through their effect on duration of attendance (thereby satisfying the exclusion restriction). The first is easily tested and, as shown in the results section, holds true in all our models. The second may be violated if parents time their child's birth to maximize or minimize duration of *école maternelle* participation, or for reasons that are correlated with both duration of attendance and child development. Although we are unable to fully rule this out, we argue that it is unlikely to occur. First, at the time of *Elfe* cohort births, in 2011, there was little seasonal variation in birth timing and the limited fluctuations suggests a summer (July-August) peak and winter (January-March) low point.⁴ Moreover, there are few differences in birth timing by SES and those differences do not suggest systematic variation. In addition, only 14% of mothers report attempting to time their births and, among those, the most common reasons are attempting to align the birth with the summer holidays, to increase time for the father to provide childcare, and for reasons related to the health of the mother or baby (Régnier-Loilier, 2010). As such, there is little reason to suspect systematic selection into birth timing to

⁴ Tabulated by the authors using data from the National Institute of Statistics and Economic Studies (Insee).

increase duration of *école maternelle* attendance, nor for reasons that are likely correlated with duration of *école maternelle* attendance and child development. Nonetheless, to further examine this possibility, we present descriptive data on child language skills at age 2.5, prior to *école maternelle* attendance, and results from falsification tests in which we estimate our OLS and IV models using age-2.5 measures of child language skills. Unfortunately, the *Elfe* data do not include a global development measure prior to age 3.5.

It is important to note that, whereas our focus is on duration of attendance, duration of attendance is highly (but not perfectly) correlated with age at entry into *école maternelle*. Children who spend more time in preschool likely enter younger than those who spend less time. Our estimates thus reflect combined effects of age at entry into and length of exposure to *école maternelle*; it is not possible for us to disentangle these two highly correlated factors. To minimize the influence of this combination of effects, we limited school exposure to 1 to 10 months to exclude children who entered at the very earliest age, the year before they turned 2.

Disentangling age at pre-school entry, age at test, and school exposure effects is a common challenge in this body of research (Szabó-Morvai, Horn, Lovász, & De Witte 2023). Most studies rely on standardized tests, which are typically administered based on the school calendar rather than at a specific age. A key limitation of this approach is that children are not at the same age at testing, and age at testing may explain a large proportion of the variance in test scores by age at entry or duration of attendance, particularly among the youngest children. For example, Bedart and Dhuey (2006) found that the youngest 4th grade students score was, on average, 4-12 percentiles lower on standardized tests than the oldest 4th grade students. Moreover, the relative age gap among children in the same classroom has been found to be particularly large during earlier childhood (Marcenaro-Gutierrez & Lopez-Agudo, 2021). Although developmental assessments were conducted for children at approximately the same age in *Elfe*, our study does not avoid confounding effects of school exposure and age at entry. However, it allows us to estimate the effects of *école maternelle* on child development conditional on exposure (or age at entry) being quasi-randomly determined.

We estimate our models for the full sample and for key subgroups defined by family SES, child and family characteristics, and ECEC experiences. Examining heterogeneity by these characteristics provides key information about which groups may benefit most from *école maternelle* and in what contexts and circumstances, with implications for program targeting. Moreover, analyses by prior ECEC experiences may inform whether particular types of early care may complement (by

providing developmental scaffolding for children to most efficiently benefit from) *école maternelle* by jointly promoting child development, as well as whether specific types of *école maternelle* are more or less effective in doing so.

8. Results

8.1. Descriptive statistics

Fig. 2 presents age-standardized cognitive skills (BAS) and global development (CDI) scores at the time of the age-3.5 interview, by the education level of the child's most highly educated parent.⁵ Socioeconomic disparities in average scores are evident. For example, children of the most educated parents have, on average, more than quarter of a standard deviation (*SD*) higher scores than those of the least educated parents (Fig. 2). Cognitive skills and global development gaps between children from the lowest and highest income quintiles are similarly large (see Figure A1).

Fig. 3 shows the distribution of age-standardized cognitive skills and global development scores at 3.5 years of age—after children had entered *école maternelle*—by birth month. Although interviewed at around the same age (3.5 years), children born in April and June/July had considerably lower cognitive skills and global development scores than those born in September/October and November/December. One possible explanation is that spring/summer-born children would have spent a lesser duration in preschool prior to assessment, since they entered *école maternelle* at a later age than those born in fall/winter.

The distributions of scores at age 2.5—before most children had entered *école maternelle*—on two child development measures, the MacArthur-Bates Inventory, which measures vocabulary size, and a global measure of mastery of eight motor skills, are presented in Figure A2. This analysis approximates a placebo test for school attendance since the assessments were conducted before school entrance. However, given that different developmental measures, which tap slightly different domains of child development, were administered at the age-2 and age-3.5 interviews, the scores are not fully comparable. Nonetheless, the pattern of difference in scores before and after *école maternelle* entry provides insight into whether developmental differences may reflect exposure to *école maternelle*, due to variation at age of entry, rather than preexisting differences in development that may be correlated with age at entry.

In contrast to the birth month pattern exhibited in the age 3.5 assessments (Fig. 3), we find no average differences in vocabulary size by birth month in the age 2.5 assessments (Figure A2), with the possible exception that children born in April may have slightly better vocabularies than those born in July. One reason may be that the former are more likely to have attended high-quality universal childcare, known as *crèche*, by age 1 (Berger, Panico & Solaz, 2021). Notably, that we do not find this pattern in cognitive skills or global development after preschool entry (assessed at approximately age 3.5), suggests this pattern does not contradict our assumption of a positive effect of longer preschool attendance on child development. Rather, if anything, our estimates of differences by birth month in developmental skills at age 3.5 may be downwardly biased.

Finally, Fig. 4 presents average age-standardized cognitive skills and global development scores assessed at the age-3.5 interview by months of *école maternelle* attendance. For both outcomes, we see a clear gradient with more months of exposure associated with higher scores. Overall, then, the raw data suggest that longer duration of school attendance is associated with better child development. Moreover, the

gap is particularly marked during the first 5 months for cognitive scores, with a magnitude greater than a quarter of a standard deviation, corresponding to the order of magnitude of the development gap observed at this age between children whose parents are least educated and those whose parents are most educated.

8.2. Regression results

Table 1 presents OLS estimates of the association of length of *école maternelle* exposure with cognitive skills and global development as each set of covariates is sequentially added to the model. Longer *école maternelle* exposure is associated with greater cognitive skills and global development in all models, suggesting that each additional month of attendance is associated with approximately .04 *SDs* greater scores on each measure. As such, an additional 6 months of *école maternelle* exposure is associated with about .24 *SDs* greater cognitive skills and global development, a substantively meaningful magnitude of difference that is comparable in size to the SES gaps in these measures observed at these ages. Notably, adjusting for the covariates, including intensity of *école maternelle* participation and region or birth hospital fixed effects, has little effect on the magnitude of the estimated association of *école maternelle* exposure with child development. Moreover, we find no evidence that intensity of attendance is associated with cognitive skills, but some evidence (for full-time attendance and eating lunch at the *école maternelle* canteen) that it is associated with better global development.

Our full-sample IV results are presented in Table 2. The first stage results indicate that our instrument (birth month) is a strong and highly significant predictor of duration of *école maternelle* attendance, with an F-statistic of more than 1,600 in all models. The first stage results, shown in Table A3, indicate that, relative to children born in April, those born in June/July, September/October, and November/December experience, on average, .03-, 3.0-, and 3.1-months greater duration of *école maternelle* attendance.⁶ The second stage results indicate that an additional month of *école maternelle* attendance is associated with .07-.08 *SDs* greater cognitive skills and .05 *SDs* greater global development. Notably, the magnitude of relation between duration of *école maternelle* attendance and child development is substantially larger in the IV regressions than in the OLS regressions for cognitive skills, and slightly larger for global development. This suggests that the more naïve OLS estimates are likely downwardly biased. On the whole, the magnitude of the IV estimates is substantively meaningful, suggesting that an additional 6 months of *école maternelle* attendance is associated with a .42-.48 *SD* improvement in cognitive skills and about a .30 *SD* improvement in global development. Like the OLS estimates, the IV estimates are quite stable regardless of which covariates are included. Also consistent with the OLS results, we find no evidence that intensity of attendance is associated with cognitive skills, but some evidence that full-time attendance and eating at the canteen are associated with better global development.

8.3. Falsification test

To further examine whether our instrument—birth month—likely satisfies the IV exclusion restriction assumption, such that it does not influence child development at age 3.5 through a mechanism other than *école maternelle* exposure, we conducted a falsification test in which children's age 2.5 language skills (vocabulary size) score were regressed on *école maternelle* exposure using both the OLS and IV specifications. The results, shown in Table A4, indicate that, in the OLS specification, *école maternelle* exposure at age 3.5 is significantly associated with

⁵ Descriptive statistics for all variables used in our analyses are presented in Table A1. On average, BAS and CDI scores follow expected patterns. For example, scores are higher for girls and lower for children who were born prematurely and low birth weight (<2500 grams), as well as for twins.

⁶ Descriptive statistics indicate that children born in April or June/July and those born in September/October, or November/December experienced, on average, 3.8 months and 6.8 months of *école maternelle*, respectively, by the age 3.5 assessment (see Table A2).

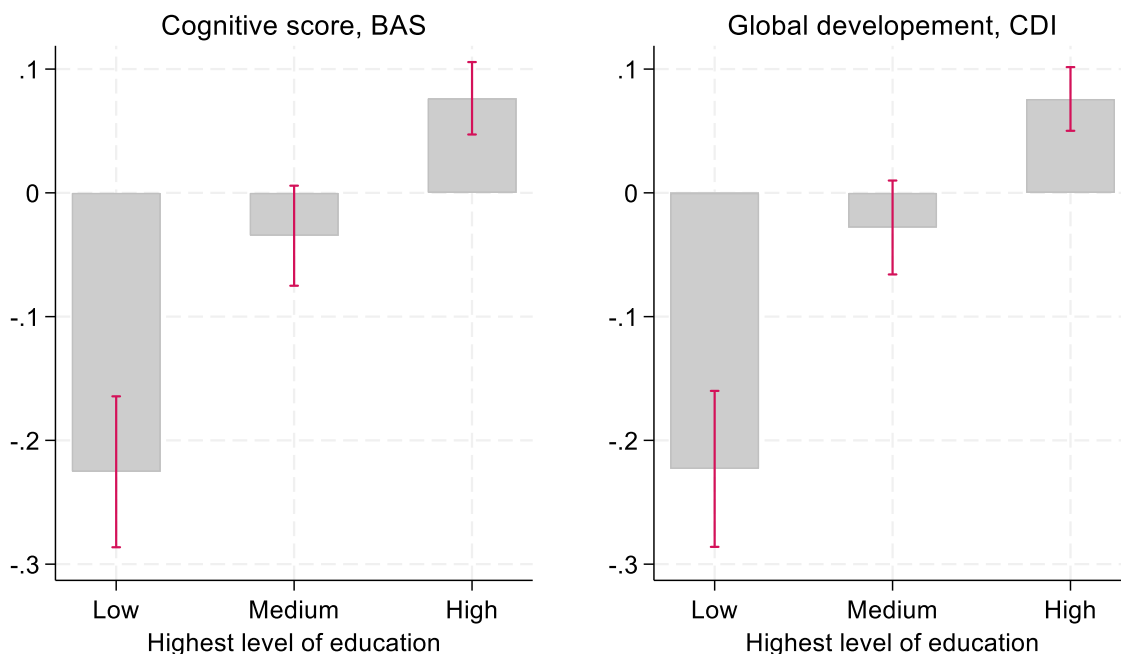


Fig. 2. Mean age-standardized British Ability Scale (BAS) and Child Development Inventory (CDI) scores assessed at the 3.5-year survey, by educational attainment of most educated parent. Note: 95% confidence intervals.

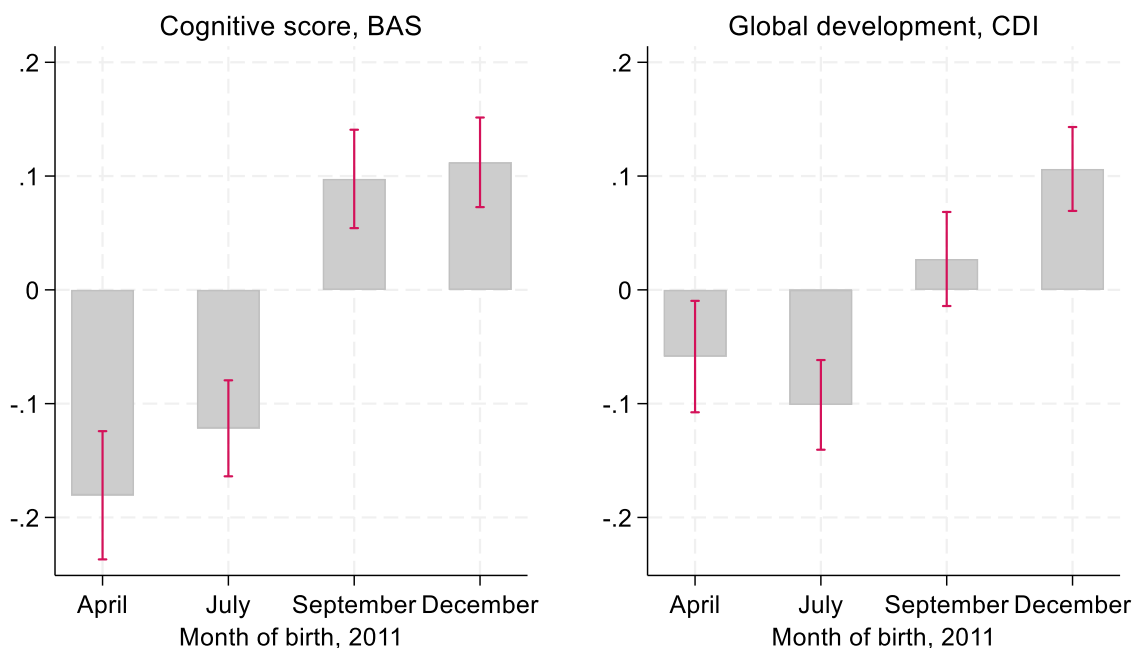


Fig. 3. Mean age-standardized British Ability Scale (BAS) and Child Development Inventory (CDI) scores assessed at the 3.5-year survey, by month of birth. Note: 95% confidence intervals. July=June/July birth; September=September/October birth; December=November/December birth.

greater preexisting language skills (at age 2.5). This may suggest that there is positive selection into earlier *école maternelle* attendance by children’s cognitive skills. However, the IV results indicate that *école maternelle* exposure, identified by birth month, is unrelated to children’s preexisting language skills, thus increasing our confidence that our instrument satisfies the exclusion restriction.

8.4. Robustness tests

Although children in the *Elfe* study were intended to be assessed at

age 3.5, there was modest variation in actual age of assessment due to the timing at which the *Elfe* study team was able to arrange the interview. In our primary analyses, we age-standardize cognitive skills and global development in one-month increments to account for such differences. However, it is possible that differences in timing of assessment may influence our primary results. As such, we conducted supplemental sensitivity analyses using non-age-standardized developmental scores but restricting the age range of sample children. Specifically, given that roughly 90% of sample children were assessed between 40 and 45 months of age, that roughly 55% were assessed between ages 41 and 43

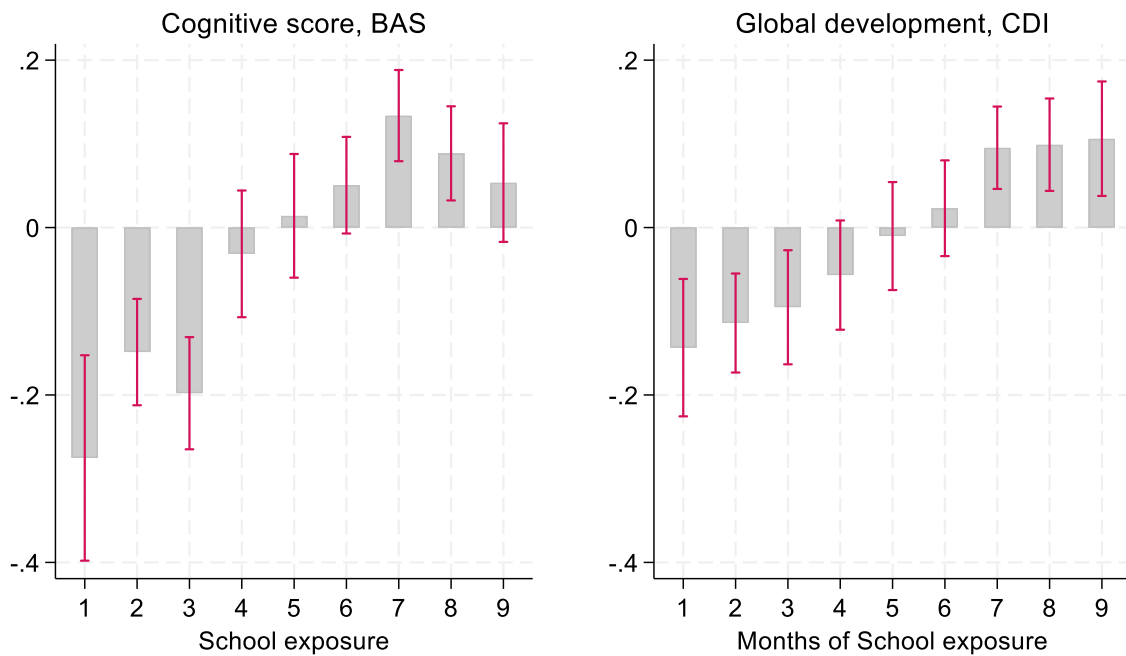


Fig. 4. Mean age-standardized British Ability Scale (BAS) and Child Development Inventory (CDI) scores assessed at the 3.5-year survey, by months of *école maternelle* attendance.

Note: 95% confidence intervals. Due to small sample size, values for 0 months (less than 1 month) of preschool exposure are not presented.

months, and that roughly 20% were assessed at 42 months, we re-estimated our models for children only within these age bounds. Results were consistent with those of our primary models: we consistently find a positive effect of duration of *école maternelle* attendance on both cognitive skills and global development, with the IV estimates being larger in magnitude than the OLS estimates for cognitive skills, though not global development (see Table A5).

8.5. Heterogeneity by socioeconomic background

Universal preschool has been promoted as a core means of reducing intergenerational transmission of inequality given its potential to reduce socioeconomic gaps in school readiness. For this to be the case, children from disadvantaged families must benefit more from universal preschool attendance than children from more advantaged families. To examine whether there are differential returns to duration of *école maternelle* attendance by family social and economic advantage, we estimated our regressions, separately, for subgroups defined by highest parental education level, household income quintile, and parent immigrant status. OLS and IV results from these models are shown in Table 3. Here, we find that children of less-educated and lower-income parents benefit significantly more from greater duration of *école maternelle* attendance than their more advantage counterparts. For example, the IV results indicate that each additional month of *école maternelle* attendance is associated with .11 SDs greater cognitive skills and global development for children of the least educated parents, compared to gains of .07 SDs and .04 SDs for children of the most educated parents. Turning to family income, whereas these gains are .13 SDs and .09 SDs for children whose households are in the bottom income quintile, they are .08 SDs and .04 for children in top income quintile households. We do not, however, find significant differences by parental immigration status, with children of immigrants experiencing gains of .09 SDs and .06 SDs compared to gains of .08 SDs and .05 SDs for children of native French parents. Figs. 5 and 6 depict the predicted developmental gains (in SDs) per month of preschool attendance from the IV models for parental education and income, respectively, illuminating that longer duration of attendance closes the developmental gap between children of low and high educated (income) parents.

8.6. Heterogeneity by family and child characteristics

The effects of universal preschool may differ by family and child characteristics such as family structure, sibship size, and child sex. We find only one statistically significant difference in these estimates, such that our IV results suggest that children with large sibships (2 or more siblings) may benefit slightly more in terms of cognitive skills than children with only one sibling. Notably, however, while not attaining statistical significance, the IV results also suggest a pattern such that children in single-parent families may benefit more from a longer duration of preschool in terms of global development than those in two-parent families. Nonetheless, the totality of these results provides little indication of substantial differences by family structure, sibship size, or child sex (see Table A6).

8.7. Heterogeneity by ECEC experiences

Finally, we examined whether there may be heterogeneity in effects by type of childcare experienced at age 1 and type of *école maternelle* attended (see Table A7). We find no statistically significant differences by type of childcare (parental care, home-based care, center-based care) at age 1, though the effect size for duration of preschool attendance with respect to global development is quite a bit larger for children who received parental care at age 1 than for those who received home- or center-based care. We also compared estimates for children attending public *écoles maternelles* eligible for additional funding and resources under the disadvantaged (priority) neighborhood initiative, public *écoles maternelles* that were not eligible for such support, and private *écoles maternelles*. We find that children who attended public *écoles maternelles* eligible for priority support benefitted more in terms of global development (though not cognitive skills) than those attending standard public or private *écoles maternelles*.

Table 1
Full-sample OLS results for cognitive (BAS) and global development (CDI) scores.

Model:	(1)	(2)	(3)	(4)	(5)	(6)
Covariates included:	None	+ child and family	+ childcare	+ program intensity	+ region FE	Model (4) + birth hospital FE
Cognitive skills (BAS)						
Months of attendance	0.044*** (0.005)	0.043*** (0.005)	0.043*** (0.005)	0.042*** (0.005)	0.041*** (0.005)	0.037*** (0.005)
Attends full time				0.056 (0.031)	0.024 (0.031)	0.019 (0.031)
Eats at canteen				−0.039 (0.032)	0.005 (0.033)	−0.001 (0.033)
Attends after school program				0.010 (0.027)	0.010 (0.027)	0.021 (0.026)
Attends Wednesday afternoons				0.009 (0.032)	0.003 (0.032)	0.005 (0.032)
R-squared	0.011	0.031	0.032	0.033	0.048	0.149
Global development (CDI)						
Months of attendance	0.036*** (0.004)	0.037*** (0.004)	0.037*** (0.004)	0.037*** (0.004)	0.037*** (0.004)	0.036*** (0.004)
Attends full time				0.115*** (0.029)	0.126*** (0.029)	0.107*** (0.030)
Eats at canteen				0.052 (0.029)	0.067*** (0.030)	0.064* (0.031)
Attends after school program				−0.010 (0.024)	−0.013 (0.024)	−0.011 (0.025)
Attends Wednesday afternoons				−0.040 (0.029)	−0.038 (0.029)	−0.031 (0.030)
R-squared	0.008	0.065	0.070	0.074	0.076	0.113
Model includes:						
Child and family characteristics	No	Yes	Yes	Yes	Yes	Yes
Early childcare experiences	No	No	Yes	Yes	Yes	Yes
Program intensity	No	No	No	Yes	Yes	Yes
Region fixed effect	No	No	No	No	Yes	No
Birth hospital fixed effect	No	No	No	No	No	Yes

Note. 7,778 observations for BAS regression and 9,079 for CDI regressions. Coefficients (and White-Huber heteroscedasticity robust standard errors) presented. Child and family characteristics include child sex, whether the child was born prematurely, whether the child was a twin, the mother's report of the child's overall physical health at age two, family structure at age 3.5, whether at least one of the co-resident parents is not French-born, number of siblings, parental employment status, highest level of parental educational attainment, and equivalized household income quintile. Early childcare experiences include the primary type of childcare used at age one and the type of *école maternelle* attended. Program intensity is measured by full-time *école maternelle* attendance, child eats at canteen, child attends after school programming, and child attend *école maternelle* on Wednesday afternoons.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

9. Discussion

9.1. Universal preschool helps reduce socioeconomic inequalities in child development

Our results provide plausibly causal evidence that high-quality universal preschool programs such as the French *école maternelle* program have the potential to both foster children's early cognitive skills and global development, and also reduce early socioeconomic inequalities in child development. Specifically, our analyses indicate that greater duration of exposure to universal preschool prior to age 3.5 bolsters child development, particularly for children in lower-income families and those with less-educated parents.

9.2. Intensity of preschool attendance does not appear to be a driving factor

We find no compelling (descriptive) evidence that greater intensity (hours per day) of attendance is a key factor linking preschool participation with child development. This is consistent with recent work on the US Head Start program, which finds that an extra year of attendance resulted in developmental gains, while daily intensity did not have an effect (Melo et al., 2024). We cannot rule out, however, that the absence of an intensity effect is context- and/or age-specific. Indeed, in many *écoles maternelles* (and especially in the first year thereof), morning

sessions are more highly focused on education than afternoon sessions, which also include a nap. As such, for the large majority of children attending full-day (72%), meals and napping can fill up much of afternoon. Furthermore, though we tested diverse dimensions of children's daily schedules (hours in care, lunch participation, afterschool activity participation), we were not able to correct for selective participation in them by parents as we could not identify an instrument of sufficient quality. Our findings on intensity therefore suggest that some of the negative correlations found by earlier US studies between intensity and child behavior (Belsky et al., 2006), might be context dependent, limited to lower quality programs, and/or limited to programs without a strong focus on education.

9.3. Duration of attendance and age at entry are confounded

It is important to note that duration of preschool attendance and age at preschool entry are highly correlated and that we are unable to differentiate the effects of each. That is, children who enter preschool earlier will have also been in school longer at the time of age-conditioned assessment, which occurred at approximately age 3.5 in the *Elfe* study. Furthermore, as in all quasi-random designs, we cannot be sure to have ruled out all potential cross-contamination between the treated and control groups (Cook et al. 2010), and between children from different backgrounds. With this caveat in mind, our findings regarding age of entry—and, thus, duration of preschool

Table 2
Full-sample IV results for cognitive (BAS) and global development (CDI) scores.

Model:	(1)	(2)	(3)	(4)	(5)	(6)
Covariates included:	None	+ child and family	+ childcare	+ program intensity	+ region FE	Model (4) + birth hospital FE
Cognitive skills (BAS)						
Months of attendance	0.082*** (0.008)	0.079*** (0.008)	0.079*** (0.008)	0.079*** (0.008)	0.078*** (0.007)	0.073*** (0.007)
Attends full time				0.045 (0.031)	0.015 (0.031)	0.011 (0.030)
Eats at canteen				−0.039 (0.032)	0.004 (0.033)	−0.001 (0.032)
Attends after school program				0.011 (0.027)	0.012 (0.027)	0.022 (0.026)
Attends Wednesday afternoons				0.007 (0.033)	0.000 (0.033)	0.001 (0.032)
First-stage F-statistic	1,741	1,751	1,752	1,748	1,746	1,652
Global development (CDI)						
Months of attendance	0.051*** (0.007)	0.049*** (0.007)	0.049*** (0.007)	0.050*** (0.007)	0.050*** (0.007)	0.051*** (0.007)
Attends full time				0.112*** (0.028)	0.124*** (0.029)	0.104*** (0.029)
Eats at canteen				0.054 (0.029)	0.068*** (0.030)	0.064* (0.031)
Attends after school program				−0.010 (0.024)	−0.013 (0.024)	−0.011 (0.024)
Attends Wednesday afternoons				−0.041 (0.029)	−0.039 (0.029)	−0.033 (0.029)
First-stage F-statistic	2,024	2,091	2,095	2,100	2,100	1,956
Model includes:						
Child and family characteristics	No	Yes	Yes	Yes	Yes	Yes
Early childcare experience	No	No	Yes	Yes	Yes	Yes
Program intensity	No	No	No	Yes	Yes	Yes
Region fixed effect	No	No	No	No	Yes	No
Birth hospital fixed effect	No	No	No	No	No	Yes

Note. 7,778 observations for BAS regression and 9,079 for CDI regressions. Coefficients (and White-Huber heteroscedasticity robust standard errors) presented. Child and family characteristics include child sex, whether the child was born prematurely, whether the child was a twin, the mother’s report of the child’s overall physical health at age two, family structure at age 3.5, whether at least one of the co-resident parents is not French-born, number of siblings, parental employment status, highest level of parental educational attainment, and equivalized household income quintile. Early childcare experiences include the primary type of childcare used at age one and type of *école maternelle* attended. Program intensity is measured by full-time *école maternelle* attendance, child eats at canteen, child attends after school programming, and child attends *école maternelle* on Wednesday afternoons.

* $p < .05$.
 ** $p < .01$.
 *** $p < .001$.

attendance—on child development stand in contrast to those of much of the literature in this area, which suggest that entering school at a later age is beneficial to children (Dhuey, Figlio, Karbownik & Roth 2019; Fletcher & Kim, 2016; Kuehnle & Oberfichtner, 2020). This may reflect several key differences between our study and many of those prior. First, we focus on age at preschool entry, whereas much of the prior literature has focused on entry into primary school. It is possible that early entry to preschool and early entry to primary school have different effects on child development. Second, we focus on high-quality education-focused ECE, whereas many prior studies of young children have focused on childcare rather than education-focused programs; this has been particularly true of studies finding adverse developmental effects of earlier entry. Differences in findings may reflect that high-quality education-focused preschool programs have distinct benefits for early childhood development that may not be mirrored by lower-quality or childcare-focused programs. Third, in addition to being characterized by homogeneously high-quality programming delivered by highly qualified teachers using a national curriculum, *école maternelle* is universally available and, while not mandatory during our observation period, attended by the vast majority of French children. This may suggest that our estimates are less biased by selection into ECEC, in general, and into particular types thereof, than those of prior studies focused on targeted programs.

9.4. Study contributions

The primary contribution of our study is to quantify the effects of universal preschool on child development. Our results indicate that 6 additional months of *école maternelle* is comparable in magnitude to gaps in child development observed between children of the least and most educated parents. A second contribution is our careful consideration of potential heterogenous effects across population subgroups and settings. Consistent with previous work, we find that children from disadvantaged families reap particularly large benefits from a longer duration in preschool. In other words, longer duration of *école maternelle* attendance reduces the developmental gap between disadvantaged and advantaged children.

9.5. Limitations

Our results should be interpreted in light of a number of limitations. First, our findings are specific to the French setting and may not apply to settings with different preschool systems. Key elements of the French system include the relatively homogeneous, high-quality, and centrally funded and monitored nature of the schooling provided. Second, we recognize that our measures do not capture all salient elements of early development, such as socioemotional development, which ECEC participation might also affect. While our global development measure includes some proxies for socioemotional development, such as

Table 3
OLS and IV results, stratified by parent education, household income, and immigrant status.

	Cognitive Skills (BAS)		Global Development (CDI)	
	OLS	IV	OLS	IV
Parent education				
Low				
Months of attendance	0.051*** (0.013)	0.111*** (0.022)	0.053*** (0.013)	0.109*** (0.023)
Observations (First-stage F-statistic)	1,113	1,113 (191)	1,349	1,349 (239)
Medium				
Months of attendance	0.034*** (0.009)	0.086*** (0.015)	0.047*** (0.008)	0.045*** ^a (0.013)
Observations (First-stage F-statistic)	2,266	2,266 (401)	2,697	2,697 (531)
High				
Months of attendance	0.041*** (0.006)	0.067*** ^{a,b} (0.009)	0.027*** ^a (0.005)	0.037*** ^a (0.008)
Observations (First-stage F-statistic)	4,341	4,341 (1,189)	4,975	4,975 (1,358)
Household income				
Bottom quintile				
Months of attendance	0.041** (0.012)	0.131*** (0.024)	0.041*** (0.012)	0.088*** (0.021)
Observations (First-stage F-statistic)	1,196	1,196 (166)		1,499 (227)
Second quintile				
Months of attendance	0.051*** (0.010)	0.081*** ^c (0.017)	0.024* (0.010)	0.046** (0.016)
Observations (First-stage F-statistic)	1,544	1,544 (322)	1,875	1,875 (376)
Third quintile				
Months of attendance	0.026* (0.010)	0.081*** ^{c,d} (0.016)	0.044*** (0.009)	0.030* ^c (0.015)
Observations (First-stage F-statistic)	1,604	1,604 (342)	1,861	1,861 (379)
Fourth quintile				
Months of attendance	0.043*** (0.010)	0.047** ^c (0.015)	0.042*** (0.009)	0.053*** (0.013)
Observations (First-stage F-statistic)	1,647	1,647 (431)	1,907	1,907 (561)
Top quintile				
Months of attendance	0.052*** ^{d,e} (0.011)	0.081*** ^c (0.015)	0.031*** (0.008)	0.043*** ^c (0.012)
Observations (First-stage F-statistic)	1,635	1,635 (469)	1,835	1,835 (576)
Parent immigrant status				
At least one parent foreign born				
Months of attendance	0.038** (0.013)	0.090*** (0.021)	0.018 (0.012)	0.057** (0.020)
Observations (First-stage F-statistic)	1,076	1,076 (215)	1,287	1,287 (256)
Both parents native				
Months of attendance	0.041*** (0.005)	0.076*** (0.008)	0.040*** ^f (0.004)	0.049*** (0.007)
Observations (First-stage F-statistic)	6,693	6,693 (1,517)	7,782	7,782 (1,841)

Note. Coefficients (and White-Huber heteroscedasticity robust standard errors) presented. The models include child and family characteristics (child sex, whether the child was born prematurely, whether the child was a twin, the mother’s report of the child’s overall physical health at age two, family structure at age 3.5, whether at least one of the co-resident parents is not French-born, number of siblings, parental employment status, highest level of parental educational attainment, and equalized household income quintile), early childcare experiences (primary type of childcare used at age one and type of *école maternelle* attended), program intensity (full-time *école maternelle* attendance, whether child eats at canteen, attends after school programming, and attends *école maternelle* on Wednesday afternoons) as well as region fixed effects.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

^a Differs from low education at $p < .10$ ($p < .05$ if bold).

^b Differs from medium education at $p < .10$ ($p < .05$ if bold).

^c Differs from first income quintile at $p < .10$ ($p < .05$ if bold).

^d Differs from second income quintile at $p < .10$ ($p < .05$ if bold).

^e Differs from third income quintile at $p < .10$ ($p < .05$ if bold).

^f Differs from parent foreign born at $p < .10$ ($p < .05$ if bold).

autonomy and socialization, it does not capture other key features such as self-regulation, perseverance, and motivation, which may also be influenced by high quality ECEC programs and have implications for long term outcomes (Heckman, Pinto, Savelyev, 2013). Third, we assess relatively short-term outcomes after the start of preschool. We therefore cannot comment on whether these effects will persist or fade over time. Fourth, as with all longitudinal studies, there has been attrition over time from the *Elfe* sample. Attrition appears to be disproportionate among more disadvantaged and residentially mobile families (Thierry

et al., 2018). This, too, may limit the generalizability of our results. It may also suggest that we underestimate the impact of preschool on child development given that it appears to be concentrated among less disadvantaged children. Finally, as previously mentioned, we could not find an instrument to employ an instrumental variables strategy to assess intensity of *école maternelle* participation, and thus to correct for selective intensity of enrollment by parents. As such, our intensity results should be viewed as purely descriptive.

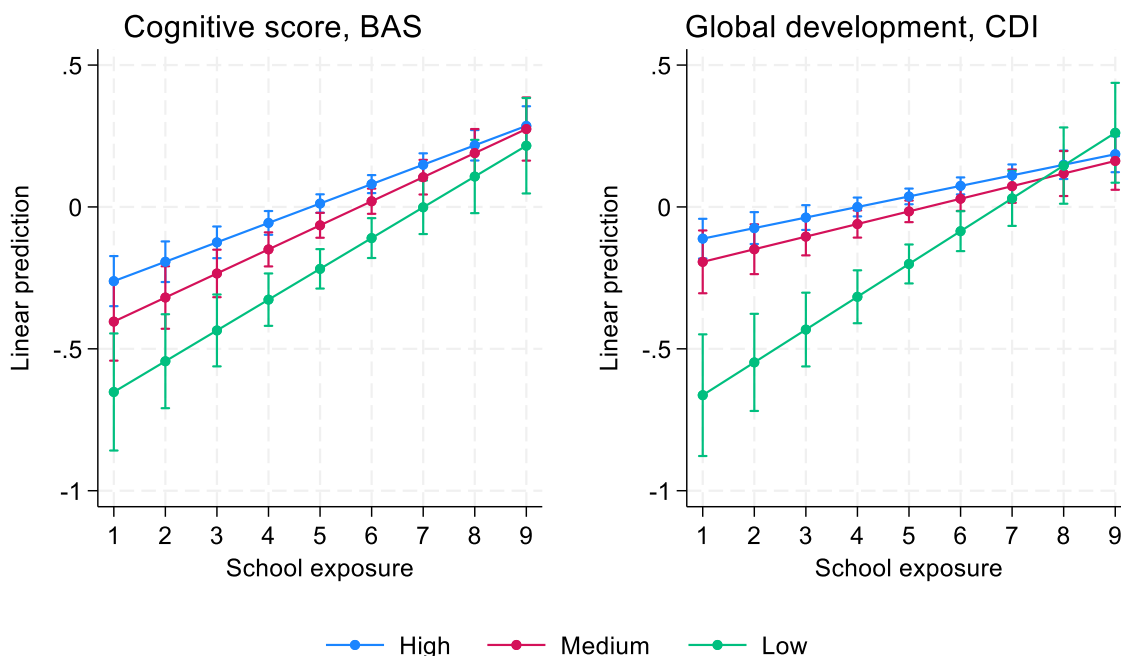


Fig. 5. Predictive margins by parental education and duration of pre-school exposure (in months), British Ability Scale (BAS) and Child Development Inventory (CDI) scores assessed at the 3.5-year survey.
 Note: 95% confidence intervals. Due to small sample size, coefficient for 0 months (less than 1 month) of preschool exposure are not presented.

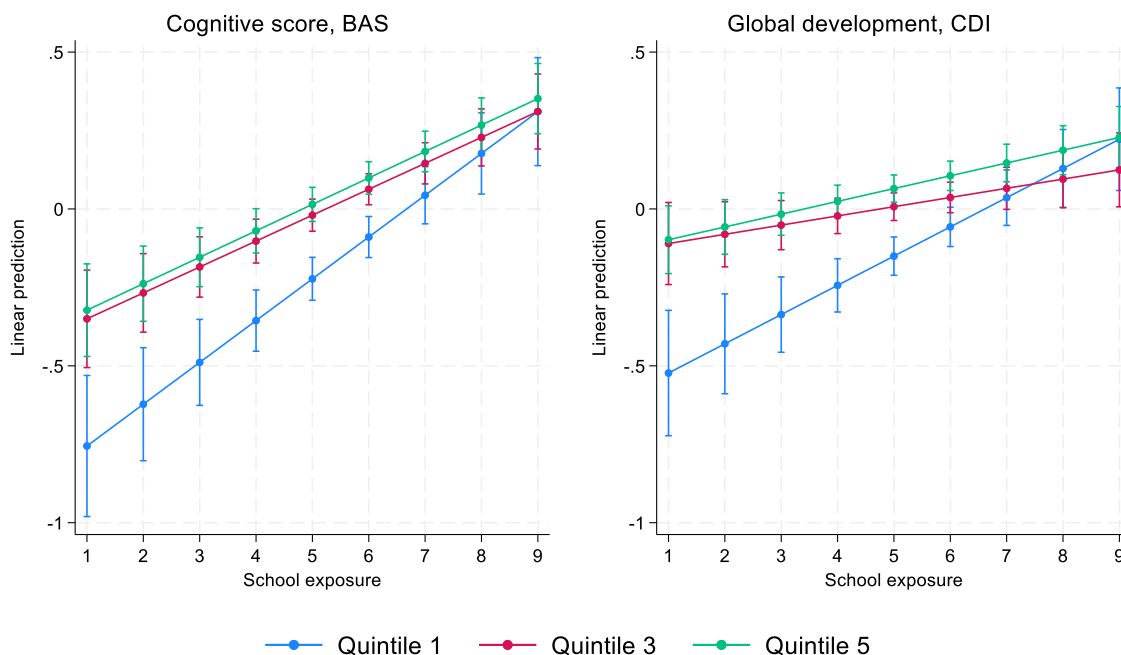


Fig. 6. Predictive margins by quintile of household income and duration of pre-school exposure (in months), British Ability Scale (BAS) and Child Development Inventory (CDI) scores assessed at the 3.5-year survey.
 Note: 95% confidence intervals. Due to small sample size, coefficient for 0 months (less than 1 month) of preschool exposure are not presented. For clarity, only Q1, Q3 and Q5 are depicted.

10. Conclusion

We demonstrate that *école maternelle* participation has a plausibly causal positive effect on child development, particularly for disadvantaged children. Overall, this finding is relatively consistent when examining parental education, family income, and attendance at a public *écoles maternelles* that were eligible for additional funding and

resources under the disadvantaged (priority) neighborhood initiative as proxies for disadvantage. Whereas most prior studies find that high-quality ECEC attendance (and, in some cases, longer duration of high-quality ECEC attendance) is particularly beneficial to disadvantaged children, such that it reduces disparities in school readiness, a subset find that this reflects that children from advantaged backgrounds experience adverse developmental effects of preschool in at least some

domains (Haeck et al., 2018; Havnes & Mogstad, 2015). We do not find this to be the case. Rather, we find positive effects of longer duration of *école maternelle* attendance for both advantaged and disadvantaged children, but that these effects tend to be larger for disadvantaged children. Again, this may reflect that *école maternelle* consists of high-quality education-focused rather than lower-quality or childcare focused ECEC. Nonetheless, it is important to highlight that, while our findings are encouraging vis-à-vis the potential role of *école maternelle* attendance helping to reduce disparities in child development between lower- and higher-SES children, these groups start preschool on an unequal footing, and the SES differences we observe in the effects of preschool on developmental gaps are not large enough to fully eliminate them.

CRedit authorship contribution statement

Lawrence M. Berger: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Lidia Panico:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Anne Solaz:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

None

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.ecresq.2026.03.010](https://doi.org/10.1016/j.ecresq.2026.03.010).

Data availability

The authors do not have permission to share data.

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