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O. FILATRIAU[1]
D. FOUGERE[2]
M. TO[3]

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1 CREST (INSEE), Paris.

2 CREST and CNRS (Paris), CEPR (London) and IZA (Bonn)
(Corresponding author : Denis Fougère, CREST, 15 Boulevard Gabriel Péri, 92245 Malakoff Cedex, France. Email : fougere@ensae.fr

3 CREST and Sciences Po, Paris.

Will Sooner Be Better? The Impact of Early Preschool Enrollment on Cognitive and Noncognitive Achievement of Children*

Olivier Filatriau† Denis Fougère‡ Maxime Tô§

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Abstract: In this paper we measure the effect of entering preelementary school at age 2 rather than 3 in France. Our identification strategy relies on ratios between the number of young children and the capacity of preelementary schools observed at the very local level. This information allows us to solve the endogeneity issue due to the potential correlation between unobserved determinants of early enrollment decision and children achievement. We measure this effect on schooling achievement in primary and lower secondary schools. We show that early enrollment in preelementary school improves cognitive and noncognitive skills at age six, and both literacy and numeracy from the third to the ninth grades.

Keywords: Schooling decision; Preschool; Human capital; Cognitive and noncognitive skills.

JEL Classification Numbers: I21, J13

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†Crest (Insee) (Paris)

‡Cnrs and Crest (Paris), CEPR (London) and IZA (Bonn). **Corresponding author:** Denis Fougère, Crest, 15 Boulevard Gabriel Péri 92245 Malakoff Cedex, FRANCE. Telephone: +33 1 41 17 77 13, e-mail: fougere@ensae.fr

§Crest and Sciences-Po (Paris).

Introduction

From studies based on individual longitudinal data, many economists have concluded that a large part of socioeconomic inequalities is explained by initial accumulation of human capital. These results have increased the interest for early childhood as a potential explanation for future outcomes such as health, education or labor market income. Almond and Currie (2011) survey recent results obtained in the economic literature which show that child environment and policy interventions may have a significant impact on short-term outcomes of children and may even explain large shares of adult socioeconomic inequalities.

In particular, focusing on the process of human capital accumulation, several articles have established that early investment may have an important impact on adult outcomes. As shown by Cunha and Heckman (2008) and Cunha, Heckman, and Schennach (2010), the family environment of children plays a key role on the formation of cognitive and noncognitive skills from the age of six. Interested in younger ages, Bernal and Keane (2011) put in evidence that child care between 0 and 5 has a significant impact on future school test scores. Especially, they find that the quality of child care must be taken into account: informal child care has a negative impact on test scores whether formal child care is not different from mother care.[1] Finally, Heckman, Malofeeva, Pinto, and Savelyev (2010) have shown that changes in noncognitive traits induced by an early experimental preschool program, like the Perry Preschool program, has a little lasting effect on IQ but explains a sizable portion of later-life outcomes in education, employment, earnings and crime through an increase in noncognitive skills.[2]

Given the sensitivity of adult outcomes with respect to child care and to early investments in children, public policies focusing on young children are considered as a major issue in many countries. Subsidizing formal child care, supplying vouchers, preschool programs or developing early schooling are possible public policies to provide child care alternatives for parents. However, the effects of such policies on future outcomes are not clear and must be assessed.

The availability of such policies and the age of children for being eligible to these policies differ significantly across countries. Consequently, the estimated impacts differ also a lot. On the one hand, Leuven, Lindahl, Oosterbeek, and Webbink (2010) find that the expansion of school opportunities to age 4 in the Netherlands had a positive impact for disadvantaged children. Using English data, Apps, Mendolia, and Walker (2012) find that Pre-school has a positive impact on cognitive tests at ages 11, 14 and 16 and reduces health risky behaviours. On the other hand, lowering school starting age has

[1] In earlier works based on structural and quasi structural estimates, Bernal (2008) and Bernal and Keane (2010) also find a negative impact of informal child care for children of both single and married women.

[2] In the same vein, Heckman, Moon, Pinto, Savelyev, and Yavitz (2010a), Heckman, Moon, Pinto, Savelyev, and Yavitz (2010b) and Heckman, Pinto, Shaikh, and Yavitz (2011) detail the methodology used to estimate the rate of return of this program.

been shown to have a negative effect in several studies. For instance, Black, Devereux, and Salvanes (2011) finds that young Norwegians starting school at 7 rather than 6 have both better cognitive and noncognitive outcomes at age 18. In the same vein, Datar (2006) finds that a one year delay before entering kindergarten is associated with an increase in maths and reading test scores.

Identification of the effect of such programs is not straightforward, since the choice that parents make between preschool enrollment and other child care alternatives is based on both observed and unobserved characteristics of children, such characteristics also influencing their schooling outcomes. More generally, the existence of unobserved determinants which affect both preschool enrollment decisions and schooling outputs is a serious issue for identification and estimation of the effect of preschool enrollment on cognitive and noncognitive achievement. Consequently, some source of exogeneity is needed to solve this issue.

When random assignment does not guarantee the exogeneity of preschool enrollment, the literature relies generally on quasi-experimental methods based on discontinuities in the enrollment process. Two main sources of discontinuity are then used, either variations in the age of entry in kindergarten across states or countries, as in Datar (2006), or discontinuities in the month of birth which are implied by rules governing school starting age, as in Black, Devereux, and Salvanes (2011) or Leuven, Lindahl, Oosterbeek, and Webbink (2010).

In this paper, we propose an alternative identification strategy to assess the impact of early school enrollment in France. To instrument schooling decisions, we use ratios between the number of young children and the capacity of preelementary schools observed at the very local level. We find that children who spend four rather than three years in preschool have higher cognitive and noncognitive skills at the beginning of the first grade in elementary school. Our data allows us to refine these results and to distinguish between several types of cognitive and noncognitive skills. For instance, we find that the effect on cognitive skills corresponds to an increase both in literacy and in numeracy. For noncognitive skills, the effect of spending more time in preschool increases mainly sociability of children at age six. The analysis on later cognitive outcomes show that early schooling enrollment still has an effect on literacy and numeracy up to the ninth grade.

The reminder of the paper is as follows. In the first section, we introduce the model and our identification strategy. Then we present the data we use. In the next section, we comment our results. Last section concludes.

1 Identification Strategy

1.1 The French preelementary school

The French academic year starts in September and schooling is compulsory from age 6. Thus, children normally enter the first grade the year they turn 6. However children can start school in preelementary grades which are integrated to elementary schools. Preelementary schools have the obligation to accept any children who turn 3 during the academic year. They are composed of three different grades, namely *Petite Section*, *Moyenne Section* and *Grande Section*. It is worth noting that French preelementary school is different from preschool systems existing in other countries. Indeed, preelementary schools are integrated within elementary schools; consequently they share the same administration and the same pool of teachers who are recruited with the same criteria.[3] Thus, children in a preelementary school share the same institutional context, and they often share the same building and yard, than children in the nearby elementary school who are aged between 6 and 11.

Almost all children are enrolled in preelementary school at age 3. Moreover, preelementary schools frequently admit children who turned 2 during the year. By law, early enrollment is accepted in priority for children with disadvantaged social background. As shown by Figure 1, from 1968 to 1980, the share of children enrolled at school during the year they turned 2 increased from 13% to about 35%. The rate of early enrollment remained stable around one third until the beginning of the last decade. Since then, due to public policies promoting formal and informal child care alternatives, the enrollment rate has fallen down to 13.6% in 2010.

When entering preelementary school at 2, children spend two years in the first of preelementary grades (*Petite Section*) and thus spend 4 years in preelementary school rather than three years. For parents, frequent alternatives to preelementary enrollment are formal and informal child care. Blanpain (2006) shows that in 2002, the more frequent alternative to preelementary school was home care by parents or relatives. Many families choose home care by registered childminders. Very few parents use child care centers which are known to be very scarce in France.

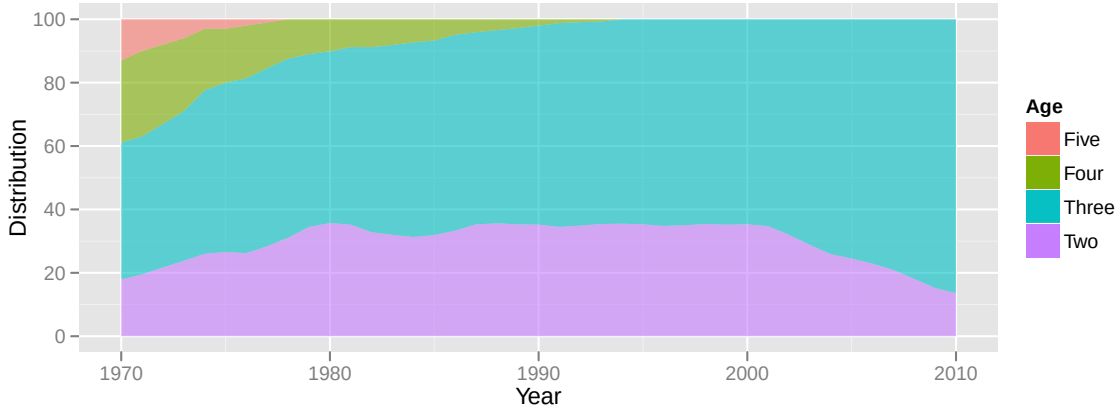
Considering this institutional context, we are interested in assessing the effect of spending 4 years in preelementary school rather than 3 years.

1.2 A two-equations model

We first estimate the impact of early preelementary school with a two-equations linear model estimated by two-stages-least squares (2SLS).

[3]Teachers in preelementary and elementary schools are civil servants selected on the basis of a regional contest. To pass this contest, candidates must have completed at least three years of post-secondary education.

Figure 1: Distribution of Age when Entering Preschool from 1970 to 2010



Notes : Source : *MENJVA-DEPP Enquête dans les écoles publiques et privées de l'enseignement pré-élémentaire et élémentaire*

We denote Y_i child's i achievement in first grade. This outcome is specified as a linear combination of children, family and school characteristics X_i, a dummy variable S_i which equals one if the child spent 4 years in preelementary school rather than 3 years, and an unobserved heterogeneity term ε_i.

Given that preschool enrollment decision by parents depends on both observed and unobserved characteristics of the child, the OLS estimation of the effect of S_i on Y_i is potentially biased. To treat this endogeneity issue, we introduce an auxiliary equation which defines S_i as a linear function of X_i, instrumental variables Z_i which influence preschool enrollment decision but do not directly affect children achievement, and unobserved heterogeneity term η_i. Thus, the model is:

$$Y_i = X_i\alpha_1 + \alpha_2 S_i + \varepsilon_i \quad (1)$$

$$S_i = X_i\delta_1 + Z_i\delta_2 + \eta_i \quad (2)$$

In our study, instruments are chosen to be ratios between the numbers of children who are eligible to be enrolled in preelementary school and capacities of preelementary schools in local neighborhoods. These capacities are obtained from administrative data provided by the French Ministry of Education.

These instruments are valid when assuming that parents do not sort among neighborhoods on the basis of demographic variations or more precisely according to the local variation of the number of children who are eligible for preelementary school.

Although economists have shown that school quality plays an important role in the household's location choice (Black (1999), Bayer, Ferreira, and McMillan (2007)), the possibility of an early preele-

mentary school enrollment is a slightly different issue. Indeed, residential mobility is a costly process and, when choosing their location, parents are more likely to take into account the local quality of primary and secondary schools than early schooling possibilities in the neighborhood.

Furthermore, if parents are able to gather information on the capacity of preelementary schools in their neighborhood, it is much more difficult for them to evaluate the number of children aged between 2 and 6 who will be enrolled in these preelementary schools at the time their child will be eligible to apply.

The two-equations model gives a simple and direct evidence of the validity of the instruments and of the causal effect of early preelementary school enrollment on children's later achievement. However it does not allow to derive more structural parameters such as the average or the marginal treatment effect. This derivation is done below by using a Roy selection model (see section 4).

2 Data

2.1 Primary data source

Our primary data source is the *Panel d'élèves du premier degré 1997* (*Panel 97*) which is a survey collected by the *Direction de l'Evaluation, de la Prospective et de la Performance* (DEPP, French Ministry of Education). All surveyed children have entered first grade in September 1997. For the sake of sample homogeneity, we have restricted our study to children born in France in 1991 and who have spent 3 or 4 years in preelementary school. The final sample we use is composed of 6,603 children.

The *Panel 97* survey provides information on children's cognitive and noncognitive achievement when they enter first grade. This information corresponds to measurements derived from formal tests and teachers' assessments of children's attitudes in school.[4] The *Panel 97* contains also information on cognitive test scores of children when they enter the 3rd and the 6th grades, and at the end of the 9th grade.

In addition to these assessments, the *Panel 97* survey contains information about the child's family and her social environment. Most of these variables were collected in 1997 by the head of school, when the child entered first grade. An additional questionnaire was sent to parents in 1999 and gives more precise information about the child's family composition and characteristics. In our econometric analysis, we control for parents' characteristics (labor market status, social category, national origin, mother's education), the family context (number of siblings, rank of birth, language spoken at home, single motherhood), the child's characteristics (gender and month of birth) and school characteristics

[4]Tables 3 and 4 in Appendix A.1 describe the standardized values of these measurements. All tables are reported in Appendices.

(public vs. private schools, size of the city where the school is located and whether the school is situated in a ZEP[5])[6].

In our final sample, exactly one third of children spend 4 years in preelementary school. On average, children born in the first two quarters of the year spend more time in preelementary school. The parents of children who enter preelementary school at age 2 are more likely to be blue-collar workers and their mothers are more often uneducated. School characteristics also affect on early enrollment: children enrolled in public school and in schools located in ZEP are less likely to enter preelementary school at 2 years old. Finally, children in small cities are more likely to enter school at 2.

2.2 Outcomes

As stated in the recent literature on cognitive and noncognitive skills (Cunha and Heckman (2007), Cunha, Heckman, and Schennach (2010)), measurements must be considered as noisy signals of latent skills. Although we are not interested in modeling the dynamics of skills, we follow this assumption; since we dispose of various measures we can extract latent skills by using factor analysis. These methods are worthwhile since they allow to extract meaningful skill indices and to aggregate data through a data-driven procedure.

From the measurements available in the *Panel 97* survey, we can then predict five cognitive and noncognitive scores in the first grade.

For cognitive skills, we consider a score for literacy and a score for numeracy. Noncognitive skills are captured by three scores: language, sociability and a score that accounts for the aptitude of children to fulfill school activities. Each score is built from carefully selected test scores and teachers' assessments.[7]

Literacy and numeracy are directly derived from the corresponding formal tests. A higher score is then associated with a higher level of skill. We define language as the capacity of children to understand and to participate in conversations. Sociability is defined as the capacity of children to interact with other children and to integrate themselves in the group of pupils. Finally, the last noncognitive skill correspond to the adaption of children to school activities. Tables 3, 4 and 5 in Appendix A.1 show that average gross scores in the 1st grade are in general higher for those pupils who enter preelementary school at age 2.

When assessing schooling achievement in upper grades, we consider single standardized test scores

[5]ZEP : Zone d'éducation Prioritaires are defined areas that beneficiate from additive resources on the basis of the social composition of the school. See Bénabou, Kramarz, and Prost (2009) for an evaluation of the ZEP program.

[6]Tables 11, and 12 in Appendix give a full description of the control variables that we include in our regressions.

[7]Appendix B.1 details the construction of scores. All scores are computed through Principal Factor Analysis and can be considered as the one dimensional vector space that better explains the variance of the subset of chosen measurements. Tables 13 and 14 in Appendix B.1 describe the correspondence between skills and measurements and Appendix B.2 gives the estimated factor loadings generating final scores. All scores are then standardized for facilitating interpretation.

for literacy and numeracy in the 3^{rd}, the 6^{th} and the 9^{th} grades. More precisely, for the 3^{rd} and the 6^{th} grades, we observe scores obtained in national tests, while for the 9^{th}, we use the yearly average grades of the student. This last score does not come from a national evaluation.

2.3 Instruments for early enrollment

In order to treat potential endogeneity of early enrollment, we use instruments which are ratios between the numbers of children who are eligible to be enrolled in preelementary school and capacities of preelementary schools in local neighborhoods. To do so, we take advantage of the knowledge of the precise location of elementary schools where children are enrolled in the first grade.

On the one hand, we get from the 1999 national population Census the numbers of children who were aged 2, 3, 4, 5 and 6 in 1993 and who were living in the neighborhood including the school were a pupil of our sample is enrolled.[8] On the other hand, we use administrative data collected by the French Ministry of Education to know the numbers of children who were enrolled in 1993[9] in the different grades of all preelementary schools located in this neighborhood, the three possible grades being *Petite section*, *Moyenne section* and *Grande section*.

Although those children aged 2 are only concerned by enrollment in the first preelementary grade, namely *Petite Section*, we choose to take into account variations in the ratios for upper preelementary grades. Indeed, in many schools, it happens that children enrolled in successive grades are put together in the same classroom. As a consequence, the number of children enrolled in upper preelementary grades (i.e., aged above 3) may also have an influence on early preelementary enrollment possibilities.

The neighborhood of the elementary school where child i is enrolled is denoted $\ell(i)$. The instrumental variables for this neighborhood are denoted $Z_k^{\ell(i)}$, $k \in \{1, 2, 3, 4, 5\}$.[10]

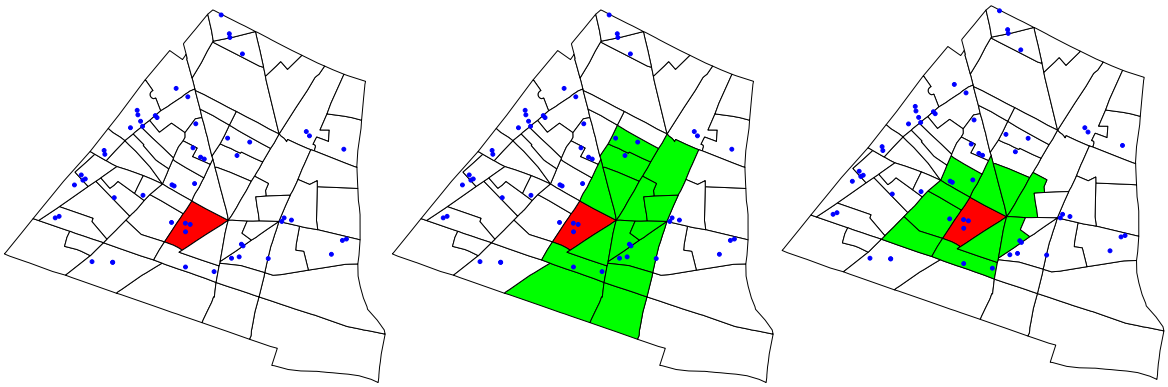
In order to test for different specifications, we consider neighborhoods with different perimeters. Given that preelementary assignment of children to schools is decided at the municipality level, we constrain these areas (i.e., perimeters) to belong to a single municipality. The smallest and basic geographical level is the Census Tract (called *Iris* in the French Census).[11] The largest zone we consider is built by Insee by grouping several Census Tracts. This zone is called the *Large District* (in

[8] We must use this census since the previous one was taken in 1990.

[9] 1993 is the year in which children born in 1991 are two years old and so are eligible to be enrolled in preelementary school. The numbers of children in preelementary schools come from the *Enquête 19* collected by the French Ministry of Education.

[10] Table 6 in Appendix A.2 summarizes the different instruments that we have built and used.

[11] Iris is an acronym for "Ilots Regroupés pour l'Information Statistique". These French basic units for the dissemination of local data divide Metropolitan France into 50,100 zones. The population of each IRIS falls between 1,800 and 5,000 inhabitants. A formal definition of IRIS can be found at `http://www.insee.fr/en/methodes/default.asp?page=definitions/iris.htm`.



(a) Iris (b) Large District (c) Contiguity zone

Figure 2: Alternative definitions of neighborhoods for three schools in the 14th *arrondissement* of Paris.

French, *Grand Quartier*).[12] These two areas are nested so each Census Tract is included in a Large District. However, given its size, a municipality may be divided or not into subdivisions, which implies that for some municipalities, Iris, Large Districts and municipalities coincide.[13]

We have finally built an intermediate area, comprised between the Census Tract and the Large District, which is composed of the aggregation of the Census Tract containing the school and the contiguous Census Tracts. This intermediate perimeter is called the *Contiguity* zone.

Figure 2 gives an illustration of the different perimeters that we use to construct the instruments. On this figure, we represent the Census Tract (2a), the Large District (2b) and the Contiguity zone (2c) which all include three given elementary schools located in the 14th *arrondissement* in Paris.

Table 7 in Appendix A.2 shows that the average number of children per school in each preelementary grade and the standard deviation of this number have been remarkably stable over years 1992, 1993 and 1994. This proves that the number of children who were enrolled in preelementary schools in those years were mainly fixed by school capacities (ie. "supply-driven") and not much affected by demographic variations (ie. "demand driven"). This argument is in line with Figure 1 which shows the the overall share of children aged 2 enrolled in preelementary school in the nineties was quite stable.

Numbers in Tables 8, 9 and 10 in Appendix A.2 are constructed by using schools located in the neighborhood of schools sampled in our panel. First these tables show that the average values of the

[12]According to Insee, the *large district* is defined as a grouping of several adjoining census tracts within the same municipality. The size of these districts is variable. It must meet certain population norms. For example, a municipality of 20,000 inhabitants will generally not be divided into more than two or three districts; likewise only a few municipalities of less than 10,000 inhabitants are divided into districts.

[13]For instance, cities with less than 5,000 inhabitants are too small to differentiate the two zones.

instruments in 1993 in each zone are always lower than 1 in the first preelementary grade (namely for instruments denoted $Z_1^{\ell(i)}$ and $Z_2^{\ell(i)}$) and get closer to 1 in the second and third preelementary grades (namely for instruments denoted $Z_3^{\ell(i)}$ to $Z_5^{\ell(i)}$). This may be explained by the fact that at lower ages, the number of children aged 2 and 3 in a given neighborhood is higher than the total number of children enrolled in the first grade (*petite section*) of schools located in this neighborhood in 1993, since this grade accepts children who are both aged 2 and 3 years old, and also children coming from other neighborhoods. Moreover, the sum of the average values of the two instruments denoted $Z_1^{\ell(i)}$ and $Z_2^{\ell(i)}$ is always much greater than 1, which means that the total number of children aged 2 and 3 years old in a given zone is on average greater than the number of children of these ages who can be enrolled by the schools located in this area. This is not the case for the second and third grades of preelementary schools since the ratios for these grades (corresponding to instruments $Z_3^{\ell(i)}$ to $Z_5^{\ell(i)}$) are still lower than 1 but much closer to 1. This is particularly true for both the contiguity and large district levels, which shows that these areas are relevant for our study.

3 Results

In this section, we present first the estimated effects of the instrumental variables on early preelementary school enrollment, and the estimated of the impact of the latter variable on several schooling achievement measures. We examine the robustness of our results in two dimensions : 1) we use the several geographical partitions previously defined : Iris, contiguity and large districts, 2) and we make the set of instruments vary. In the simplest specification, we only use the ratios between children aged 2 in the area and the number of children enrolled in the lowest preelementary grade (*Petite section*), and then add progressively ratio for later ages.[14]

3.1 First stage estimates

Tables 20, 22 and 24 in Appendix C report the estimated effects of several sets of instrumental variables (all measured in 1993) on early preelementary school enrollment (entering at age 2 rather than 3). These effects are successively estimated at the Iris (Table 20), contiguity (Table 22) and the large district (Table 24) levels. All F-statistics are sufficiently high for the estimations to be reliable and partial R^2 statistics, comprised between 1.9 and 8.2%, are positive.[15]

Although point estimates slightly differ according to the neighborhood perimeter, the pattern of

[14] The several sets of instruments are described in Table 6 in Appendix A.2.

[15] See Bound, Jaeger, and Baker (1995), Staiger and Stock (1997), Stock and Yogo (2002) and Stock, Wright, and Yogo (2002) for a discussion about the correspondence between the strongness of instruments and bias of the second stage estimates.

the results for Iris, contiguity and large district levels is very similar. First, as expected, instruments $Z_1^{\ell(i)}$ a,d $Z_2^{\ell(i)}$ have a negative impact on the probability to be enrolled in preelementary school at age 2. This result is quite natural since the more children of ages 2 and 3 there are relative to the number of children enrolled in preelementary schools in a given neighborhood, the more difficult it is be enrolled. Second, the points estimates of the coefficients associated with instruments $Z_3^{\ell(i)}$ and $Z_4^{\ell(i)}$ are significantly positive. The sign of these coefficients can be explained as a delayed effect: children who are in the second preelementary grade (*Moyenne Section*) in 1993 were in the first grade (*Petite Section*) in 1992 and leave room for younger children. Incorporating instruments corresponding to older ages (4 and 5 years old) has an impact on the values of coefficients associated with $Z_1^{\ell(i)}$ and $Z_2^{\ell(i)}$; these coefficients remain negative but have higher absolute values. Finally, the impact of the last instrument $Z_5^{\ell(i)}$ is not significantly different from zero. This result is not surprising since children aged 6 are generally not enrolled in preelementary school.

To test whether our instrumentation is relevant, we estimate the same first-stage equation using the same instrumental variables but now built for years 1992 and 1994 instead of 1993 (which is the year when parents may decide to enroll their children born in 1991). Tables 26 and 27 in Appendix C.2 give respectively the F-statistics and the partial R^2 of the first stage regressions using the different sets of instruments. These statistics show that for the three geographical perimeters, F-statistics and partial R^2 associated with regressions with 1993 instruments are much higher than those associated with regressions regressions using 1992 or 1994 instruments. This result validates the choice we make to use these instrumental variables measured in 1993.

Although their impact is weaker, instruments build for years 1992 and 1994 still have a strong impact. Thus, we may be concerned by the fact that capacities local schools to enroll children at early ages could influence parents' residential choices. In this case, early preelementary school enrollment decision could be correlated with unobserved heterogeneity and our instrumentation would be invalidated. In order to check for this possibility, we estimate the impact of instruments measured in 1993 when controlling for the set of instruments ($Z_1^{\ell(i)}$, $Z_2^{\ell(i)}$, $Z_3^{\ell(i)}$ and $Z_4^{\ell(i)}$) measured in 1992. Tables 21, 23 and 25 in Appendix C report the results of these estimations. Although the inclusion of additional control variables strongly correlated with instruments lower statistical significance of the estimates, our instruments are still strong according to the F-statistics, which are comprised between 16.99 and 56.16. This result shows that, even when controlling for past values of the instruments, our data still provide enough exogenous variation to provide reliable estimates of the model.

3.2 Effects on cognitive and noncognitive skills in the first grade

Estimated effects on cognitive and noncognitive achievement in the first grade are reported in Tables 28, 30 and 32 in Appendix D for the different neighborhoods that we consider. Although most of the results are not significantly different from 0 at a 5% level, it is worthwhile to notice that early preelementary school enrollment is linked with a higher achievement in numeracy. According to the specification, the effect is estimated to lie between 16.3% of a standard deviation (which is not statistically significant at a 5% level) and 31.4%. The IV estimate is much higher than the OLS one which is comprised between 4 and 6% of a standard deviation and not statistically significant.

Moreover, early preelementary school enrollment is associated with a slight positive effect on sociability of children. The effect is only significant at a 10% level for two specifications with instruments taken at the contiguity level.

The impact on literacy is positive: it is estimated to be around 19%, but not statistically significant.

3.3 Later cognitive outcomes

When considering later cognitive achievement, we find a much stronger effect of early preelementary schooling enrollment on numeracy and literacy tests (see Tables in Appendix D.2).

From a general point of view, we observe that the effect of early preelementary schooling enrollment has a positive impact on both literacy and numeracy in the 3rd, the 6th and the 9th grades. This shows that early enrollment has a protracted effect that lasts up to 13 years after entering preelementary school at age 2. It is also worth noting that this effect has an important magnitude, preelementary school enrollment increasing achievement by around one third of a standard deviation. It is interesting to compare this effect with the OLS effect which is close to 0 and not statistically significant.

Point estimates of the effects on literacy are estimated between 17 and 41% of a standard deviation in the 3rd grade, between 26 and 49% in the 6th grade and between 21 and 42% in the 9th grade. Furthermore, when considering each specification separately, we find that that the impact of early preelementary school enrollment is stable over time, although the effect is slightly weaker in the 6th grade.

The effects on numeracy are also statistically significant and have the same magnitude than those on literacy.

It is important to note that the results are robust to the choice of the specification and to the choice of the perimeter.

4 Estimating treatment effects

4.1 A generalized Roy model

To circumvent the drawbacks of the two-equations linear model, we now represent the parents' decision to enroll their child in early preschool by using a generalized Roy model. As before, we denote S_i the dummy variable taking the value 1 if child i is enrolled in preschool at age 2 and 0 if enrolled at age 3. Following Heckman and Vytlacil (2005), we suppose that children potential outcomes (Y_{i0}, Y_{i1}) are specified as linear combinations of covariates X_i and unobserved characteristics (U_{i0}, U_{i1}):

$$\begin{aligned} Y_{i0} &= X_i\beta_0 + U_{i0} \\ Y_{i1} &= X_i\beta_1 + U_{i1} \end{aligned}$$

Consequently, observed achievement Y_i corresponds to one of the two potential outcomes according to the enrollment decision S_i:

$$Y_i = S_i.Y_{i1} + (1 - S_i).Y_{i0}$$

Finally, the early enrollment decision S_i is defined as:

$$\begin{aligned} S_i &= \mathbb{1}(X_i\gamma_1 + Z_i\gamma_2 - V_i > 0) \\ &= \mathbb{1}(X_i\gamma_1 + Z_i\gamma_2 > V_i) \\ &= \mathbb{1}(F_V(X_i\gamma_1 + Z_i\gamma_2) > F_V(V_i)) \\ &= \mathbb{1}(F_V(X_i\gamma_1 + Z_i\gamma_2) > U_{Si}) \end{aligned}$$

where Z_i is the vector of instrumental variables, F_V is the cumulative density function of V and U_{Si} is the quantile of V_i the unobserved heterogeneity term affecting the enrollment decision.

From this simple framework and following Heckman and Vytlacil (2005), we can derive all the treatment effect parameters we are interested in. The individual return to treatment is given by:

$$\Delta_i = Y_{i1} - Y_{i0}$$

Aggregate treatment effects can be derived from the marginal treatment effect (MTE) defined as :

$$MTE(x, u) = E(\Delta_i | X_i = x, U_{Si} = u)$$

For instance, the average treatment effect (ATE), the average treatment effect on the treated (ATT) and the average treatment effect on the untreated (ATU) are obtained as weighted means of MTE:

$$\begin{aligned} ATE(x) &= \int_0^1 MTE(x, u)du \\ ATT(x) &= \int_0^1 MTE(x, u)dF_{U_s|X,S=1}(u) \\ ATU(x) &= \int_0^1 MTE(x, u)dF_{U_s|X,S=0}(u) \end{aligned}$$

To aggregate over X, we then integrate over the distribution of observed characteristics:

$$\begin{aligned} ATE &= \int ATE(x)dF_X(x) \\ ATT &= \int ATT(x)dF_X(x) \\ ATU &= \int ATU(x)dF_X(x) \end{aligned}$$

Furthermore, we assume that the unobserved heterogeneity terms (U_{0i}, U_{1i}, V_i) have a joint normal distribution, with the following covariance terms :

$$\begin{aligned} Cov(U_0, V) &= \sigma_{VU_0} \\ Cov(U_1, V) &= \sigma_{VU_1} \\ Var(V) &= 1 \end{aligned}$$

As a consequence, MTE has a parametric form which can be directly derived from the estimates of the model:

$$MTE(x, u) = X(\beta_1 - \beta_0) - (\sigma_{VU_1} - \sigma_{VU_0})\Phi^{-1}(u)$$

Identification of this model mainly relies on the existence of variables Z_i such that (U_{0i}, U_{1i}, V_i) is independent of (X_i, Z_i).

Finally, the estimation of the parametric model allows to test for the heterogeneity of treatment effects by testing the following equality :

$$\mathcal{H}_0 \ : \ \sigma_{VU_1} - \sigma_{VU_0} = 0 \tag{3}$$

If the correlation between the selection equation unobserved heterogeneity and outcomes unobserved heterogeneity is constant ($\sigma_{VU_1} = \sigma_{VU_0}$), $MTE(X, u)$ are constant across values of u and treatment effect parameters should be equal (ATE = ATT = ATU).

4.2 Heterogeneity of treatment effects

We estimate the generalized Roy model with instrumental variables ($Z_1^{\ell(i)}$, $Z_2^{\ell(i)}$, $Z_3^{\ell(i)}$ and $Z_4^{\ell(i)}$) taken at the large district level.

From the estimation of the model by a maximum likelihood method, we formally test for hypothesis (3). The test statistics and p-values of the tests are given in Table 1 for all the outcomes we consider.

Considering almost all test statistics, we cannot reject the null hypothesis at the 5% level, which means that MTE heterogeneity is not statistically significant. As a consequence, we may find values

Table 1: Testing for the heterogeneity of the MTE : test and p-values

	Test values	p-values
Literacy	1.44	0.15
Numeracy	0.85	0.39
Sociability	0	1
School activities	0.63	0.53
Language	-0.58	0.56
Numeracy 3rd Grade	1.48	0.14
Numeracy 6th Grade	1.25	0.21
Numeracy 9th Grade	0.83	0.41
Literacy 3rd Grade	1.03	0.3
Literacy 6th Grade	1.46	0.15
Literacy 9th Grade	2.48	0.01

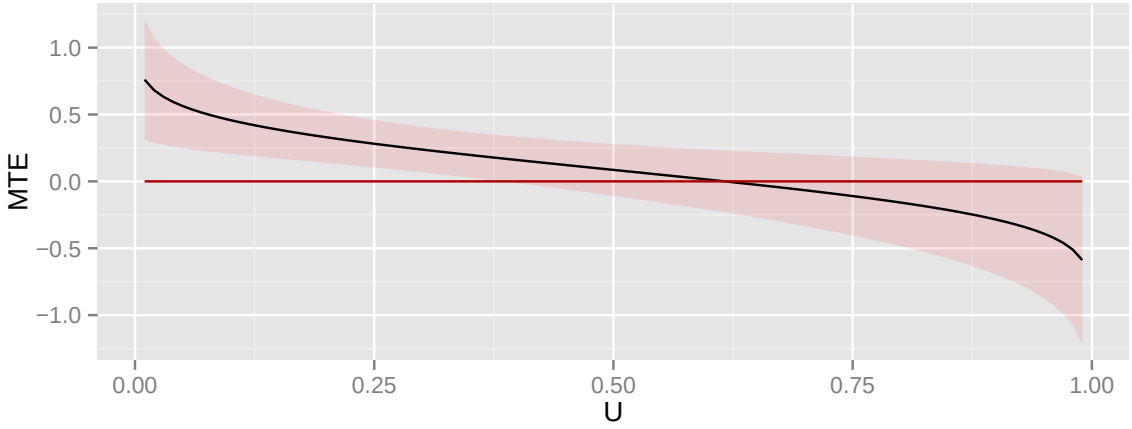
Notes : Source : *Panel DEPP 1997*. Standard errors are obtained by the Delta method applied to maximum likelihood estimates of the model parameters. All estimations include controls for the child' month of birth, gender, familly, parents and school characteristics. The set of instrumental variables chosen for this estimation is IV3 taken at the large district level.

of the estimates of the different treatment effects which are relatively close from each other and close to the LATE estimated in the previous section.

However, it is worth noting that the null hypothesis is rejected for one output, namely literacy achievement in the 9th grade. Thus, for this achievement, the impact can be considered as heterogenous with respect to the quantile of unobserved heterogeneity of the early enrollment equation.

Figure 3 displays the shape of the MTE along the distribution of unobserved heterogeneity. Provided that the difference $\sigma_{VU_1} - \sigma_{VU_0}$ is positive and given the parametric form of the model, it is not surprising that the MTE function has a decreasing shape. However, the fact that $\sigma_{VU_1} - \sigma_{VU_0}$ is positive indicates that individuals who are more likely to be enrolled early have also a higher return to this enrollment than children who are less likely to be enrolled early.

Figure 3: Marginal treatment effect of early schooling enrollment on literacy achievement in the 9th grade.



Notes : Source : *Panel DEPP 1997*. Shaded area represents the 95% confidence interval obtained by bootstrapping (250 replications). All estimations include controls for child month of birth, gender, household, parents and school characteristics. The plotted MTEs are integrated over the sample empirical distribution of covariates.

4.3 Treatment Effects

Treatment effects estimated from the model are presented in Table 2. As expected from the heterogeneity test, although we can observe some variability, values of estimated ATE, ATT and ATU parameters are quite close to each other, and the wider gap between ATT and ATU is observed for literacy in the 9th grade. Results are in line with those of the two-equations model estimated through an IV method, but coefficients appear to be much more significant.

When focusing on the first grade outcomes, we observe that the ATT for literacy is 26% of a standard deviation and that the ATT for numeracy is 37% of a standard deviation, which is close to what we previously obtained. For noncognitive outcomes, the ATT for sociability is 23% of a standard deviation, and ATT for school activities aptitudes is equal to about 21% of a standard deviation. All these estimates are significant at a 5% level. The ATT for language skill is equal to 19% of a standard deviation but only significant at a 10% level.

Thus, from the treatment effect estimates, we can conclude that early preelementary school enrollment has a strong impact on both cognitive and noncognitive skills in the first grade.

Considering later cognitive outcomes, we still find a strong and positive impact of early preelementary school enrollment. The impact on numeracy is equal to 28% in the 3rd grade, 23% in the 6th grade and 26% in the 9th grade. Similarly, the impact on literacy is equal to 32% in the third grade,

Table 2: Treatment effects derived from the generalized Roy model

	ATE	ATT	ATU
Literacy	0.11 (1.08)	0.26 (2.33)	0.03 (0.24)
Numeracy	0.28 (2.27)	0.37 (4.32)	0.23 (1.35)
Sociability	0.23 (0.91)	0.23 (2.78)	0.23 (0.62)
School activities	0.14 (1.68)	0.21 (2.19)	0.11 (0.99)
Language	0.25 (0.95)	0.19 (1.9)	0.28 (0.74)
Numeracy 3rd Grade	0.13 (1.36)	0.28 (2.83)	0.05 (0.4)
Numeracy 6th Grade	0.09 (0.73)	0.23 (2.1)	0.02 (0.12)
Numeracy 9th Grade	0.15 (1.32)	0.26 (2.42)	0.1 (0.62)
Literacy 3rd Grade	0.21 (2.01)	0.32 (3.64)	0.16 (1.1)
Literacy 6th Grade	0.09 (0.72)	0.24 (2.7)	0.01 (0.03)
Literacy 9th Grade	0.09 (0.87)	0.37 (3.49)	−0.06 (−0.45)

Notes : Source : *Panel DEPP 1997*. Standard errors were obtained by bootstrapping (250 replications). T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents and school characteristics. The set of instrumental variables chosen for this estimation is IV3 taken at the large district level.

24% in the 6th grade and 37% in the 9th grade. Again, the impact appears to be strong and persistent over time.

Finally, it is important to note that for several outcomes, like numeracy in the first grade and literacy in the third grade, ATEs are also significatively positive and ATUs are all positive (except the ATU for literacy in the 9th grade). This result suggests that many children who entered preelementary school at age 3 would have beneficiated from being enrolled at age 2 and that marginally increasing enrollment possibilities would have had a positive impact on children achievement.

5 Conclusion

Our estimations show that early preelementary school enrollment has a significant effect on both cognitive and noncognitive skills. In particular, we find that children who spend four rather than three

years in preelementary school have higher skills in literacy, numeracy and sociability, and have better aptitudes for school activities when they enter the first grade in elementary school. The results do not much vary with the choice of the instrument set and with the definition of the neighborhood. In addition, we find that early preelementary school enrollment has a strong effect on later literacy and numeracy achievement up to the 9th grade.

The survey used in our study does not provide information about future labor market outcomes of children. The EVA (*Entrée dans la Vie Active*) survey jointly conducted by the French Ministry of Education and by INSEE (Paris) has followed until 2011 a cohort of approximately 18,000 children who entered the 6th grade in 1995. This survey allows to observe both their 6th grade test scores and their future earnings. Using this survey, we have estimated that an increase of one standard deviation in the 6th grade maths score is associated with a 12.5% in monthly earnings three years after leaving school. The impact of literacy on earnings is much lower: it is estimated to be equal to 2%.[16] From these findings, it is possible to deduce that our estimates of the ATT parameters evaluated at the 6th grade test scores (in numeracy and in literacy) implies that an early preschool enrollment increases by 46.5 euros the average monthly wage three years after leaving school.

From the derivation of a generalized Roy model, we find that the effects are strong for both cognitive and noncognitive skills, suggesting that a marginal extension of early enrollment would have had a positive impact on children achievement.

However, this extension should take into account the contemporaneous context of the survey. At that time, formal alternatives to preelementary school were scarce and the share of children enrolled at age 2 was steady, around 33%. Nowadays, the implementation of such a policy should take into account that alternatives to preelementary school may have changed locally and that the impact of being enrolled early may be different given that children aged 2 who enrolled in preelementary school have very different peers, since only 10% of children in the first preelementary grade are aged 2.

It would also be interesting to consider the effect of alternative child care choices, like child care centers, which provide analogous services to families but with different pedagogical contents and enroll children aged 1 and 2 only.

Finally, the fact that such a policy may increase labor supply of mothers (see, for instance, Goux and Maurin (2010)) should also be taken into account.

[16] We have estimated these gross returns by running a simple regression of monthly earnings on test scores obtained by children in the 6th grade. The 6th grade tests taken by the 1995 cohort observed in the EVA survey are the same as the 6th grade tests taken by the children observed in our data set.

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A Descriptive Statistics

A.1 Scores

Table 3: Average standardized test scores at the beginning of the first grade according to the time spent in pre-elementary school

	Time in preelementary school					
	4 years		3 years		All	
	Mean	st. dev.	Mean	st. dev.	Mean	st. dev.
General knowledge	0.050	0.965	-0.025	1.016	0.000	1.000
Knowledge of writing	0.095	0.996	-0.047	0.999	-0.000	1.000
Phonologic tasks	0.060	0.981	-0.030	1.008	0.000	1.000
Morphosyntactic tasks	0.054	0.971	-0.027	1.013	-0.000	1.000
Simple calculations	0.127	0.972	-0.063	1.008	0.000	1.000
Knowledge of temporal concepts	0.094	0.963	-0.047	1.015	0.000	1.000
Oral comprehension	0.087	0.943	-0.043	1.024	0.000	1.000
Technical knowledge	0.081	0.969	-0.040	1.013	0.000	1.000
Writing	0.117	0.996	-0.058	0.997	-0.000	1.000
Knowledge of spatial concepts	0.052	0.949	-0.026	1.024	0.000	1.000
Reading	0.052	1.006	-0.026	0.996	-0.000	1.000
Numbers and geometrical figures	0.073	0.962	-0.037	1.017	-0.000	1.000

Notes : Source : *Panel DEPP 1997*;

Table 4: Average standardized teachers' assessments at the beginning of the first grade according to the time spent in pre-elementary school

	Time in preelementary school					
	4 years		3 years		All	
	Mean	st. dev.	Mean	st. dev.	Mean	st. dev.
Self-confidence during school activities	0.111	0.979	-0.055	1.006	0.000	1.000
Fails due to excessive confidence	0.050	1.012	-0.025	0.993	-0.000	1.000
Capable of regular attention	0.059	0.987	-0.030	1.005	-0.000	1.000
Actively participates in group activities	0.078	0.964	-0.039	1.015	0.000	1.000
Rapidly completes tasks	0.109	0.983	-0.054	1.004	-0.000	1.000
Efficiently completes tasks	0.099	0.971	-0.049	1.011	0.000	1.000
Autonomous	0.113	0.970	-0.056	1.010	-0.000	1.000
Has no difficulty in activities involving gestures	0.108	0.968	-0.054	1.012	0.000	1.000
Fatigues during school activities	-0.016	1.014	0.008	0.993	0.000	1.000
Actively participates in class discussions	0.108	0.988	-0.054	1.002	0.000	1.000
Consciously intervenes in class discussions	0.081	0.982	-0.040	1.007	0.000	1.000
Anticipates and is organized	0.119	0.980	-0.059	1.005	-0.000	1.000
Integrates herself/himself well in class	0.092	0.936	-0.046	1.027	0.000	1.000
Linguistic level compared to class average	0.094	0.960	-0.047	1.016	-0.000	1.000
Adaptation to the rhythm of her/his class	0.112	0.970	-0.056	1.010	0.000	1.000

Notes : Source : *Panel DEPP 1997*;

Table 5: Average standardized value of skills at the beginning of the first grade according to the time spent in pre-elementary school

	Time in preelementary school					
	4 years		3 years		All	
	Mean	st. dev.	Mean	st. dev.	Mean	st. dev.
Literacy	0.102	0.995	-0.052	0.999	-0.000	1.000
Numeracy	0.114	0.965	-0.058	1.012	0.000	1.000
Language	0.107	0.973	-0.054	1.009	-0.000	1.000
Sociability	0.108	0.966	-0.054	1.012	0.000	1.000
Schooling Activities	0.127	0.971	-0.064	1.008	0.000	1.000

Notes : Source : *Panel DEPP 1997*;

A.2 Instruments

Table 6: Instruments

Notation	Corresponding instrument
$Z_1^{\ell(i)}$	$\frac{\#\text{ Children aged 2 in } \ell(i)}{\#\text{Children enrolled in } \textit{Petite Section} \text{ in } \ell(i)}$
$Z_2^{\ell(i)}$	$\frac{\#\text{ Children aged 3 in } \ell(i)}{\#\text{Children enrolled in } \textit{Petite Section} \text{ in } \ell(i)}$
$Z_3^{\ell(i)}$	$\frac{\#\text{ Children aged 4 in } \ell(i)}{\#\text{Children enrolled in } \textit{Moyenne Section} \text{ in } \ell(i)}$
$Z_4^{\ell(i)}$	$\frac{\#\text{ Children aged 5 in } \ell(i)}{\#\text{Children enrolled in } \textit{Grande Section} \text{ in } \ell(i)}$
$Z_5^{\ell(i)}$	$\frac{\#\text{ Children aged 6 in } \ell(i)}{\#\text{Children enrolled in } \textit{Grande Section} \text{ in } \ell(i)}$

Specification	Set of instruments
IV1	$Z_1^{\ell(i)}$
IV2	$Z_1^{\ell(i)}$,$Z_2^{\ell(i)}$
IV3	$Z_1^{\ell(i)}$,$Z_2^{\ell(i)}$,$Z_3^{\ell(i)}$
IV4	$Z_1^{\ell(i)}$,$Z_2^{\ell(i)}$,$Z_3^{\ell(i)}$,$Z_4^{\ell(i)}$
IV5	$Z_1^{\ell(i)}$,$Z_2^{\ell(i)}$,$Z_3^{\ell(i)}$,$Z_4^{\ell(i)}$,$Z_5^{\ell(i)}$

Table 7: Average number of children by school in each preelementary grade for years between 1992 and 1994

		Preelementary grade					
		First		Second		Third	
	Number of schools	Mean	st. dev.	Mean	st. dev.	Mean	st. dev.
1992	63094	16.466	22.212	13.001	17.663	12.877	17.163
1993	62640	16.706	22.253	13.059	17.666	13.169	17.479
1994	62241	16.727	22.132	13.078	17.631	13.169	17.435

Notes : Source : *Enquête 19 DEPP (1992-1994)*

Table 8: Description of instruments computed at the Iris level

	Time in preelementary school					
	4 years		3 years		All	
	Mean	st. dev.	Mean	st. dev.	Mean	st. dev.
$Z_1^{\ell(i)}$	0.570	0.326	0.671	0.442	0.637	0.410
$Z_2^{\ell(i)}$	0.572	0.318	0.672	0.425	0.639	0.396
$Z_3^{\ell(i)}$	0.842	0.459	0.796	0.468	0.811	0.466
$Z_4^{\ell(i)}$	0.882	0.695	0.810	0.576	0.834	0.619
$Z_5^{\ell(i)}$	0.914	0.733	0.829	0.611	0.857	0.655

Notes : Source : *Enquête 19 DEPP (1992-1994)* and *National Census (1999)*.

Table 9: Description of instruments computed at the Contiguity level

	Time in preelementary school					
	4 years		3 years		All	
	Mean	st. dev.	Mean	st. dev.	Mean	st. dev.
$Z_1^{\ell(i)}$	0.663	0.277	0.809	0.391	0.761	0.364
$Z_2^{\ell(i)}$	0.665	0.266	0.810	0.365	0.762	0.342
$Z_3^{\ell(i)}$	0.963	0.349	0.957	0.369	0.959	0.363
$Z_4^{\ell(i)}$	1.001	0.552	0.965	0.416	0.977	0.465
$Z_5^{\ell(i)}$	1.027	0.615	0.982	0.472	0.997	0.524

Notes : Source : *Enquête 19 DEPP (1992-1994)* and *National Census (1999)*.

Table 10: Description of instruments computed at the Large District level

	Time in preelementary school					
	4 years		3 years		All	
	Mean	st. dev.	Mean	st. dev.	Mean	st. dev.
$Z_1^{\ell(i)}$	0.653	0.267	0.789	0.352	0.744	0.332
$Z_2^{\ell(i)}$	0.653	0.255	0.791	0.330	0.745	0.314
$Z_3^{\ell(i)}$	0.954	0.355	0.938	0.319	0.943	0.331
$Z_4^{\ell(i)}$	0.989	0.550	0.948	0.357	0.961	0.431
$Z_5^{\ell(i)}$	1.018	0.616	0.966	0.436	0.983	0.503

Notes : Source : *Enquête 19 DEPP (1992-1994)* and *National Census (1999)*.

A.3 Covariates

Table 11: Average control variable according to the time spent in pre-elementary school (1)

	Time in preelementary school					
	4 years		3 years		All	
	Mean	st. dev.	Mean	st. dev.	Mean	st. dev.
Month of birth						
January	0.117	0.322	0.055	0.228	0.076	0.265
February	0.112	0.315	0.059	0.236	0.077	0.266
March	0.126	0.332	0.063	0.242	0.084	0.277
April	0.107	0.310	0.074	0.262	0.085	0.279
May	0.094	0.292	0.088	0.283	0.090	0.286
June	0.089	0.284	0.088	0.283	0.088	0.283
July	0.082	0.275	0.094	0.292	0.090	0.286
August	0.082	0.275	0.085	0.279	0.084	0.278
September	0.064	0.244	0.097	0.296	0.086	0.280
October	0.052	0.222	0.101	0.302	0.085	0.279
November	0.040	0.195	0.096	0.295	0.078	0.268
December	0.035	0.184	0.100	0.299	0.078	0.269
Children Characteristics						
Girl	0.495	0.500	0.488	0.500	0.491	0.500
Nb of children in the household	2.480	1.093	2.428	1.147	2.445	1.130
Rank of birth	1.943	1.085	1.937	1.121	1.939	1.109
Mother speaks a foreign language	0.078	0.269	0.117	0.322	0.104	0.306
Children with African origins	0.059	0.235	0.080	0.271	0.073	0.260
Family type						
Both parents present	0.880	0.325	0.859	0.348	0.866	0.341
Only one parent	0.091	0.287	0.109	0.311	0.103	0.304
One parent and her spouse	0.026	0.160	0.028	0.166	0.028	0.164
Other	0.003	0.057	0.004	0.066	0.004	0.063
Mother's education						
No diploma	0.208	0.406	0.235	0.424	0.226	0.418
Vocational degree	0.339	0.474	0.318	0.466	0.325	0.468
High school degree	0.208	0.406	0.196	0.397	0.200	0.400
College	0.244	0.430	0.251	0.434	0.249	0.432

Notes : Source : *Panel DEPP 1997*;

Table 12: Average control variable according to the time spent in pre-elementary school (2)

	Time in preelementary school					
	4 years		3 years		All	
	Mean	st. dev.	Mean	st. dev.	Mean	st. dev.
Socioeconomic category of the father						
Farmer	0.039	0.194	0.022	0.145	0.027	0.163
Craftman, retailer, business owner	0.099	0.298	0.102	0.302	0.101	0.301
Executives, intellectual occupation	0.146	0.353	0.161	0.368	0.156	0.363
Intermediate occupation	0.180	0.384	0.181	0.385	0.180	0.385
White collar worker	0.122	0.328	0.125	0.331	0.124	0.330
Blue collar worker	0.354	0.478	0.318	0.466	0.330	0.470
Other	0.060	0.237	0.092	0.289	0.081	0.273
Labor market situation of the father						
Working	0.907	0.291	0.884	0.320	0.891	0.311
Unemployed	0.037	0.190	0.039	0.193	0.038	0.192
Retired	0.016	0.126	0.025	0.155	0.022	0.146
Other	0.040	0.195	0.053	0.224	0.048	0.215
Labor market situation of the mother						
Working	0.642	0.480	0.623	0.485	0.630	0.483
Unemployed	0.044	0.206	0.043	0.202	0.043	0.203
Retired	0.309	0.462	0.329	0.470	0.323	0.467
Other	0.005	0.071	0.005	0.067	0.005	0.069
School context						
ZEP	0.102	0.303	0.119	0.324	0.114	0.318
Private school	0.202	0.402	0.133	0.339	0.156	0.363
Rural municipality	0.293	0.455	0.210	0.408	0.238	0.426
Less than 10,000 inhabitants	0.172	0.377	0.139	0.346	0.150	0.357
Between 10,000 and 50,000	0.124	0.330	0.128	0.335	0.127	0.333
More than 50,000	0.411	0.492	0.523	0.500	0.486	0.500

Notes : Source : *Panel DEPP 1997*;

B Factor structure

Rather than using separately all test scores and teacher assessments, we prefer to extract several indices by using a factorial analysis method. Factor loadings are obtained by means of a principal factor analysis. Individual predictions of factors are estimated using Thomson (1948) method. We only keep the first factor of each principal factor analysis.

We consider five indices: numeracy, literacy, sociability, language and aptitudes for school activities. We detail below the sets of test scores chosen for the construction of each index and we report the factor loadings obtained from the principal factor analysis.

B.1 Construction of cognitive and noncognitive scores

Table 13: Measurements used to construct cognitive scores

Skills	Measurements (Tests scores)
Literacy	"Knowledge of writing" "Reading (phonologic tasks)" "Reading (morphosyntactic tasks)" "Writing" "Reading"
Numeracy	"Mathematics (simple calculations)" "Mathematics (numbers and geometrical figures)"

Table 14: Measurements used to construct noncognitive scores

Skills	Measurements (Tests scores)
Language	"actively participates in class discussions" "consciously intervenes in class discussions" "linguistic level compared to class average" "Oral comprehension"
Sociability	"actively participates in group activities" "actively participates in class discussions" "consciously intervenes in class discussions" "integrates herself/himself well in class"
School activities	"self-confident during school activities" "fails due to excessive confidence" "capable of regular attention" "rapidly completes tasks" "efficiently completes tasks" "autonomous" "has no difficulty in activities involving gestures" "fatigues during school activities" "anticipates and is organized" "adaptation to the rhythm of her/his class"

B.2 Factor loadings

Table 15: Literacy : factor loadings

	Literacy
Knowledge of writing	0.575
Phonologic tasks	0.607
Morphosyntactic tasks	0.453
Writing	0.766
Reading	0.727

Notes : Source : *Panel DEPP 1997*;

Table 16: Numeracy : factor loadings

	Numeracy
Simple calculations	0.628
Numbers and geometrical figures	0.628

Notes : Source : *Panel DEPP 1997*;

Table 17: School activities : factor loadings

	School activities
Self-confidence during school activities	0.754
Fails due to excessive confidence	-0.018
Capable of regular attention	0.762
Rapidly completes tasks	0.803
Efficiently completes tasks	0.875
Autonomous	0.872
Has no difficulty in activities involving gestures	0.701
Fatigues during school activities	-0.217
Anticipates and is organized	0.859
Adaptation to the rhythm of her/his class	0.677

Notes : Source : *Panel DEPP 1997*;

Table 18: Sociability : factor loadings

	Sociability
Actively participates in group activities	0.725
Actively participates in class discussions	0.744
Consciously intervenes in class discussions	0.818
Integrates herself/himself well in class	0.667

Notes : Source : *Panel DEPP 1997*;

Table 19: Language : factor loadings

	Language
Actively participates in class discussions	0.770
Consciously intervenes in class discussions	0.810
Linguistic level compared to class average	0.666
Oral comprehension	0.382

Notes : Source : *Panel DEPP 1997*;

C First stage estimation

C.1 The impact of instruments on early preelementary school enrollment

Table 20: First stage estimation: impact of the instruments (measured in 1993) on the preschool enrollment age (2 vs 3) at the Iris level

	IV1	IV2	IV3	IV4	IV5
$Z_1^{\ell(i)}$	-0.159***	-0.068	-0.156***	-0.175***	-0.174***
	(-8.21)	(-1.64)	(-3.66)	(-4.27)	(-4.26)
$Z_2^{\ell(i)}$		-0.111**	-0.261***	-0.287***	-0.287***
		(-2.46)	(-5.06)	(-5.74)	(-5.73)
$Z_3^{\ell(i)}$			0.275***	0.206***	0.200***
			(8.01)	(5.70)	(5.49)
$Z_4^{\ell(i)}$				0.103***	0.080**
				(4.28)	(2.14)
$Z_5^{\ell(i)}$					0.029
					(0.88)
N	6567	6567	6567	6567	6567
R^2	0.112	0.114	0.146	0.154	0.155
Partial R^2	0.019	0.021	0.056	0.066	0.066
F-stat	63.40	32.27	39.91	36.24	28.91

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents and school characteristics.

Table 21: First stage estimation: impact of the instruments (measured in 1993) on the preschool enrollment age (2 vs 3) at the Iris level, when controlling for the values of the instruments in 1992

	IV1	IV2	IV3	IV4	IV5
$Z_1^{\ell(i)}$	-0.251***	-0.125**	-0.100**	-0.107**	-0.108**
	(-7.20)	(-2.54)	(-2.00)	(-2.16)	(-2.17)
$Z_2^{\ell(i)}$		-0.245***	-0.269***	-0.262***	-0.261***
		(-3.21)	(-3.48)	(-3.44)	(-3.43)
$Z_3^{\ell(i)}$			0.308***	0.310***	0.311***
			(5.73)	(5.84)	(5.87)
$Z_4^{\ell(i)}$				0.067**	0.076**
				(2.39)	(2.03)
$Z_5^{\ell(i)}$					-0.011
					(-0.30)
N	6567	6567	6567	6567	6567
R^2	0.148	0.154	0.171	0.172	0.172
Partial R^2	0.017	0.024	0.044	0.046	0.046
F-stat	46.12	20.69	28.62	22.75	18.41

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents, school characteristics and values of the instruments in 1992.

Table 22: First stage estimation: impact of the instruments (measured in 1993) on the preschool enrollment age (2 vs 3) at the Contiguity level

	IV1	IV2	IV3	IV4	IV5
$Z_1^{\ell(i)}$	-0.232***	-0.094**	-0.182***	-0.211***	-0.211***
	(-8.03)	(-2.14)	(-3.90)	(-4.64)	(-4.64)
$Z_2^{\ell(i)}$		-0.174***	-0.297***	-0.307***	-0.307***
		(-3.62)	(-5.19)	(-5.58)	(-5.58)
$Z_3^{\ell(i)}$			0.300***	0.214***	0.214***
			(7.38)	(4.97)	(4.98)
$Z_4^{\ell(i)}$				0.133***	0.132***
				(4.15)	(2.91)
$Z_5^{\ell(i)}$					0.001
					(0.04)
N	6567	6567	6567	6567	6567
R^2	0.125	0.129	0.159	0.169	0.169
Partial R^2	0.033	0.038	0.070	0.081	0.081
F-stat	61.03	28.96	43.06	36.26	29.00

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents and school characteristics.

Table 23: First stage estimation: impact of the instruments (measured in 1993) on the preschool enrollment age (2 vs 3) at the Contiguity level, when controlling for the values of the instruments in 1992

	IV1	IV2	IV3	IV4	IV5
$Z_1^{\ell(i)}$	-0.302***	-0.159***	-0.134**	-0.138***	-0.139***
	(-7.89)	(-3.04)	(-2.57)	(-2.66)	(-2.68)
$Z_2^{\ell(i)}$		-0.285***	-0.276***	-0.271***	-0.271***
		(-3.63)	(-3.38)	(-3.35)	(-3.36)
$Z_3^{\ell(i)}$			0.288***	0.289***	0.292***
			(5.03)	(5.08)	(5.17)
$Z_4^{\ell(i)}$				0.050*	0.069*
				(1.76)	(1.73)
$Z_5^{\ell(i)}$					-0.023
					(-0.57)
N	6567	6567	6567	6567	6567
R^2	0.167	0.174	0.186	0.186	0.186
Partial R^2	0.021	0.030	0.044	0.045	0.045
F-stat	56.16	28.90	27.61	21.05	17.13

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents, school characteristics and values of the instruments in 1992.

Table 24: First stage estimation: impact of the instruments (measured in 1993) on the preschool enrollment age (2 vs 3) at the Large District level

	IV1	IV2	IV3	IV4	IV5
$Z_1^{\ell(i)}$	-0.270***	-0.105**	-0.185***	-0.210***	-0.210***
	(-10.30)	(-2.50)	(-3.92)	(-4.53)	(-4.54)
$Z_2^{\ell(i)}$		-0.213***	-0.313***	-0.321***	-0.321***
		(-4.45)	(-5.56)	(-5.89)	(-5.88)
$Z_3^{\ell(i)}$			0.286***	0.212***	0.209***
			(6.88)	(4.92)	(4.84)
$Z_4^{\ell(i)}$				0.124***	0.112**
				(4.19)	(2.56)
$Z_5^{\ell(i)}$					0.013
					(0.37)
N	6567	6567	6567	6567	6567
R^2	0.129	0.135	0.161	0.169	0.169
Partial R^2	0.038	0.045	0.073	0.082	0.082
F-stat	101.16	53.47	43.79	36.77	29.43

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents and school characteristics.

Table 25: First stage estimation: impact of the instruments (measured in 1993) on the preschool enrollment age (2 vs 3) at the Large District level, when controlling for the values of the instruments in 1992

	IV1	IV2	IV3	IV4	IV5
$Z_1^{\ell(i)}$	-0.310***	-0.162***	-0.135**	-0.138**	-0.139**
	(-7.74)	(-2.92)	(-2.45)	(-2.52)	(-2.54)
$Z_2^{\ell(i)}$		-0.299***	-0.279***	-0.272***	-0.272***
		(-3.58)	(-3.20)	(-3.14)	(-3.15)
$Z_3^{\ell(i)}$			0.289***	0.294***	0.296***
			(4.86)	(4.92)	(5.00)
$Z_4^{\ell(i)}$				0.049*	0.067*
				(1.67)	(1.67)
$Z_5^{\ell(i)}$					-0.021
					(-0.53)
N	6567	6567	6567	6567	6567
R^2	0.169	0.176	0.188	0.188	0.188
Partial R^2	0.021	0.030	0.044	0.045	0.045
F-stat	54.19	28.59	27.27	20.91	16.99

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents, school characteristics and values of the instruments in 1992.

C.2 Comparing F-stat and partial R^2

In this section, we compare the F-stat and partial R^2 obtained by considering instruments in years (1992, 1993, 1994).

Table 26: First stage F-statistics for instruments measured in different years

	Year	IV1	IV2	IV3	IV4	IV5
Iris	1992	10.491	19.715	18.372	24.404	19.784
	1993	63.399	32.270	39.913	36.235	28.906
	1994	22.108	15.821	14.734	12.256	9.835
Contiguity	1992	11.510	18.631	24.845	28.910	23.151
	1993	61.034	28.959	43.055	36.259	29.003
	1994	15.893	22.336	24.654	20.067	16.042
Large District	1992	9.966	33.352	25.367	30.891	24.779
	1993	101.160	53.475	43.786	36.768	29.427
	1994	13.843	23.366	20.553	17.002	13.929

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents and school characteristics.

Table 27: First stage partial R^2 for instruments measured in different years

	Year	IV1	IV2	IV3	IV4	IV5
Iris	1992	0.012	0.014	0.027	0.043	0.043
	1993	0.019	0.021	0.056	0.066	0.066
	1994	0.013	0.015	0.037	0.043	0.043
Contiguity	1992	0.020	0.025	0.049	0.059	0.059
	1993	0.033	0.038	0.070	0.081	0.081
	1994	0.026	0.032	0.063	0.067	0.067
Large District	1992	0.024	0.031	0.049	0.062	0.062
	1993	0.038	0.045	0.073	0.082	0.082
	1994	0.026	0.035	0.059	0.063	0.063

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents and school characteristics.

D Second stage estimates

D.1 The effect of early preelementary school enrollment on cognitive and noncognitive skills in the first grade

Table 28: Impact of early schooling enrolment on 1st grade achievement using instruments constructed at the Iris level

	OLS	IV 1	IV 2	IV 3	IV 4	IV 5
Literacy	0.041	0.191	0.266	0.157	0.196	0.183
	(1.33)	(0.76)	(1.12)	(0.97)	(1.36)	(1.25)
Numeracy	0.059**	0.065	0.024	0.224	0.314**	0.308**
	(2.11)	(0.29)	(0.11)	(1.61)	(2.45)	(2.41)
Language	0.057**	-0.063	-0.058	0.099	0.111	0.116
	(2.03)	(-0.27)	(-0.25)	(0.75)	(0.94)	(0.97)
Sociability	0.060*	-0.004	-0.037	0.189	0.178	0.187
	(1.96)	(-0.02)	(-0.14)	(1.28)	(1.33)	(1.39)
School activities	0.065**	0.005	-0.003	0.146	0.135	0.131
	(2.23)	(0.02)	(-0.01)	(1.13)	(1.17)	(1.13)

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents and school characteristics;

Table 29: Impact of early schooling enrollment on the 1st grade achievement using instruments constructed at the Iris level, when controlling for the values of the instruments in 1992.

	OLS	IV 1	IV 2	IV 3	IV 4	IV 5
Literacy	0.043	0.051	0.296	0.246	0.247	0.250
	(1.39)	(0.19)	(1.24)	(1.22)	(1.26)	(1.27)
Numeracy	0.055*	0.345	0.311	0.277*	0.311*	0.311*
	(1.95)	(1.42)	(1.51)	(1.70)	(1.93)	(1.94)
Language	0.063**	0.193	0.278	0.206	0.192	0.188
	(2.23)	(0.82)	(1.38)	(1.30)	(1.24)	(1.21)
Sociability	0.068**	0.375	0.357	0.289*	0.274*	0.271
	(2.21)	(1.43)	(1.63)	(1.70)	(1.65)	(1.61)
School activities	0.067**	0.068	0.014	0.158	0.170	0.170
	(2.29)	(0.30)	(0.07)	(1.04)	(1.14)	(1.14)

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents, school characteristics and values of the instruments in 1992.

Table 30: Impact of early schooling enrolment on 1st grade achievement using instruments constructed at the Contiguity level

	OLS	IV 1	IV 2	IV 3	IV 4	IV 5
Literacy	0.041	-0.020	0.049	0.102	0.117	0.117
	(1.33)	(-0.11)	(0.29)	(0.69)	(0.90)	(0.90)
Numeracy	0.059**	0.214	0.163	0.260**	0.314***	0.314***
	(2.11)	(1.13)	(0.90)	(2.02)	(2.68)	(2.68)
Language	0.057**	0.042	-0.021	0.109	0.112	0.114
	(2.03)	(0.24)	(-0.12)	(0.91)	(1.04)	(1.05)
Sociability	0.060*	0.073	-0.005	0.167	0.158	0.161
	(1.96)	(0.39)	(-0.03)	(1.25)	(1.29)	(1.30)
School activities	0.065**	-0.063	-0.139	0.104	0.118	0.120
	(2.23)	(-0.38)	(-0.88)	(0.86)	(1.09)	(1.11)

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents and school characteristics;

Table 31: Impact of early schooling enrollment on the 1st grade achievement using instruments constructed at the Contiguity level, when controlling for the values of the instruments in 1992.

	OLS	IV 1	IV 2	IV 3	IV 4	IV 5
Literacy	0.033	-0.138	0.053	0.155	0.159	0.164
	(1.05)	(-0.53)	(0.23)	(0.75)	(0.78)	(0.81)
Numeracy	0.041	0.285	0.187	0.272	0.297*	0.293*
	(1.45)	(1.22)	(0.93)	(1.58)	(1.73)	(1.73)
Language	0.053*	0.222	0.134	0.187	0.178	0.165
	(1.89)	(0.99)	(0.73)	(1.18)	(1.14)	(1.05)
Sociability	0.058*	0.339	0.202	0.256	0.248	0.234
	(1.90)	(1.39)	(0.99)	(1.49)	(1.47)	(1.36)
School activities	0.058**	0.116	-0.065	0.127	0.133	0.129
	(2.01)	(0.58)	(-0.37)	(0.83)	(0.88)	(0.85)

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents, school characteristics and values of the instruments in 1992.

Table 32: Impact of early schooling enrollment on the 1st grade achievement using instruments constructed at the Large District level

	OLS	IV 1	IV 2	IV 3	IV 4	IV 5
Literacy	0.041	0.013	0.092	0.120	0.138	0.135
	(1.33)	(0.07)	(0.56)	(0.84)	(1.06)	(1.03)
Numeracy	0.059**	0.223	0.191	0.279**	0.340***	0.339***
	(2.11)	(1.39)	(1.28)	(2.26)	(2.97)	(2.96)
Language	0.057**	0.083	0.035	0.108	0.121	0.125
	(2.03)	(0.53)	(0.23)	(0.95)	(1.15)	(1.18)
Sociability	0.060*	0.166	0.108	0.191	0.192	0.199
	(1.96)	(0.92)	(0.63)	(1.47)	(1.60)	(1.64)
School activities	0.065**	0.076	0.009	0.132	0.143	0.145
	(2.23)	(0.48)	(0.06)	(1.13)	(1.35)	(1.37)

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents and school characteristics.

Table 33: Impact of early schooling enrollment on the 1st grade achievement using instruments constructed at the Large District level, when controlling for the values of the instruments in 1992.

	OLS	IV 1	IV 2	IV 3	IV 4	IV 5
Literacy	0.035	-0.042	0.178	0.183	0.180	0.187
	(1.12)	(-0.16)	(0.77)	(0.88)	(0.88)	(0.93)
Numeracy	0.045	0.397*	0.349*	0.322*	0.345**	0.343**
	(1.57)	(1.72)	(1.78)	(1.90)	(2.05)	(2.05)
Language	0.056**	0.288	0.244	0.187	0.176	0.165
	(1.99)	(1.31)	(1.36)	(1.22)	(1.16)	(1.08)
Sociability	0.059*	0.444*	0.353*	0.271	0.259	0.248
	(1.93)	(1.84)	(1.78)	(1.61)	(1.56)	(1.47)
School activities	0.060**	0.183	0.028	0.137	0.143	0.140
	(2.05)	(0.93)	(0.17)	(0.92)	(0.97)	(0.96)

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents, school characteristics and values of the instruments in 1992.

D.2 The effect of early preelementary school enrollment on later cognitive outcomes

Table 34: Impact of early schooling enrolment on later cognitive achievement using instruments constructed at the Iris level

	OLS	IV 1	IV 2	IV 3	IV 4	IV 5
Literacy 3rd Grade	0.048*	0.416**	0.459**	0.354***	0.357***	0.352***
	(1.65)	(2.12)	(2.43)	(2.66)	(3.03)	(2.92)
Literacy 6th Grade	-0.030	0.471**	0.491**	0.326**	0.306**	0.287**
	(-0.99)	(2.07)	(2.31)	(2.27)	(2.47)	(2.28)
Literacy 9th Grade	0.004	0.057	0.151	0.295**	0.239*	0.202
	(0.14)	(0.26)	(0.68)	(2.02)	(1.92)	(1.57)
Numeracy 3rd Grade	0.094***	0.129	0.153	0.256*	0.280**	0.275**
	(3.00)	(0.65)	(0.83)	(1.91)	(2.34)	(2.29)
Numeracy 6th Grade	0.013	0.447*	0.400*	0.204	0.201	0.186
	(0.40)	(1.79)	(1.68)	(1.36)	(1.44)	(1.32)
Numeracy 9th Grade	0.050	-0.127	-0.078	0.266	0.188	0.181
	(1.46)	(-0.52)	(-0.32)	(1.62)	(1.25)	(1.22)

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents and school characteristics;

Table 35: Impact of early schooling enrollment on later cognitive achievement using instruments constructed at the Iris level, when controlling for the values of the instruments in 1992.

	OLS	IV 1	IV 2	IV 3	IV 4	IV 5
Literacy 3rd Grade	0.036	0.261	0.384**	0.380**	0.374**	0.394***
	(1.19)	(1.35)	(2.10)	(2.47)	(2.50)	(2.60)
Literacy 6th Grade	-0.040	0.287	0.306	0.295*	0.303*	0.307*
	(-1.26)	(1.25)	(1.49)	(1.77)	(1.85)	(1.83)
Literacy 9th Grade	0.009	0.041	0.239	0.398**	0.415**	0.408**
	(0.28)	(0.20)	(1.24)	(2.32)	(2.45)	(2.35)
Numeracy 3rd Grade	0.084***	0.053	0.115	0.308*	0.327**	0.332**
	(2.64)	(0.23)	(0.56)	(1.95)	(2.12)	(2.15)
Numeracy 6th Grade	0.012	0.313	0.280	0.232	0.265	0.268
	(0.39)	(1.25)	(1.31)	(1.37)	(1.57)	(1.57)
Numeracy 9th Grade	0.057	-0.057	0.033	0.388*	0.440**	0.437**
	(1.63)	(-0.26)	(0.16)	(1.94)	(2.21)	(2.19)

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents, school characteristics and values of the instruments in 1992.

Table 36: Impact of early schooling enrolment on later cognitive achievement using instruments constructed at the Contiguity level

	OLS	IV 1	IV 2	IV 3	IV 4	IV 5
Literacy 3rd Grade	0.048*	0.393***	0.413***	0.377***	0.346***	0.359***
	(1.65)	(2.83)	(3.08)	(3.25)	(3.36)	(3.45)
Literacy 6th Grade	-0.030	0.354*	0.381**	0.325***	0.319***	0.319***
	(-0.99)	(1.96)	(2.26)	(2.60)	(2.88)	(2.84)
Literacy 9th Grade	0.004	0.357*	0.406**	0.385***	0.354***	0.348***
	(0.14)	(1.81)	(2.13)	(2.98)	(3.08)	(2.96)
Numeracy 3rd Grade	0.094***	0.170	0.197	0.329***	0.319***	0.322***
	(3.00)	(1.13)	(1.40)	(2.68)	(2.93)	(2.97)
Numeracy 6th Grade	0.013	0.170	0.152	0.228*	0.277**	0.276**
	(0.40)	(1.06)	(1.01)	(1.84)	(2.38)	(2.36)
Numeracy 9th Grade	0.050	-0.001	0.012	0.294**	0.315**	0.313**
	(1.46)	(-0.00)	(0.07)	(2.10)	(2.47)	(2.46)

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents and school characteristics;

Table 37: Impact of early schooling enrollment on later cognitive achievement using instruments constructed at the Contiguity level, when controlling for the values of the instruments in 1992.

	OLS	IV 1	IV 2	IV 3	IV 4	IV 5
Literacy 3rd Grade	0.024	0.294	0.373**	0.396**	0.373**	0.414***
	(0.82)	(1.62)	(2.14)	(2.51)	(2.44)	(2.66)
Literacy 6th Grade	-0.053*	0.232	0.264	0.276*	0.280*	0.291*
	(-1.70)	(1.12)	(1.40)	(1.67)	(1.72)	(1.76)
Literacy 9th Grade	-0.009	0.317	0.404**	0.413**	0.412**	0.419**
	(-0.27)	(1.63)	(2.21)	(2.47)	(2.50)	(2.50)
Numeracy 3rd Grade	0.076**	0.212	0.278	0.382**	0.370**	0.385**
	(2.39)	(1.04)	(1.49)	(2.35)	(2.34)	(2.44)
Numeracy 6th Grade	-0.003	0.355	0.334*	0.272	0.288*	0.298*
	(-0.10)	(1.54)	(1.67)	(1.63)	(1.74)	(1.78)
Numeracy 9th Grade	0.040	0.277	0.284	0.381**	0.399**	0.399**
	(1.14)	(1.36)	(1.54)	(2.09)	(2.21)	(2.21)

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents, school characteristics and values of the instruments in 1992.

Table 38: Impact of early schooling enrollment on later cognitive achievement using instruments constructed at the Large District level

	OLS	IV 1	IV 2	IV 3	IV 4	IV 5
Literacy 3rd Grade	0.048*	0.322**	0.358**	0.329***	0.308***	0.314***
	(1.65)	(2.21)	(2.52)	(2.82)	(2.94)	(2.94)
Literacy 6th Grade	-0.030	0.182	0.218	0.234*	0.231**	0.222**
	(-0.99)	(1.17)	(1.54)	(1.92)	(2.09)	(1.98)
Literacy 9th Grade	0.004	0.139	0.215	0.298**	0.284**	0.268**
	(0.14)	(0.91)	(1.45)	(2.41)	(2.52)	(2.32)
Numeracy 3rd Grade	0.094***	0.144	0.185	0.288**	0.282***	0.283***
	(3.00)	(0.95)	(1.30)	(2.40)	(2.60)	(2.61)
Numeracy 6th Grade	0.013	0.106	0.079	0.174	0.213*	0.207*
	(0.40)	(0.64)	(0.52)	(1.35)	(1.76)	(1.69)
Numeracy 9th Grade	0.050	-0.027	0.001	0.258*	0.284**	0.280**
	(1.46)	(-0.17)	(0.00)	(1.90)	(2.24)	(2.22)

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents and school characteristics.

Table 39: Impact of early schooling enrollment on later cognitive achievement using instruments constructed at the Large District level, when controlling for the values of the instruments in 1992.

	OLS	IV 1	IV 2	IV 3	IV 4	IV 5
Literacy 3rd Grade	0.027	0.173	0.283	0.346**	0.336**	0.374**
	(0.91)	(0.95)	(1.60)	(2.16)	(2.16)	(2.34)
Literacy 6th Grade	-0.045	0.113	0.156	0.219	0.229	0.235
	(-1.42)	(0.54)	(0.84)	(1.33)	(1.40)	(1.41)
Literacy 9th Grade	-0.002	0.215	0.360**	0.374**	0.377**	0.383**
	(-0.05)	(1.15)	(2.02)	(2.29)	(2.32)	(2.31)
Numeracy 3rd Grade	0.081**	0.105	0.194	0.348**	0.352**	0.363**
	(2.51)	(0.52)	(1.06)	(2.12)	(2.19)	(2.27)
Numeracy 6th Grade	0.005	0.327	0.297	0.258	0.271	0.276
	(0.15)	(1.40)	(1.46)	(1.52)	(1.61)	(1.62)
Numeracy 9th Grade	0.046	0.261	0.300	0.389**	0.409**	0.409**
	(1.29)	(1.30)	(1.64)	(2.15)	(2.28)	(2.28)

Notes : Source : *Panel DEPP 1997*. Standard errors are clustered at the school level. T-test statistics are reported between parentheses. All estimations include controls for child month of birth, gender, household, parents, school characteristics and values of the instruments in 1992.