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## Does Pre-School Improve Child Development and Affect the Quality of Parent-Child Interaction? Evidence from Algeria

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# **DOES PRE-SCHOOL IMPROVE CHILD DEVELOPMENT AND AFFECT THE QUALITY OF PARENT-CHILD INTERACTION? EVIDENCE FROM ALGERIA**

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## **Abstract**

This paper investigates the impact of attending early childcare on the quality of parent–child interactions and children’s cognitive outcomes. My identification strategy exploits geographical differences in terms of exposure to the program, controlling for the period when the program is implemented across Algerian municipalities as an instrument for individual early childcare attendance. I estimate 2SLS regression analysis and employ a difference-in-difference strategy. I use two Multiple Indicator Cluster Surveys conducted in 2006 and 2012. I find a positive effect of preschool on the cognitive development of children. In turn, the effect is only significant for mother with negative effect on the interaction between mother and children, which means that there is a substitution effect, mother use this time to do something else. These findings call for future research on parents’, especially mother’s, time use when their children attend early childcare.

**Keywords:** Childcare, Cognitive skills, Family–child interaction, Time use, two stage least squares, Difference-in-difference.

**JEL Classification:** J13, H75, I20, I28.

## **1. Introduction**

Early childhood development is the most important phase of human development. Experiences in early childhood strongly influence learning, education, health, employment and social engagement throughout life. The first years of a child's life are a window of opportunity to build a solid foundation of human development (Heckman, 2006, Shonkoff & Phillips, 2000). Gaps in early childhood development have always been a challenge in the Maghreb. Children have unequal chances to develop due to a variety of factors around their birth. The success or failure of countries in promoting early childhood development will not only determine the life cycle of young children, but also the development trajectories of countries. Nores & Barnett (2010) find that investments in early childhood would have a significant impact on economic growth by promoting the accumulation of human capital. Such an investment would have a return in excess of costs that would otherwise have occurred (Engle et al., 2011). Heckman & Masterov (2007) showed that early childhood policies promote equity in society.

An increasing number of studies estimate the effects of universal childcare programs on cognitive outcomes. Berlinski, Galiani, and Gertler (2009) and Felfe and Lalive (2018) estimate the effects on children's behavioral outcomes in Argentina and Germany, respectively, and find that childcare enrolment improves children's behavior. There is striking evidence that extending preschool access to the poorest and most vulnerable children can boost their education and livelihood opportunities later in life.

The positive effects of early childhood education (ECE) are well documented in the literature. ECE attendance improves health, cognitive and psychosocial development of children (Behrman, Chen, & Todd, 2004, Mustard 2007, Waldfogel 2006). Early childhood education plays a role of equalizer between the poor and the wealthy inasmuch as children from more disadvantaged households benefit more from ECE attendance (Irwin, Siddiqi, & Hertzman, 2007). Early childhood education is also important for sustainable economic development, since it considerably improves the future productivity of children (i.e. Grunewald & Rolnick, 2007; Magnuson, Meyers, & Waldfogel, 2007).

Evidence from empirical studies shows that participation in an early childhood education program improves not only the cognitive skills but also the socio-emotional skills of children. Heckman, Pinto, and Savelyev (2013) conclude that the program leads to less crime, lower receipt of welfare, and greater voter turnout through improving socio-emotional skills. Overall, their findings suggest that the program has positive externalities and therefore benefits the whole of society. Datta Gupta and Simonsen (2010) evaluated the universal childcare program in Denmark and identified no significant effects on non-cognitive child outcomes.

While a number of studies estimate the efficacy of childcare programs, only a few examine the mechanisms through which childcare enrollment impacts children. Baker et al. (2008) find that the childcare program in Quebec leads to more hostile and less consistent parenting and lower-quality parental relationships. In contrast, Gelber and Isen (2013) analyze US data from the Head Start Impact Study and find that Head Start causes a substantial increase in parental involvement with their children.

The parent-child relationship during the preschool period influences the formation of children's attitudes about the world and about themselves, teaches children how to respond to different situations, and to develop emotional perception of their environment. The empirical works show that childcare enrollment increases monetary investment in children, improves parenting quality, and improves the wellbeing of less-educated mothers. Analysis suggests that informing less-educated mothers about better parenting practices brings about a more positive home environment for children.

The benefits of high-quality parent-child interactions have been demonstrated through the research literature. Better parent-child interactions are associated with more secure attachments between children and parents which in turn lead to psychosocial well-being and resilience (Dallaire & Weinraub, 2007). Higher-quality parent-child interactions are also associated with improvement in problem solving skills and general cognitive outcomes, fostering higher academic achievement (Maulik & Darmstadt, 2009).

Parent-child interaction through the form of telling stories and singing together are predictors of enhanced language development (Smith & Gibbard, 2011). Improved parent-child interactions are also a predictor of improved non-cognitive skills, for instance, motivation and enthusiasm (Carneiro & Heckman, 2003).

Schady & Araujo (2008) demonstrated that childcare enrolment is associated with lower levels of parent-child interactions, which in turn lead to lower levels of socio-emotional development among those children. Carneiro & Heckman (2003) found similar results using data from the Panel Study of Income Dynamics. They found that childcare enrolment, and thus being away from parents, is associated with poorer cognitive and non-cognitive skills. Other researchers (Harvey, 1999; Scarr, 1997) have confirmed similar negative effects of childcare as it relates to parent-child interactions.

Craig (2005) found that the parents of childcare-enrolled children were able to successfully maintain interaction time with their children even if employed full-time. Edwards, Logue, Loehr, and Roth (1986) reported that homes of childcare-enrolled children became more child-centered over time, leading to higher quality parent-child interaction.

The focus on early childhood education traces back to the findings of Heckman et al (2013) suggesting that ability gaps between individuals and socioeconomic groups open up at early ages for both cognitive and non-cognitive skills. Through this study, I attempt to fill an important gap in the literature regarding the effect of

childcare enrolment on the cognitive development of children and the impact on the quality of parent–child interactions in the Middle East and North Africa (MENA) region.

The paper is organized as follows. In section 1, I reviewed the existing literature on the effects of childcare enrolment on child development. In section 2, I describe the Algerian public early childcare system. In section 3, I present the data. In section 4, I illustrate my identification strategy. In section 5, I provide a descriptive analysis. I discuss the empirical results in section 6. Section 7 concludes.

## **2. Algerian education system**

The Algerian education system is divided into five levels: 1) Preschool program, 2) Preparatory education, 3) Basic education, combining primary and middle education, 4) Secondary education and finally 5) Higher education (See Figure 1). Pre-schools are physically and administratively attached to primary schools. They typically operate two shifts (morning and afternoon) each for three and a half hours a day, five days a week over the nine-month school year. The organization and management of the primary, middle, and secondary levels are ensured by the Ministry of National Education. The management of higher education is entrusted to the Ministry of Higher Education and Scientific Research.

In 2008, the Algerian government introduced free public preschool for children aged three to four. The reforms of the National Education systems in 2008 specified that pre-school education prepares children for primary education. Pre-school education brings together, before compulsory schooling, the various stages of socio-educational care for children ages three to four. It is provided in preparatory schools, kindergartens and open kindergarten classes in primary schools. Preparatory education, within the meaning of this law, corresponds to the final stage of pre-school education; it is the one that prepares children, aged five years old, to access primary education. We use this policy change—the introduction of free public preschool in Algeria—to estimate the effects on child development.

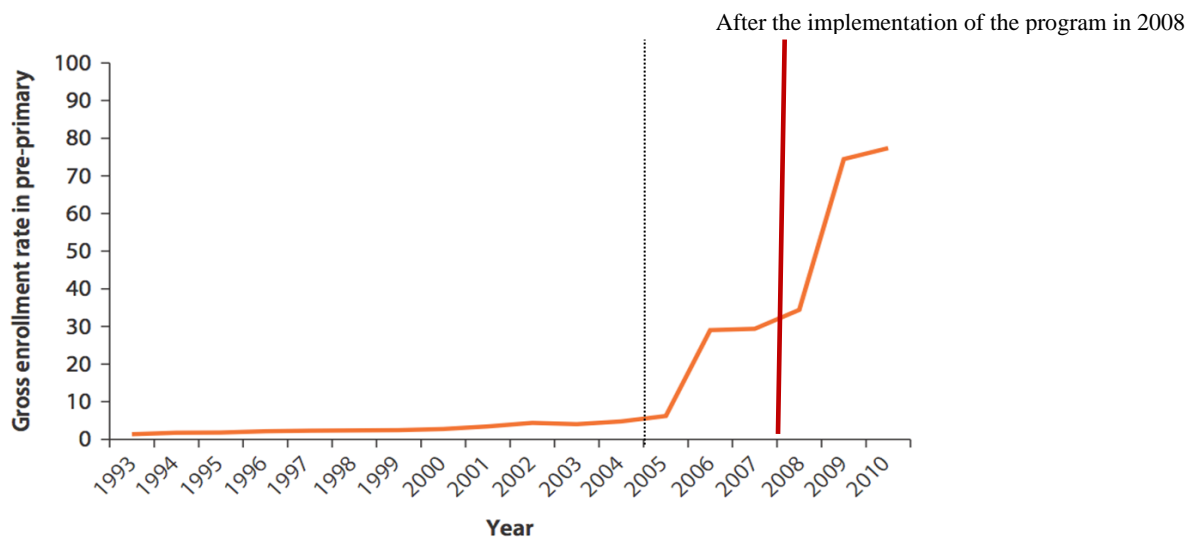
Preschool programs in Algeria have two main objectives: 1) Improve the cognitive and non-cognitive development of children, and 2) Deliver centralized, nationwide, universal free-of-charge services aimed at reducing income, gender, education, regional, and rural–urban disparities. The purpose of preparatory education is to a) encourage the children's enjoyment of their personalities through playful activities, b) make them aware of their body, especially thanks to the acquisition, by the play of sensor motor skills, c) instill good habits through training in community life, d) develop their practice of language through communication situations induced through activities and games, e) introduce them to the first elements of reading, writing and arithmetic through appropriate activities and games.

In order to achieve these goals, the curriculum was explicitly designed to develop: a) communication skills, b) personal autonomy and behavioral skills, c) social skills, d) logical and mathematical skills and e) emotional skills.

Noting the non-compulsory nature of preschool education, the state ensures the development of preparatory education and pursues its generalization with the help of public institutions, associations and the private sector<sup>1</sup>.

Algeria has made enormous progress in ECE attendance in recent years. Starting in 1993, gross enrollment in pre-primary was only 1 percent. As recently as 2005, the gross enrollment rate in pre-primary was only 6 percent, but starting in 2006, enrollments rapidly increased, reaching a high of 70.

**Figure 1: Enrollment Rate in Pre-Primary (ECE)**



**Source:** World Development Indicators<sup>2</sup>.

### 3. Data

I use data from Multiple Indicator Cluster Surveys (MICS) conducted in 2006 and 2012 by UNICEF. The MICS is a nationally representative survey of children and women. The MICS contains three model questionnaires: a questionnaire for children under the age of 5 (addressed to the mother or primary caretaker of the child), a questionnaire for women, and a household questionnaire. The children's questionnaire contains age and gender of every child in the household. Most importantly for our study, the children's questionnaire contains a question about early childhood education (ECE) attendance, which is asked for every child of preschool age (3-4 years). The women's questionnaire contains information about age of the mother and her educational attainment. The household questionnaire contains information about each household such as place

<sup>1</sup> Private school started in 2014.

<sup>2</sup> Expanding Opportunities for the Next Generation Early Childhood Development in the Middle East and North Africa – World Bank Group report - El-Kogali S., Krafft C- pp71.

of living (rural–urban, regions) and the wealth of the household as indicated by the wealth index. Linking the household and child questionnaire allows the attribution of the above-mentioned household characteristics to every child. For the survey conducted in 2006 (MICS3) the sample size is around 29,000 households, more than 43,600 women aged 15-49 and 15,000 children under five years were interviewed. For the survey conducted in 2012 (MICS4) the sample size is around 27000 households. More than 38,500 women aged 15-49 and 14,700 children under five years were interviewed. In addition to the MICS survey, I used administrative data from Ministry of Education (distribution of primary school and pre-school classes at governorate and municipality levels between 2006 and 2016).

#### **4. Identification strategy**

##### **4.1. Two-Stage least squares (2SLS) regression**

It would be ideal to compare the development and parent-child interaction outcomes of children who were randomly offered places in preschool to those who were not. However, I am unable to conduct a randomized experiment, so I turn to non-experimental methods.

The quasi-experimental program evaluation focuses on the estimation of the Average Treatment Effect (ATE), that is the average effect of a treatment on the outcome of interest. Here, treatment is defined as enrolment in a preschool program and the outcomes of interest are 1) cognitive development and 2) the quality of parent–child interaction.

Consider a child  $i$  from a sample of  $n$  children, providing that these  $n$  children are drawn at random from across the entire population. Variable  $Y_i$  is a binary treatment indicator. The treatment indicator denotes whether the child is enrolled in preschool. A child's outcome is defined as  $Y_{1i}$  if the child received treatment and as  $Y_{0i}$  if the child did not receive treatment. To measure the effect of treatment, I compute the difference in outcomes with and without treatment. Consequently, the Average Treatment Effect can be computed as  $ATE \equiv E(Y_{1i} - Y_{0i})$ , where the ATE represents the expected average effect of treatment on an individual who has been randomly drawn from the population. Computation of ATE allows us to say what would be the outcome of the participation in the treatment if every child could participate in the treatment.

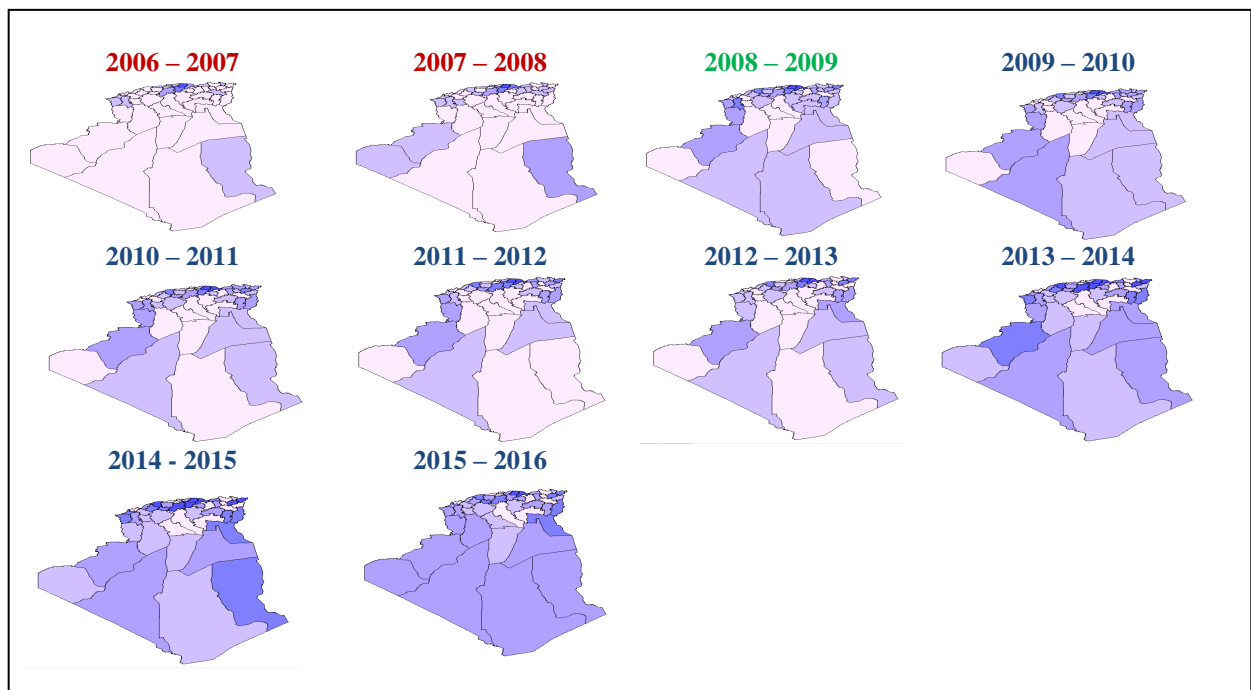
The problem known as the “selection on unobservables” arises when observational data are used. The children who are enrolled in pre-school are different from those who are not enrolled in unobservable ways that are simultaneously correlated with the outcome of interest. A single-equation regression model that ignores the effects of unobservable will produce inconsistent estimates. To address the issue of the selection on unobservables, I estimate 2SLS regression, two-stage simultaneous equations for the participation in treatment and outcome. In the first stage, preschool enrolment is regressed on all exogenous variables and instruments. In the second stage main equation, the outcome variable the quality of parent-child interaction is regressed on all

endogenous variables and on the predicted treatment variable. ATE is equal to the value of the regression coefficient on treatment in the main equation.

I exploit the variation introduced by the program's expansion over time that generated differences in exposure by municipality as an instrumental variable (see Figure 2). The only criterion for the construction of primary schools is the number of children of school age in a municipality (Art. 4)<sup>3</sup>. Preschool classes are physically and administratively attached to primary schools.

I run regressions on the number of primary schools at the municipality level by some locality characteristics to determine if the implementation of primary school is due only to the proportion of children of school age (see annex 1). The results show that the number of children 0 to 4 years old is strongly significant with a positive correlation with the number of primary schools. The proportion of households with electricity connection and the proportion of households with internet are both significant with positive effects, but at the 10 percent level. The number of children of school age is the principal determinant of the implementation of primary schools in a locality.

**Figure 2:** Number of preschool class per child age 0 - 4 constructed by governorates between 2006 and 2016



**Source:** Computed by the author from data of Ministry of Education.

<sup>3</sup> Official Newspaper, January 4, 2010 - page 8.



## 4.2. Difference-in-difference (DID) strategy

DID is usually implemented as an interaction term between time and treatment group dummy variables in a regression model.

$$Y = \beta_0 + \beta_1 [\text{Time}] + \beta_2 [\text{Intervention}] + \beta_3 [\text{Time*Intervention}] + \beta_4 [\text{Covariates}] + \varepsilon$$

With:

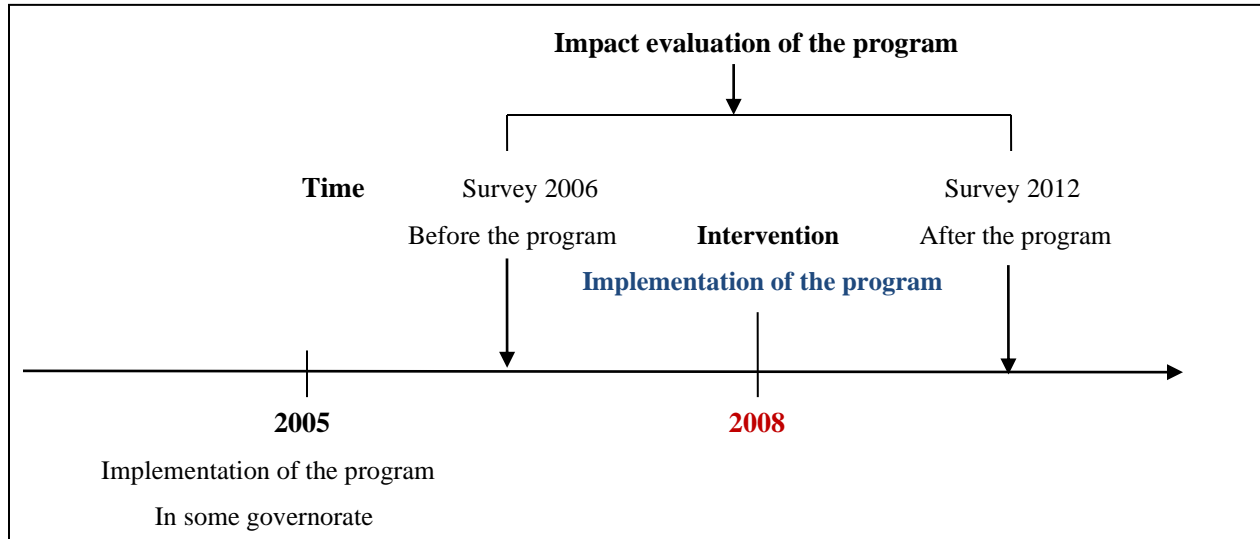
$\beta_0$  : Baseline average

$\beta_1$  : Time trend in control group

$\beta_2$  : Difference between two groups pre-intervention

$\beta_3$  : Difference in change over time

**Figure 3:** Illustration of DID strategy



### Research questions

The two principal research questions of this study are:

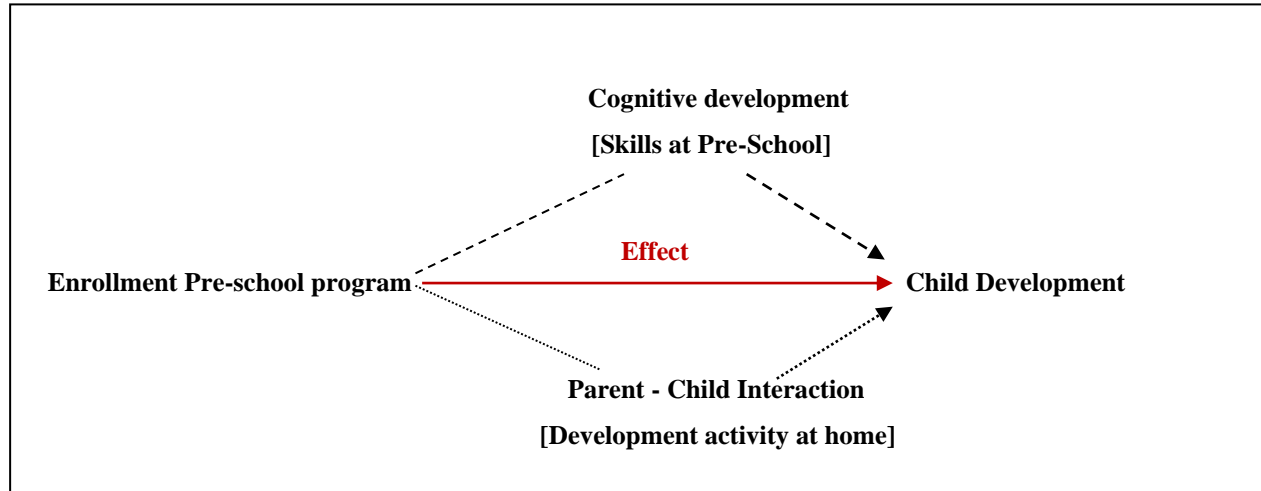
- 1) Does early childhood education improve children's cognitive development?
- 2) What are the effects of preschool on the quality of parent-child interactions in Algeria? Are they substitution effects or complementary effects?

The MICS defines childcare as any organized learning or early childhood education program, such as a private or government facility, including community childcare or kindergarten. The MICS asks if a child under 5 had attended childcare within the last 7 days. Based on this information, I create an indicator treatment variable =1 if child was enrolled in childcare, and =0 if otherwise. A major challenge in identifying the causal effect of preschool attendance on outcomes (cognitive development and parental-child interaction) is non-random

selection into early education. We use as instrumental variables the geographical differences in terms of exposure to the program controlling the period where the program is implemented in the governorates.

To answer the research questions, I use a quasi-experimental evaluation of the non-randomized data from national surveys conducted in Algeria.

**Figure 4:** Effect of Pre-school on Child Development



#### 4.3. Outcome variable

##### a. Cognitive development

For the first research question the outcome variable is cognitive development. Seven questions related to child's cognitive development are asked but only in the survey of 2012. The measures are as follows: 1) Child knows or can recite at least ten letters of the alphabet, 2) Child can read some words, 3) Child is able to follow simple instructions to do something, 4) Child is able to do something independently, 5) Child gets along well with other children, and 6) Child is easily distracted. In the first step we sum up six dichotomous questions to develop a cognitive development index (the highest value is 6 and the lowest value is 0). In the second step we construct a cognitive development index using principal component analysis.

##### b. Quality index of parent–child interaction

For the second research question the outcome variable is the quality of parent–child interactions. The MICS contains a set of six dichotomous questions about the quality of parent–child interactions: 1) spends time with the child by naming, counting, or drawing things, 2) plays with the child, 3) tells stories to the child, 4) takes the child outside the home, compound, yard, or enclosure, 5) sings songs with the child, and 6) reads books or looks at pictures with the child. The mother, father, and any other family member older than 15 years are asked if they had been involved in the six above-mentioned interactions with the child within the past three days. First, we sum up six dichotomous questions to develop a quality index of parent–child interaction. We calculate

different indexes: interaction between mother and child (index 1), interaction between father and child (index 2), interaction between parents (mother and father) and child (index 3), interaction between all family members and child (index 4) and finally if at least one person in family interacts with child to do development activities at home (index 5). I also construct a quality index of parent-child interaction using principal component analysis.

For indices 1, 2, and 5, the highest value for the index (6) indicates the highest quality of parent-child interactions. The lowest value of the index (0) indicates the lowest quality of parent-child interactions. For index 3, the value of the index has a range of 0 to 12. For index 4, the value of the index has a range of 0 to 18. The highest value for the index (18) indicates the highest quality of parent-child interactions. This value is achieved if all members of the family were engaged in all six activities with the child within past three days. The lowest value of the index (0) indicates the lowest quality in terms of the quality of parent-child interactions. This value is achieved if no one in the family engaged in development activities with the child in the past three days. In the second step, I construct an index of quality of parent-child interaction using principal component analysis to take into account the weights of different variables. The questions related to development activities are asked in both the 2006 and 2012 MICS and in the same way.

## **5. Enrollment into Pre-school program and development of child**

### **5.1. Determinants of preschool enrolment**

Descriptive analysis shows that, in urban areas, the proportion of children enrolled in pre-school is higher compared to rural areas. This result can be explained by the greater number of pre-school establishments and the conditions of access (for example, transportation) that are available in urban areas. It is important to note that the proportion of children enrolled in preschool increased between 2006 and 2012 in both rural and urban areas. This is due to the government's decision to generalize the preschool program throughout the nation. There are notable differences in the preschool enrolment by region of residence. The proportion of children enrolled in preschool has increased in all regions, but the increase is largest in the North and South. Preschool enrolment is positively correlated with mother's education. A higher level of education for the mother is associated with a higher proportion of children enrolled in preschool. The effect of the mother's education on children's preschool enrolment is increasing over time.

**Table 1:** Percentage of children enrolled in preschool by characteristics (2006 – 2012)

Child in Preschool (3 – 4 years)	2006 (%)	Chi <sup>2</sup>	2012 (%)	Chi <sup>2</sup>
<b>Residence</b>		***		***
Rural	4		7	
Urban	13		23	
<b>Region</b>		***		***
Northeast	8		17	
North Central	9		24	
Northwest	10		17	
Higher Plateau Central	4		5	
Higher Plateau East	8		13	
Higher Plateau West	9		8	
South	15		28	
<b>Mother's education</b>		***		***
Without instruction	3		5	
Primary	7		10	
Below secondary	10		20	
Secondary	14		23	
Higher education	31		36	
<b>Wealth</b>		***		***
Poorest	3		7	
Poorer	4		12	
Middle	6		15	
Richer	11		20	
Richest	20		30	
<b>Total</b>	9		17	

**Source:** Computed by the author from the 2006 and 2012 MICS surveys.

There is a positive correlation between wealth and preschool enrolment. This means that the proportion of children from rich households enrolled in preschool is higher compared to children from poor households. The wealth effect is larger in 2012 compared to 2006 for all wealth levels, but the most significant increase is observed for the highest level of wealth.

## 5.2. Pre-school enrolment and cognitive development

Table 2 shows that children enrolled in preschool have higher scores in cognitive indicators compared to children not enrolled in preschool. Thus, the proportion of children enrolled in preschool who: know at least ten letters of alphabet, can read a few sentences, can count, can follow simple instructions, do things independently of adults, are more important compared to children not enrolled in pre-school. Also, children enrolled in preschool are less violent and less distracted compared to children not enrolled in preschool. These descriptive statistics give us promising information on the positive effects of preschool on children's cognitive development, but we need to control for other factors to rule out selection bias.

**Table 2:** Percentage of children achieving development milestones by preschool enrollment

Development measure	Preschool enrolment		Total
	No preschool	Preschool	
Child knows or can recite at least ten letters of the alphabet	26	66	33
Child is able to read some words	15	41	19
Child is able to count	32	66	38
Child is able to follow simple instructions to do something	85	89	89
Child is able to do something independently	81	88	82
Child gets along well with other children	84	87	84
Child is easily distracted	59	53	58

**Source:** Computed by the author from the 2012 MICS.

### 5.3. Pre-school enrolment and quality of parent-child interaction

Children's preschool is positively correlated with the development activities carried out by parents in the home. For example, in a household where there is a child enrolled in preschool, more than 69% of parents read books or show picture books to their children, compared to 46% in households with children not enrolled in preschool. For telling stories, the percentages are 84% and 72% respectively. For singing songs, the percentages are 85% and 74% respectively. For spending time with the child, the proportions are 95% and 85% respectively.

**Table 3:** Quality of parent-child interaction (percentages) by preschool enrollment

	Preschool enrolment		Total
	No Preschool	Preschool	
<b>Read books or look at picture books</b>			
2006 ***	37	65	40
2012 ***	46	69	50
<b>Tell stories</b>			
2006 ***	76	83	77
2012 ***	72	84	74
<b>Sing songs</b>			
2006 **	82	87	82
2012 ***	74	85	76
<b>Take a walk outside the house</b>			
2006 ***	91	96	92
2012 ***	85	89	86
<b>Play</b>			
2006 NS	95	95	95
2012 *	93	95	93
<b>Spend time together</b>			
2006 ***	63	82	65
2012 ***	85	95	87

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Source:** Computed by the author from the 2012 MICS.

## **6. Findings**

### **6.1. Preschool enrolment and cognitive development**

To analyse the effect of preschool enrolment on child cognitive development, I first estimate an OLS regression. Second, I estimate the reduced form and the 2SLS regression equation. I exploit the variation introduced by the program's expansion over time (that generated differences in exposure) by municipality as an instrumental variable. I use two dependent variables. First, I sum the six dichotomous questions to develop a cognitive development index. In the second step I construct a cognitive development index using principal component analysis (PCA).

The first result that emerges is that, overall, results are similar regardless of the index used. From the OLS regression I find that preschool enrolment has a positive association with cognitive development. This is true for both boys and girls (see annex table 3). As expected, several other variables affect children's cognitive development, such as mother's education. Household wealth is also positively correlated with children's cognitive development. When I estimate the relationship between preschool enrollment and each child development factor separately, I find that enrolment has the greatest association with children's reading, counting, and letter knowledge (see annex table 4). The association is positive but smaller for the ability to follow simple instructions, act independently, and some motor skills (catching an object). Finally, enrollment in preschool does not relate to interaction with other children.

In the reduced form, the dependent variable is children's cognitive development. We introduce the instrumental variable—number of preschool classes per child aged 0 – 4 at the municipality level—in the controls. The results show that the instrumental variable is very significant.

The results of the 2SLS model show a positive and significant association between urban residence and preschool enrolment. We observe some differences according to the region of residence. Residence in the Northeast and South of Algeria is positively associated with preschool enrolment compared to the North Central region. However, the effect is negative for those living in the Higher Plateau region. The probability of preschool enrolment increases with education of mothers. There is also a positive correlation between preschool enrolment and household wealth. The instrument (number of preschool classes per child aged 0 – 4 at the municipality level) is significant with positive relationship between preschool class to child ratio and preschool enrolment. The most important variable in the main stage regression equation is preschool enrolment. I find that preschool enrolment improves the cognitive development of children.

These results have important implications for public policy. Policy makers should continue their efforts to implement preschool and build schools throughout the nation.

**Table 4:** Models of cognitive development and preschool enrolment: OLS and 2SLS

	OLS Model			2SLS Model	
	Index	PCA	Reduced form model	First stage	Second stage
Dependent Variable:	Cognitive development	Cognitive development	Cognitive development	Preschool enrolment	Cognitive development
<b>Enrollment into Pre-school program</b>	<b>1.062***</b> (0.0635)	<b>1.087***</b> (0.0553)			<b>5.695**</b> (3.162)
<b>Sex</b>					
Male	-0.235*** (0.0445)	-0.138*** (0.0387)	-0.243*** (0.0460)	-0.00696 (0.0102)	-0.206*** (0.0685)
Female (ref)					
<b>Residence</b>					
Urban	0.0151 (0.0571)	0.0104 (0.0497)	0.105* (0.0594)	0.0817*** (0.0132)	-0.359 (0.261)
Rural (ref)					
<b>Region (ref: North Central)</b>					
Northeast	0.0692 (0.0934)	0.0144 (0.0813)	0.127 (0.0972)	0.0717*** (0.0216)	-0.290 (0.256)
Northwest	-0.552*** (0.0892)	-0.419*** (0.0777)	-0.581*** (0.0932)	0.00363 (0.0207)	-0.596*** (0.131)
Higher Plateau Central	-0.201** (0.0849)	-0.0530 (0.0740)	-0.300*** (0.0893)	-0.0795*** (0.0198)	0.152 (0.299)
Higher Plateau East	-0.349*** (0.0847)	-0.387*** (0.0738)	-0.430*** (0.0895)	-0.0375* (0.0199)	-0.207 (0.184)
Higher Plateau West	0.141 (0.0864)	0.155** (0.0752)	0.0373 (0.0899)	-0.0706*** (0.0200)	0.438* (0.266)
South	-0.523*** (0.0825)	-0.483*** (0.0718)	-0.413*** (0.0864)	0.128*** (0.0192)	-1.135*** (0.404)
<b>Mother's education (ref: no education)</b>					
Primary	0.225*** (0.0709)	0.314*** (0.0617)	0.236*** (0.0735)	0.0151 (0.0163)	0.148 (0.115)
Less than secondary	0.301*** (0.0677)	0.322*** (0.0590)	0.382*** (0.0698)	0.0660*** (0.0155)	-0.00166 (0.231)
Secondary	0.345*** (0.0735)	0.431*** (0.0640)	0.444*** (0.0757)	0.0854*** (0.0168)	-0.0384 (0.290)
Higher education	0.396*** (0.101)	0.458*** (0.0878)	0.644*** (0.103)	0.187*** (0.0230)	-0.441 (0.609)
<b>Wealth (ref: Poorest)</b>					
Poorer	0.0646 (0.0737)	0.0966 (0.0642)	0.118 (0.0765)	0.0257 (0.0170)	-0.0383 (0.138)
Middle	0.0570 (0.0799)	0.148** (0.0696)	0.135 (0.0829)	0.0443** (0.0184)	-0.119 (0.185)
Richer	0.151* (0.0820)	0.211*** (0.0714)	0.215** (0.0848)	0.0573*** (0.0188)	-0.104 (0.222)
Richest	0.343*** (0.0864)	0.300*** (0.0753)	0.470*** (0.0892)	0.117*** (0.0198)	-0.197 (0.397)
<b>Number of preschool classes (per child aged 0 – 4) at municipality level</b>			<b>0.00147**</b> (0.000586)	<b>0.000262**</b> (0.000130)	
Constant	5.247*** (0.0879)	-0.369*** (0.0766)	5.199*** (0.0989)	-0.00301 (0.0220)	5.217*** (0.137)
<b>Observations</b>	<b>4807</b>	<b>4807</b>	<b>4761</b>	<b>4740</b>	<b>4740</b>

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Source:** Computed by the author from the 2012 MICS.

## 6.2. Does preschool enrolment influence parent-child interactions?

### 6.2.1. 2SLS estimation

To analyze the impact of preschool on the quality of interaction between parents and children, I calculate different indexes: interaction between mother and child (index 1), interaction between father and child (index 2), interaction between parents (mother and father) with child (index 3), interaction between all family members and child (index 4) and finally if at least one person in family interacts with child to do development activities at home (index 5). I also construct a quality index of parent-child interaction using principal component analysis. For each index, I first estimate an OLS regression, in the second step I estimate the reduced form and 2SLS regression. I exploit the variation introduced by the program's expansion over time by municipality as an instrumental variable.

**Table 5:** Determinants of the quality of parent-child interaction: OLS estimation, PCA

	Mother Interaction	Father Interaction	Mother + Father Interaction	At least one of family members	All household members
<b>Sex</b>					
Male	-0.0333 (0.0391)	0.141*** (0.0400)	0.0821* (0.0459)	-0.0116 (0.0410)	-0.0700 (0.0453)
Female (ref)					
<b>Enrollment into Pre-school program</b>					
Yes	<b>0.289***</b> <b>(0.0572)</b>	<b>0.393***</b> <b>(0.0586)</b>	<b>0.472***</b> <b>(0.0676)</b>	<b>0.277***</b> <b>(0.0601)</b>	<b>0.133**</b> <b>(0.0663)</b>
No (ref)					
<b>Residence</b>					
Urban	0.00215 (0.0501)	-0.149*** (0.0513)	-0.102* (0.0589)	0.156*** (0.0526)	0.0769 (0.0581)
Rural (ref)					
<b>Region (ref: Nord-Cent)</b>					
Northeast	-0.0539 (0.0815)	-0.327*** (0.0835)	-0.293*** (0.0954)	0.174** (0.0855)	0.257*** (0.0944)
Northwest	-0.167** (0.0789)	-0.273*** (0.0809)	-0.354*** (0.0925)	-0.0893 (0.0828)	0.0746 (0.0915)
Higher Plateau Central	-1.005*** (0.0742)	-0.996*** (0.0760)	-1.418*** (0.0876)	-0.670*** (0.0779)	-0.0393 (0.0860)
Higher Plateau East	-0.470*** (0.0756)	-0.621*** (0.0774)	-0.774*** (0.0890)	-0.619*** (0.0793)	-0.460*** (0.0876)
Higher Plateau West	-0.702*** (0.0756)	-0.800*** (0.0774)	-1.062*** (0.0885)	-0.468*** (0.0793)	-0.0162 (0.0876)
South	-0.0333 (0.0731)	-0.461*** (0.0748)	-0.357*** (0.0861)	-0.608*** (0.0767)	-0.387*** (0.0847)
<b>Mother's education (ref: without instruction)</b>					
Primary	0.237*** (0.0617)	0.205*** (0.0632)	0.308*** (0.0724)	0.385*** (0.0647)	0.0846 (0.0715)
Below secondary	0.632*** (0.0592)	0.374*** (0.0607)	0.715*** (0.0695)	0.477*** (0.0622)	0.148** (0.0687)
Secondary	0.915*** (0.0643)	0.554*** (0.0659)	1.029*** (0.0754)	0.709*** (0.0675)	0.224*** (0.0745)
Higher education	1.026*** (0.0900)	0.694*** (0.0922)	1.233*** (0.106)	0.653*** (0.0945)	0.257** (0.104)
<b>Wealth (ref: Poorest)</b>					
Poorer	0.0774 (0.0645)	0.203*** (0.0660)	0.216*** (0.0756)	0.289*** (0.0677)	0.188** (0.0747)
Middle	0.224*** (0.0699)	0.303*** (0.0717)	0.373*** (0.0821)	0.438*** (0.0734)	0.228*** (0.0811)
Richer	0.229*** (0.0719)	0.342*** (0.0736)	0.417*** (0.0844)	0.593*** (0.0755)	0.377*** (0.0833)
Richest	0.380*** (0.0759)	0.350*** (0.0777)	0.530*** (0.0891)	0.780*** (0.0796)	0.428*** (0.0879)
Constant	-0.328*** (0.0775)	-0.0562 (0.0794)	-0.265*** (0.0908)	-0.592*** (0.0813)	-0.0395 (0.0898)
<b>Observations</b>	<b>5366</b>	<b>5366</b>	<b>5517</b>	<b>5366</b>	<b>5366</b>

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.

**Source:** Computed by the author from the 2012 MICS.



**Table 6:** Impact of preschool enrolment on the quality of parent-child interaction – 2SLS estimation - PCA

	Reduced form model					Instrumental equation					Main stage regression equation				
	Quality of interaction Parents – Childs					Preschool enrolment					Quality of interaction Parents – Childs				
	Mother Interaction	Father Interaction	Mother + Father Interaction	At least one of family members	All household members	Mother Interaction	Father Interaction	Mother + Father Interaction	At least one of family members	All household members	Mother Interaction	Father Interaction	Mother + Father Interaction	At least one of family members	All household members
<b>Enrollment into Pre-school program</b>											<b>2.066</b>	<b>1.194</b>	<b>3.466</b>	<b>4.266</b>	<b>3.466</b>
<b>Sex</b>											<b>(1.643)</b>	<b>(1.579)</b>	<b>(2.875)</b>	<b>(3.224)</b>	<b>(2.875)</b>
Male	-0.0300	0.139***	0.0835*	-0.00644	0.0946*	-0.00873	-0.00873	-0.00779	-0.00779	-0.00779	-0.0119	0.145***	0.108*	0.124*	0.108*
Female (ref)	(0.0394)	(0.0404)	(0.0465)	(0.0413)	(0.0495)	(0.00941)	(0.00941)	(0.00924)	(0.00924)	(0.00924)	(0.0448)	(0.0430)	(0.0581)	(0.0652)	(0.0581)
<b>Milieu</b>															
Urban	0.0416	-0.115**	-0.0544	0.156***	-0.0649	0.0726***	0.0726***	0.0695***	0.0695***	0.0695***	-0.115	-0.207*	-0.302	-0.373	-0.302
Rural (ref)	(0.0508)	(0.0521)	(0.0599)	(0.0533)	(0.0637)	(0.0122)	(0.0122)	(0.0119)	(0.0119)	(0.0119)	(0.124)	(0.119)	(0.203)	(0.228)	(0.203)
<b>Region (ref: Nord-Cent)</b>															
Northeast	-0.0299	-0.318***	-0.280***	0.203**	-0.357***	0.0679***	0.0679***	0.0663***	0.0663***	0.0663***	-0.162	-0.399***	-0.490**	-0.625***	-0.490**
	(0.0826)	(0.0848)	(0.0972)	(0.0867)	(0.103)	(0.0198)	(0.0198)	(0.0193)	(0.0193)	(0.0193)	(0.138)	(0.133)	(0.213)	(0.239)	(0.213)
Northwest	-0.157*	-0.284***	-0.356***	-0.0854	-0.351***	-0.000117	-0.000117	-0.00101	-0.00101	-0.00101	-0.157*	-0.284***	-0.347***	-0.343***	-0.347***
	(0.0803)	(0.0824)	(0.0946)	(0.0843)	(0.101)	(0.0192)	(0.0192)	(0.0188)	(0.0188)	(0.0188)	(0.0870)	(0.0836)	(0.110)	(0.123)	(0.110)
Higher Plateau Central	-1.014***	-1.040***	-1.450***	-0.712***	-1.271***	-0.0694***	-0.0694***	-0.0704***	-0.0704***	-0.0704***	-0.862***	-0.951***	-1.196***	-0.964***	-1.196***
	(0.0761)	(0.0781)	(0.0903)	(0.0798)	(0.0961)	(0.0182)	(0.0182)	(0.0180)	(0.0180)	(0.0180)	(0.151)	(0.145)	(0.244)	(0.273)	(0.244)
Higher Plateau East	-0.443***	-0.641***	-0.760***	-0.594***	-0.458***	-0.0244	-0.0244	-0.0262	-0.0262	-0.0262	-0.386***	-0.606***	-0.666***	-0.342**	-0.666***
	(0.0778)	(0.0798)	(0.0923)	(0.0817)	(0.0982)	(0.0186)	(0.0186)	(0.0183)	(0.0183)	(0.0183)	(0.0977)	(0.0939)	(0.139)	(0.156)	(0.139)
Higher Plateau West	-0.723***	-0.845***	-1.104***	-0.488***	-0.994***	-0.0625***	-0.0625***	-0.0636***	-0.0636***	-0.0636***	-0.582***	-0.760***	-0.869***	-0.706***	-0.869***
	(0.0766)	(0.0786)	(0.0903)	(0.0804)	(0.0960)	(0.0183)	(0.0183)	(0.0180)	(0.0180)	(0.0180)	(0.137)	(0.131)	(0.219)	(0.245)	(0.219)
South	0.0159	-0.426***	-0.296***	-0.570***	-0.0621	0.130***	0.130***	0.127***	0.127***	0.127***	-0.251	-0.575***	-0.729**	-0.596	-0.729**
	(0.0745)	(0.0764)	(0.0882)	(0.0781)	(0.0938)	(0.0178)	(0.0178)	(0.0175)	(0.0175)	(0.0175)	(0.218)	(0.209)	(0.363)	(0.407)	(0.363)
<b>Mother's education (ref: no education)</b>															
Primary	0.239***	0.202***	0.306***	0.383***	0.246***	0.0208	0.0208	0.0213	0.0213	0.0213	0.201***	0.181**	0.239**	0.161	0.239**
	(0.0623)	(0.0638)	(0.0734)	(0.0653)	(0.0780)	(0.0149)	(0.0149)	(0.0146)	(0.0146)	(0.0146)	(0.0759)	(0.0729)	(0.106)	(0.118)	(0.106)
Less than secondary	0.638***	0.397***	0.731***	0.481***	0.729***	0.0611***	0.0611***	0.0634***	0.0634***	0.0634***	0.524***	0.331***	0.530***	0.478**	0.530***
	(0.0595)	(0.0610)	(0.0700)	(0.0624)	(0.0745)	(0.0142)	(0.0142)	(0.0139)	(0.0139)	(0.0139)	(0.120)	(0.116)	(0.201)	(0.225)	(0.201)
Secondary	0.929***	0.575***	1.047***	0.702***	1.061***	0.0869***	0.0869***	0.0876***	0.0876***	0.0876***	0.761***	0.485***	0.768***	0.706**	0.768***
	(0.0645)	(0.0661)	(0.0758)	(0.0676)	(0.0807)	(0.0154)	(0.0154)	(0.0151)	(0.0151)	(0.0151)	(0.159)	(0.153)	(0.266)	(0.298)	(0.266)
Higher education	1.061***	0.761***	1.311***	0.679***	1.297***	0.193***	0.193***	0.196***	0.196***	0.196***	0.671**	0.538*	0.637	0.466	0.637
	(0.0900)	(0.0923)	(0.107)	(0.0944)	(0.113)	(0.0215)	(0.0215)	(0.0212)	(0.0212)	(0.0212)	(0.332)	(0.319)	(0.576)	(0.645)	(0.576)
<b>Wealth (ref: Poorest)</b>															
Poorer	0.0725	0.217***	0.220***	0.305***	0.107	0.0250	0.0250	0.0246	0.0246	0.0246	0.0184	0.183**	0.132	0.00105	0.132
	(0.0651)	(0.0667)	(0.0767)	(0.0683)	(0.0816)	(0.0156)	(0.0156)	(0.0152)	(0.0152)	(0.0152)	(0.0829)	(0.0797)	(0.115)	(0.129)	(0.115)
Middle	0.245***	0.335***	0.413***	0.484***	0.250***	0.0417**	0.0417**	0.0413**	0.0413**	0.0413**	0.153	0.280***	0.259*	0.0688	0.259*
	(0.0706)	(0.0724)	(0.0832)	(0.0741)	(0.0885)	(0.0169)	(0.0169)	(0.0165)	(0.0165)	(0.0165)	(0.104)	(0.0998)	(0.155)	(0.174)	(0.155)
Richer	0.238***	0.366***	0.437***	0.620***	0.206**	0.0501***	0.0501***	0.0525***	0.0525***	0.0525***	0.127	0.301***	0.249	-0.0219	0.249
	(0.0725)	(0.0743)	(0.0854)	(0.0760)	(0.0908)	(0.0173)	(0.0173)	(0.0170)	(0.0170)	(0.0170)	(0.117)	(0.112)	(0.184)	(0.207)	(0.184)
Richest	0.416***	0.397***	0.588***	0.840***	0.326***	0.117***	0.117***	0.115***	0.115***	0.115***	0.171	0.253	0.181	-0.165	0.181
	(0.0762)	(0.0781)	(0.0899)	(0.0799)	(0.0956)	(0.0182)	(0.0182)	(0.0179)	(0.0179)	(0.0179)	(0.211)	(0.203)	(0.351)	(0.394)	(0.351)
<b>IV - Number of preschool class (per child age 0 – 4) at municipality level</b>															
Constant	0.000768	0.000437	0.000877	-8.27e-05	<b>0.00108*</b>	<b>0.000360***</b>	<b>0.000360***</b>	<b>0.000241**</b>	<b>0.000241**</b>	<b>0.000241**</b>					
	(0.000547)	(0.000561)	(0.000599)	(0.000574)	(0.000638)	(0.000130)	(0.000130)	(0.000119)	(0.000119)	(0.000119)					
Constant	-0.377***	-0.0658	-0.313***	-0.585***	-0.279***	-0.0125	-0.0125	-0.00650	-0.00650	-0.00650	-0.350***	-0.0483	-0.286***	-0.247**	-0.286***
	(0.0855)	(0.0877)	(0.100)	(0.0897)	(0.107)	(0.0205)	(0.0205)	(0.0200)	(0.0200)	(0.0200)	(0.0867)	(0.0834)	(0.110)	(0.124)	(0.110)
<b>Observations</b>	<b>5318</b>	<b>5318</b>	<b>5483</b>	<b>5318</b>	<b>5483</b>	<b>5289</b>	<b>5289</b>	<b>5,440</b>	<b>5440</b>	<b>5440</b>	<b>5289</b>	<b>5289</b>	<b>5440</b>	<b>5440</b>	<b>5440</b>

Standard errors in parentheses. \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Source:** Computed by the author from the 2012 MICS.

The results from the OLS regression show a relationship between preschool enrolment and parent-child interaction using either index. The association is the most significant using the parent interaction index (mother and father together). Unexpectedly, the association between preschool enrolment and parent-child interactions is more significant for fathers than for mothers. This means that fathers are more engaged in doing developmental activities when the child is enrolled in preschool compared to mothers.

The association of preschool enrolment on family interaction with children depends on geography. Preschool enrolment is more significantly positively correlated with family member-child interaction for those in urban areas. In contrast, when I use mother's and father's interaction with the child as the outcome variable, the association of preschool is more significant for those in rural areas.

As expected, several other variables are also important in explaining parent-child interactions. Mother's education is positively correlated with the quality of parent-child interaction. Family wealth also has a positive correlation regardless of the index used.

The results of the reduced model show that the instrumental variable (number of preschool class per child age 0 – 4 years at municipality level) is not significant using any index. However, using 2SLS estimation, the instrumental variable is significant with all indices.

In the second equation (main stage regression equation), the results show that preschool enrolment has no effect on interaction no matter the index used. This means that there is no substitution effect. Parents keep engaging development activities (at the household) with children even when they are enrolled in preschool. The relationship is not substitution, although not complementary either; there is no relationship between preschool and household development activities.

### **6.2.2. Difference-in-difference (DID) estimation**

Several equations are estimated according to the nature of the interaction: Interaction mother-child interaction, father-child interaction, parent-child interaction, other family member interaction with the child, and finally if at least one member of the household member engaged in development activities with the child. The models control for mother's education, strata of residence (urban or. rural), region, and household wealth. In addition to these variables, I introduce the time trend, treatment variable, and the interaction term between time and the treatment variable.

The most important variable in this model is the interaction term. The results show that this variable is only significant with mother-child interaction, and that the effect is negative and statistically significant. This means that preschool enrolment has a negative effect on the quality of interaction between mother and child, suggestive of a substitution effect.

**Table 7:** Difference-in-difference model: Pre-school enrolment and the quality of parents-child's interaction

	Index					PCA				
	Mother Interaction	Father Interaction	Mother + Father Interaction	At least one of family members	All household members	Mother Interaction	Father Interaction	Mother + Father Interaction	At least one of family members	All household members
l.time	-0.543*** (0.0354)	-0.560*** (0.0334)	-0.766*** (0.0577)	0.721*** (0.0264)	-1.163*** (0.0664)	-0.0192 (0.0301)	-0.00214 (0.0315)	-0.0300 (0.0372)	0.0177 (0.0259)	-0.0671* (0.0380)
chPrsc_08_98*	0.00287*** (0.000670)	0.000618 (0.000643)	0.00243** (0.00111)	0.00153*** (0.000381)	0.00106 (0.00128)	0.00248*** (0.000569)	0.000548 (0.000607)	0.00130* (0.000717)	0.00151*** (0.000375)	0.00150** (0.000732)
<b>1.time#c.chPrsc_08_98</b>	<b>-0.00194** (0.000830)</b>	<b>-5.17e-05 (0.000788)</b>	<b>-0.000909 (0.00134)</b>	<b>-0.000751 (0.000579)</b>	<b>-0.000275 (0.00154)</b>	<b>-0.00169** (0.000704)</b>	<b>2.39e-06 (0.000744)</b>	<b>-0.000367 (0.000867)</b>	<b>-0.000694 (0.000569)</b>	<b>-0.000487 (0.000884)</b>
<b>Sex</b>										
Male										
Female (ref)	-0.0959*** (0.0338)	0.130*** (0.0318)	0.0488 (0.0551)	-0.0185 (0.0226)	-0.0193 (0.0634)	-0.0788*** (0.0287)	0.107*** (0.0300)	0.0251 (0.0355)	-0.0133 (0.0221)	0.0367 (0.0363)
<b>Residence</b>										
Urban	0.159*** (0.0429)	0.0202 (0.0404)	0.146** (0.0696)	0.106*** (0.0304)	0.129 (0.0801)	0.136*** (0.0364)	0.0153 (0.0381)	0.100** (0.0449)	0.0934*** (0.0299)	0.104** (0.0459)
Rural (ref)										
<b>Region (ref: Nord-Cent)</b>										
Northeast	-0.255*** (0.0632)	-0.512*** (0.0601)	-1.014*** (0.105)	0.0785* (0.0430)	-0.923*** (0.121)	-0.205*** (0.0536)	-0.471*** (0.0567)	-0.525*** (0.0671)	0.0846** (0.0422)	-0.694*** (0.0692)
Northwest	-0.282*** (0.0615)	-0.478*** (0.0579)	-0.861*** (0.101)	-0.374*** (0.0407)	-1.445*** (0.116)	-0.251*** (0.0522)	-0.456*** (0.0546)	-0.533*** (0.0645)	-0.331*** (0.0400)	-0.522*** (0.0663)
Higher Plateau Central	-1.015*** (0.0608)	-0.931*** (0.0568)	-1.877*** (0.0984)	-0.571*** (0.0408)	-1.851*** (0.113)	-0.859*** (0.0516)	-0.879*** (0.0536)	-1.220*** (0.0636)	-0.545*** (0.0402)	-1.152*** (0.0649)
Higher Plateau East	-0.573*** (0.0647)	-0.704*** (0.0607)	-1.268*** (0.105)	-0.476*** (0.0445)	-1.886*** (0.121)	-0.473*** (0.0549)	-0.654*** (0.0573)	-0.795*** (0.0678)	-0.470*** (0.0437)	-0.615*** (0.0693)
Higher Plateau West	-0.792*** (0.0684)	-0.706*** (0.0639)	-1.484*** (0.110)	-0.603*** (0.0493)	-1.848*** (0.127)	-0.677*** (0.0580)	-0.667*** (0.0603)	-0.954*** (0.0712)	-0.579*** (0.0484)	-0.876*** (0.0726)
South	-0.317*** (0.0575)	-0.971*** (0.0544)	-1.296*** (0.0942)	-0.621*** (0.0388)	-1.987*** (0.108)	-0.285*** (0.0488)	-0.878*** (0.0513)	-0.878*** (0.0608)	-0.602*** (0.0382)	-0.697*** (0.0621)
<b>Mother's education (ref: no education)</b>										
Primary	0.420*** (0.0514)	0.253*** (0.0481)	0.630*** (0.0827)	0.207*** (0.0340)	0.523*** (0.0952)	0.361*** (0.0436)	0.229*** (0.0454)	0.406*** (0.0535)	0.202*** (0.0333)	0.401*** (0.0545)
Less than secondary	0.921*** (0.0505)	0.544*** (0.0475)	1.334*** (0.0817)	0.291*** (0.0337)	0.928*** (0.0941)	0.790*** (0.0429)	0.499*** (0.0448)	0.866*** (0.0528)	0.279*** (0.0331)	0.885*** (0.0539)
Secondary	1.312*** (0.0546)	0.759*** (0.0516)	1.838*** (0.0891)	0.438*** (0.0366)	1.230*** (0.103)	1.125*** (0.0463)	0.706*** (0.0487)	1.229*** (0.0574)	0.416*** (0.0359)	1.232*** (0.0587)
Higher education	1.636*** (0.0833)	1.129*** (0.0789)	2.533*** (0.138)	0.555*** (0.0572)	1.707*** (0.159)	1.398*** (0.0707)	1.061*** (0.0744)	1.708*** (0.0883)	0.523*** (0.0562)	1.679*** (0.0911)
<b>Wealth (ref: Poorest)</b>										
Poorer	-0.453*** (0.0674)	-0.403*** (0.0633)	-0.847*** (0.109)	-0.787*** (0.0455)	-1.632*** (0.126)	-0.382*** (0.0571)	-0.369*** (0.0598)	-0.528*** (0.0705)	-0.754*** (0.0447)	-0.337*** (0.0721)
Middle	-0.394*** (0.0596)	-0.307*** (0.0564)	-0.636*** (0.0975)	-0.549*** (0.0407)	-1.150*** (0.112)	-0.334*** (0.0506)	-0.292*** (0.0532)	-0.449*** (0.0629)	-0.521*** (0.0400)	-0.291*** (0.0643)
Richer	-0.226*** (0.0563)	-0.166*** (0.0532)	-0.359*** (0.0924)	-0.328*** (0.0381)	-0.675*** (0.106)	-0.191*** (0.0478)	-0.160*** (0.0502)	-0.256*** (0.0595)	-0.310*** (0.0374)	-0.153** (0.0609)
Richest	-0.254*** (0.0534)	-0.154*** (0.0504)	-0.353*** (0.0877)	-0.248*** (0.0363)	-0.547*** (0.101)	-0.213*** (0.0453)	-0.147*** (0.0475)	-0.245*** (0.0564)	-0.234*** (0.0356)	-0.189*** (0.0578)
Constant	3.192*** (0.0763)	2.627*** (0.0718)	5.564*** (0.125)	4.214*** (0.0525)	8.938*** (0.144)	-0.0173 (0.0647)	0.325*** (0.0677)	0.284*** (0.0803)	0.428*** (0.0518)	0.147* (0.0823)
<b>Observations</b>	<b>11096</b>	<b>10834</b>	<b>10902</b>	<b>19447</b>	<b>10902</b>	<b>11096</b>	<b>10834</b>	<b>11082</b>	<b>19447</b>	<b>10902</b>
<b>Within</b>	0.1625	0.1220	0.1507	0.1221	0.1404	0.1497	0.0976	0.1459	0.0867	0.1243
<b>Between</b>	0.5134	0.4368	0.5153	0.3674	0.4227	0.5082	0.4328	0.5376	0.2271	0.3813
<b>Overall</b>	0.1800	0.1313	0.1623	0.1329	0.1510	0.1669	0.1057	0.1591	0.0964	0.1338

\* Change in the number of preschool classes between two periods at municipality level.

Standard errors in parentheses. \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

## 7. Conclusion

Improving the quality of education has been a major preoccupation of policy makers throughout the world. In this paper I present evidence that shows that investing in universal preschool education could be an important part of a productive strategy to achieve this goal. Specifically, I examined the impact of preschool education expansion in Algeria.

Through this study, I fill an important gap in the literature regarding the effect of early childhood education enrollment on the cognitive development and quality of parent–child interactions in MENA countries. I evaluate the effects of childcare on child cognitive development and parent–child interaction using a quasi-experimental evaluation based on non-randomized data. The 2SLS regression model is used to estimate the effects of preschool enrolment on children’s cognitive development as well as to identify factors determining enrolment in preschool. The results show a positive effect of preschool enrolment on the cognitive development of children. In terms of public policy, the results have important implications. Policy makers must continue efforts to implement preschool schools throughout Algeria.

The 2SLS regression model and difference-in-difference strategy are used to estimate the effects of preschool enrollment on the quality of interaction between parents and children. I estimate different models according to the nature of interaction. The effect of preschool enrolment is only statistically significantly correlated with the quality of mother-child interaction, and the effect is negative. This suggests a substitution effect; mothers with children in preschool are able to use their new free time to pursue other activities, perhaps trading off time with children. This result is very important, especially in MENA countries, where women's labor force participation is among the lowest in the world. We must explore more if preschool enrolment of children allows mothers to enter the paid labor market.

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## References

- Baker, M., Gruber, J., Milligan, K., 2008. Universal childcare, maternal labor supply and family well-being. *Journal of Political Economy*, 79, pp.709-745.
- Behrman, J., Cheng, Y., Todd, P., 2004. Evaluating Preschool Programs when Length of Exposure to the Program Varies: A Nonparametric Approach, *Review of Economics and Statistics*, vol. 86, issue 1, pp.108-132.
- Berlinski, S., Galiani, S., Gertler, P., 2009. The effect of pre-primary education on primary school performance, *Journal of Public Economics*, Vol. 93(1-2), pp. 219-234.
- Craig, L., 2005. How do they do it? A time-diary analysis of how working mothers find time for the kids. University of New South Wales the social policy research centre discussion paper no. 136. Sydney, NSW: The Social Policy Research Centre.
- Dallaire, D.H., Weinraub, M., 2007. Infant-mother attachment security and children's anxiety and aggression at first grade. *Journal of Applied Developmental Psychology*, 28(5-6), pp.477-492.
- Datta Gupta, N., Simonsen, M., 2010. Non-cognitive child outcomes and universal high quality child care, *Journal of Public Economics*, Vol 94, Issues 1–2, pp. 30-43.
- Edwards, C.P., Logue, M. E., Loehr, S.R., Roth, S.B., 1986. The influence of model infant–toddler group care on parent–child interaction at home, *Early Childhood Research Quarterly*, 1, pp.317–332.
- Engle, P.L., Fernald, L.C.H., Alderman, H., Behrman, J., O’Gara, C., Yousafzai, A., Cabral de Mello, M., Hidrobo M., Ulkuer, N., Ertem, I., Iltus, S., and the Global Development Steering group., 2011. Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. *The Lancet*, 37, pp.1339-1353.
- Felfe, C., Lalive, R., 2018. Does early child care affect children's development? *Journal of Public Economics*, Vol. 159, pp. 33-53.
- Gelber, A., Isen, A., 2013. Children’s schooling and parents’ behavior: Evidence from the Head Start Impact Study. *Journal of Public Economics*, 101, pp.25–38.
- Grunewald, R., Rolnick, A., 2007. A productive investment: Early child development. In M. E. Young (Ed.), *Early child development — From measurement to action. A priority for growth and equity* (pp. 17–32). Washington, DC: The World Bank.
- Harvey, E., 1999. Short-term and long-term effects of early parental employment on children of the National Longitudinal Survey of Youth. *Developmental Psychology*, Vol 35(2), pp.445-459.
- Heckman, J., 2006. Skill Formation and the Economics of Investing in Disadvantaged Children. *Science*, 312(5782), 1900–2.
- Heckman, J., Masterov, D.V., 2007. The Productivity Argument for Investing in Young Children, *Review of Agricultural Economics* - Vol 29, Number 3- pp. 446–493.
- Heckman, J., Pinto, R., Savelyev, P., 2013. Understanding the Mechanisms Through Which an Influential Early Childhood Program Boosted Adult Outcomes, *American Economic Review*, 103(6), pp.2052–2086.
- Heckman, J., Carneiro, P., 2003. Human Capital Policy, NBER Working Papers 9495, National Bureau of Economic Research, Inc.
- Irwin, L.G., Siddiqi, A., Hertzman, C., 2007. Early childhood development: A powerful equalizer. Geneva, Switzerland: World Health Organisation.
- Magnuson, K., Meyers, M., Waldfogel, J., 2007. Public Funding and Enrollment in Formal Child Care in the 1990s. *Social Service Review*, 81 (1), pp. 47-83.
- Maulik, P.K., Darmstadt, G.L., 2009. Community-based interventions to optimize early childhood development in low resource settings. *Journal of Perinatology* 29, pp. 531–42.
- Mustard, F., 2007. Experienced-based brain development: Scientific underpinning of the importance of early child development in a global world. In M. Young & L. Richardson (Eds.), *Early child development: From measurement to action* (pp.43–86). Washington, D.C.: The World Bank.
- Nores, M., Barnett, W.S., 2010. Benefits of early childhood interventions across the world: (Under) Investing in the very young, *Economics of Education Review*, 29(2), pp.271–282.
- Scarr, S., 1997. Why child care has little impact on most children's development. *Current Directions in Psychological Science*, 6, pp.143-148.

- Schady, N., Araujo, M.C., 2008. Cash Transfers, Conditions, and School Enrollment in Ecuador, *Journal of the Latin American and Caribbean Economic Association*, 8(2), pp.43-70.
- Shonkoff, J.P., Phillips, D., 2000. From Neurons to Neighborhoods: The Science of Early Childhood Development. Washington, DC: National Academy Press.
- Smith, C., Gibbard, D., 2011. Baby talk home visits: Development and initial evaluations of a primary prevention service. *Child Language Teaching and Therapy*, 27(1), pp.68-83.
- Waldfogel, J., 2006. What do children need? *Public Policy Research* 13(1), pp. 26-34.

## Appendix A

**Table A1:** Determinants of the number of primary schools at commune level

Variables*	Number of primary schools at municipality level 2010 - 2011
Number of children (0 - 4 years old) 2008	<b>0.146***</b> <b>(0.00442)</b>
Proportion of households with a car	-0.0204 (0.0372)
Proportion of households with a TV	0.0691 (0.0697)
Proportion of households with a refrigerator	0.0132 (0.0469)
Proportion of households with air conditioning	0.0293 (0.0228)
Proportion of household having Parabolic	0.0241 (0.0226)
Proportion of households with internet	0.709* (0.133)
Proportion of household having Bathroom	0.0262 (0.0160)
Proportion of households with a toilet	-0.0201 (0.0316)
Proportion of households with electricity	0.0778* (0.0464)
Proportion of households with a sewer connection	-0.0143 (0.0125)
Proportion of households with a potable water connection	-0.0529 (0.0165)
Constant	-4.134 (2.925)
<b>Observations</b>	<b>1540</b>

\* All percentages are calculated at the municipal level.

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Source:** Computed by the author from RGPH survey 2008.

## Appendix B

**Table B1:** Determinants of preschool enrolment - Marginal Effects

	2006			2012		
	Boy	Girl	Total	Boy	Girl	Total
<b>Sex</b>						
Male	----	----	0.00867	----	----	-0.00521
Female (ref)			(0.00628)			(0.00752)
<b>Residence</b>						
Urban	0.0201*	0.000151	0.0104	0.0680***	0.0664***	0.0679***
Rural (ref)	(0.0116)	(0.0108)	(0.00813)	(0.0125)	(0.0142)	(0.00942)
<b>Region (ref: Nord-Cent)</b>						
Northeast	0.0329	-0.0159	0.00460	0.0498**	0.0538*	0.0510***
	(0.0220)	(0.0117)	(0.0118)	(0.0245)	(0.0279)	(0.0184)
Northwest	0.0498**	-0.0178	0.0116	0.000127	-0.00116	-0.000485
	(0.0212)	(0.0110)	(0.0114)	(0.0191)	(0.0221)	(0.0146)
Higher Plateau Central	-0.0287*	-0.0362***	-0.0342***	-0.0684***	-0.0706***	-0.0706***
	(0.0157)	(0.0109)	(0.00957)	(0.0134)	(0.0160)	(0.0103)
Higher Plateau East	0.0169	-0.0232*	-0.00695	-0.0274*	-0.00979	-0.0202
	(0.0217)	(0.0119)	(0.0118)	(0.0155)	(0.0207)	(0.0127)
Higher Plateau West	0.0297	-0.0166	0.00343	-0.0509***	-0.0576***	-0.0548***
	(0.0288)	(0.0148)	(0.0154)	(0.0142)	(0.0167)	(0.0109)
South	0.110***	0.0381**	0.0727***	0.0845***	0.121***	0.101***
	(0.0242)	(0.0157)	(0.0144)	(0.0241)	(0.0309)	(0.0193)
<b>Mother's education (ref: no education)</b>						
Primary	0.0229	0.0773***	0.0467***	0.0480*	0.0722**	0.0599***
	(0.0174)	(0.0258)	(0.0149)	(0.0282)	(0.0311)	(0.0211)
Less than secondary	0.0228	0.106***	0.0589***	0.0985***	0.101***	0.1000***
	(0.0176)	(0.0270)	(0.0154)	(0.0278)	(0.0279)	(0.0197)
Secondary	0.0438**	0.126***	0.0791***	0.133***	0.125***	0.130***
	(0.0207)	(0.0315)	(0.0180)	(0.0328)	(0.0329)	(0.0232)
Higher education	0.192***	0.226***	0.206***	0.227***	0.252***	0.239***
	(0.0574)	(0.0635)	(0.0419)	(0.0520)	(0.0560)	(0.0381)
<b>Wealth (ref: Poorest)</b>						
Poorer	0.0411	-0.0117	0.0118	0.111***	0.0337	0.0682***
	(0.0269)	(0.0161)	(0.0154)	(0.0394)	(0.0286)	(0.0234)
Middle	0.0531*	-0.0143	0.0158	0.126***	0.0562*	0.0869***
	(0.0288)	(0.0158)	(0.0159)	(0.0416)	(0.0320)	(0.0254)
Richer	0.0811**	0.0262	0.0508***	0.141***	0.0673**	0.101***
	(0.0326)	(0.0216)	(0.0194)	(0.0416)	(0.0328)	(0.0258)
Richest	0.138***	0.0608**	0.0988***	0.190***	0.124***	0.153***
	(0.0418)	(0.0282)	(0.0253)	(0.0456)	(0.0381)	(0.0290)
<b>Observations</b>	<b>2,743</b>	<b>2,603</b>	<b>5,346</b>	<b>2,879</b>	<b>2,638</b>	<b>5,517</b>

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Source:** Computed by the author from the 2012 MICS.



## Appendix C

**Table C1:** Impact of Pre-school enrolment on child development - OLS

	OLS - Index			OLS - PCA		
	Total	Boy	Girl	Total	Boy	Girl
<b>Enrollment into Pre-school program</b>	<b>1.062***</b> (0.0635)	<b>1.074***</b> (0.0886)	<b>1.051***</b> (0.0911)	<b>1.087***</b> (0.0553)	<b>1.098***</b> (0.0761)	<b>1.076***</b> (0.0806)
<b>Sex</b>						
Boy	-0.235***			-0.138***		
Girl (ref)	(0.0445)			(0.0387)		
<b>Milieu</b>						
Urban	0.0151	-0.0108	0.0412	0.0104	-0.0129	0.0335
Rural (ref)	(0.0571)	(0.0800)	(0.0818)	(0.0497)	(0.0688)	(0.0724)
<b>Region (ref: Nord-Cent)</b>						
Northeast	0.0692 (0.0934)	0.0206 (0.129)	0.112 (0.136)	0.0144 (0.0813)	-0.0156 (0.111)	0.0399 (0.120)
North West	-0.552*** (0.0892)	-0.423*** (0.125)	-0.681*** (0.128)	-0.419*** (0.0777)	-0.333*** (0.107)	-0.508*** (0.113)
Higher Plateau Central	-0.201** (0.0849)	-0.159 (0.117)	-0.247** (0.124)	-0.0530 (0.0740)	-0.0453 (0.101)	-0.0645 (0.109)
Higher Plateau East	-0.349*** (0.0847)	-0.278** (0.117)	-0.428*** (0.124)	-0.387*** (0.0738)	-0.361*** (0.100)	-0.417*** (0.109)
Higher Plateau West	0.141 (0.0864)	0.198* (0.119)	0.0789 (0.126)	0.155** (0.0752)	0.186* (0.102)	0.118 (0.111)
South	-0.523*** (0.0825)	-0.509*** (0.113)	-0.540*** (0.121)	-0.483*** (0.0718)	-0.491*** (0.0971)	-0.474*** (0.107)
<b>Mother's education (ref: without instruction)</b>						
Primary	0.225*** (0.0709)	0.151 (0.0995)	0.305*** (0.102)	0.314*** (0.0617)	0.308*** (0.0855)	0.325*** (0.0898)
Below secondary	0.301*** (0.0677)	0.306*** (0.0960)	0.292*** (0.0960)	0.322*** (0.0590)	0.334*** (0.0824)	0.311*** (0.0848)
Secondary	0.345*** (0.0735)	0.331*** (0.103)	0.356*** (0.105)	0.431*** (0.0640)	0.436*** (0.0886)	0.425*** (0.0929)
Higher education	0.396*** (0.101)	0.459*** (0.138)	0.315** (0.148)	0.458*** (0.0878)	0.516*** (0.119)	0.391*** (0.131)
<b>Wealth (ref: Poorest)</b>						
Poorer	0.0646 (0.0737)	0.0300 (0.104)	0.111 (0.105)	0.0966 (0.0642)	0.0450 (0.0892)	0.154* (0.0928)
Middle	0.0570 (0.0799)	0.0257 (0.112)	0.0954 (0.115)	0.148** (0.0696)	0.0968 (0.0961)	0.203** (0.101)
Richer	0.151* (0.0820)	0.0742 (0.114)	0.245** (0.119)	0.211*** (0.0714)	0.141 (0.0975)	0.287*** (0.105)
Richest	0.343*** (0.0864)	0.294** (0.120)	0.408*** (0.125)	0.300*** (0.0753)	0.220** (0.103)	0.395*** (0.110)
Constant	5.247*** (0.0879)	5.038*** (0.116)	5.218*** (0.124)	-0.369*** (0.0766)	-0.466*** (0.0997)	-0.413*** (0.110)
<b>Observations</b>	<b>4,807</b>	<b>2,516</b>	<b>2,291</b>	<b>4,807</b>	<b>2,516</b>	<b>2,291</b>

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Source:** Computed by the author from the 2012 MICS.

## Appendix C

**Table C2:** Impact of Pre-school enrolment on child development – Logit - Marginal Effects

Total	Child know or can cite at least ten letters of the alphabet	Child is able to read some words	Child is able to Count	Child is able to follow simple instructions to do something	Child is able to do something independently	Child can catch on the ground with two fingers a small object	Child gets along well with the other children	Child does not kick, bites or strikes other children	Child did not easily distracted
<b>Enrollment into Pre-school program</b>	<b>0.348***</b> (0.0200)	<b>0.219***</b> (0.0187)	<b>0.313***</b> (0.0201)	<b>0.0608***</b> (0.0113)	<b>0.0833***</b> (0.0121)	<b>0.0346***</b> (0.00577)	0.0204 (0.0137)	0.00667 (0.0184)	-0.00735 (0.0198)
<b>Sex</b>									
Boy	-0.0245*	-0.0165*	-0.0478***	-0.0124	-0.00574	-0.00399	-0.0470***	-0.0830***	-0.00999
Girl (ref)	(0.0131)	(0.00971)	(0.0136)	(0.00936)	(0.0103)	(0.00541)	(0.00974)	(0.0125)	(0.0138)
<b>Milieu</b>									
Urban	0.0334**	0.0246**	0.0143	-0.0177	-0.0315**	0.0122*	-0.0172	-0.00559	0.0165
Rural (ref)	(0.0167)	(0.0125)	(0.0175)	(0.0117)	(0.0126)	(0.00722)	(0.0122)	(0.0160)	(0.0177)
<b>Region (ref: Nord-Cent)</b>									
Northeast	0.104***	0.0209	0.0418	-0.115***	-0.188***	0.0241**	0.0158	0.0430*	0.00920
	(0.0289)	(0.0196)	(0.0282)	(0.0294)	(0.0322)	(0.0101)	(0.0191)	(0.0251)	(0.0279)
North West	-0.110***	-0.0120	-0.0368	-0.124***	-0.134***	-0.0241	-0.0315	-0.0276	-0.0939***
	(0.0218)	(0.0176)	(0.0254)	(0.0287)	(0.0297)	(0.0156)	(0.0210)	(0.0262)	(0.0249)
Higher Plateau Central	0.00205	-0.0372**	-0.0658***	0.00484	-0.00268	-0.00523	0.0109	0.0465**	-0.180***
	(0.0246)	(0.0161)	(0.0238)	(0.0203)	(0.0226)	(0.0123)	(0.0176)	(0.0231)	(0.0221)
Higher Plateau East	-0.0329	-0.00340	-0.124***	-0.107***	-0.114***	-0.0432**	0.0241	-0.0249	0.0451*
	(0.0237)	(0.0174)	(0.0221)	(0.0266)	(0.0277)	(0.0172)	(0.0173)	(0.0250)	(0.0261)
Higher Plateau West	0.0176	-0.0239	-0.0125	-0.00273	-0.00534	0.00685	0.0199	-0.0288	-0.00574
	(0.0251)	(0.0167)	(0.0252)	(0.0209)	(0.0232)	(0.0111)	(0.0174)	(0.0250)	(0.0259)
South	-0.0600***	-0.0819***	-0.0926***	-0.0767***	-0.0955***	-0.0550***	0.0169	-0.00775	-0.0393
	(0.0222)	(0.0130)	(0.0226)	(0.0242)	(0.0260)	(0.0178)	(0.0172)	(0.0238)	(0.0245)
<b>Mother's education (ref: without instruction)</b>									
Primary	0.112***	0.0751***	0.127***	0.0505***	0.0116	-0.000668	0.0197	-0.0193	-0.0574***
	(0.0246)	(0.0216)	(0.0244)	(0.0122)	(0.0159)	(0.00803)	(0.0142)	(0.0201)	(0.0213)
Below secondary	0.136***	0.0913***	0.150***	0.0222*	-0.00798	0.00301	0.0219	0.00695	-0.0167
	(0.0227)	(0.0198)	(0.0227)	(0.0130)	(0.0158)	(0.00775)	(0.0138)	(0.0190)	(0.0209)
Secondary	0.198***	0.109***	0.184***	0.0186	0.00247	0.0159**	0.0186	-0.0108	-0.0513**
	(0.0249)	(0.0223)	(0.0246)	(0.0140)	(0.0169)	(0.00770)	(0.0149)	(0.0208)	(0.0221)
Higher education	0.214***	0.0941***	0.260***	0.0207	0.00265	-0.0138	0.0184	0.00141	-0.0494
	(0.0349)	(0.0303)	(0.0333)	(0.0192)	(0.0239)	(0.0145)	(0.0206)	(0.0293)	(0.0302)
<b>Wealth (ref: Poorest)</b>									
Poorer	0.0204	0.00252	0.0383	0.0196	0.00562	-0.00236	0.00498	-0.00353	-0.0392*
	(0.0238)	(0.0179)	(0.0246)	(0.0141)	(0.0164)	(0.00888)	(0.0159)	(0.0208)	(0.0224)
Middle	0.0440*	-0.000617	0.0648**	0.0305**	0.0260	-0.0155	-0.0133	-0.0176	-0.0554**
	(0.0255)	(0.0187)	(0.0265)	(0.0148)	(0.0170)	(0.0110)	(0.0180)	(0.0229)	(0.0240)
Richer	0.0645**	0.00317	0.122***	0.0194	0.0321*	-0.000127	-0.0111	-0.0242	-0.0334
	(0.0262)	(0.0189)	(0.0272)	(0.0157)	(0.0173)	(0.0101)	(0.0183)	(0.0236)	(0.0250)
Richest	0.0659**	0.0260	0.130***	0.0208	0.0234	-0.00974	0.0189	0.0268	0.0204
	(0.0273)	(0.0205)	(0.0284)	(0.0166)	(0.0186)	(0.0119)	(0.0180)	(0.0240)	(0.0270)
<b>Observations</b>	<b>5,477</b>	<b>5,477</b>	<b>5,482</b>	<b>5,418</b>	<b>5,364</b>	<b>5,399</b>	<b>5,413</b>	<b>5,423</b>	<b>5,129</b>

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Source:** Computed by the author from the 2012 MICS.

## Appendix C

**Table C3:** Impact of Pre-school enrolment on child development by gender - logit - Marginal Effects

	Child know or can cite at least ten letters of the alphabet		Child is able to read some words		Child is able to Count		Child is able to follow simple instructions to do something		Child is able to do something independently		Child can catch on the ground with two fingers a small object		Child gets along well with the other children		Child does not kick, bites or strikes other children		Child did not easily distracted	
	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl
<b>Enrollment into Pre-school program</b>	<b>0.368***</b> (0.0278)	<b>0.327***</b> (0.0290)	<b>0.202***</b> (0.0253)	<b>0.238***</b> (0.0276)	<b>0.314***</b> (0.0280)	<b>0.313***</b> (0.0288)	<b>0.0573***</b> (0.0163)	<b>0.0634***</b> (0.0155)	<b>0.0836***</b> (0.0164)	<b>0.0835***</b> (0.0177)	<b>0.0292***</b> (0.00837)	<b>0.0396***</b> (0.00744)	0.0299 (0.0199)	0.00931 (0.0189)	0.00829 (0.0265)	0.00447 (0.0253)	-0.0137 (0.0273)	6.64e-05 (0.0289)
<b>Milieu</b>																		
Urban	0.0200 (0.0232)	0.0454* (0.0241)	0.0249 (0.0169)	0.0225 (0.0187)	0.0268 (0.0239)	-0.00131 (0.0258)	-0.0214 (0.0166)	-0.0144 (0.0163)	-0.0308* (0.0176)	-0.0326* (0.0181)	0.0200* (0.0105)	0.00382 (0.00944)	-0.0149 (0.0181)	-0.0181 (0.0160)	0.00171 (0.0231)	-0.0120 (0.0220)	-0.00113 (0.0246)	0.0329 (0.0258)
<b>Region (ref: Nord-Cent)</b>																		
Northeast	0.104*** (0.0400)	0.103*** (0.0419)	0.0113 (0.0252)	0.0312 (0.0304)	0.0454 (0.0385)	0.0377 (0.0414)	-0.127*** (0.0421)	-0.102** (0.0408)	-0.206*** (0.0443)	-0.170*** (0.0472)	0.0292** (0.0143)	0.0200 (0.0130)	0.00710 (0.0297)	0.0269 (0.0230)	0.0467 (0.0354)	0.0393 (0.0357)	-0.0136 (0.0378)	0.0264 (0.0413)
North West	-0.0985*** (0.0302)	-0.124*** (0.0314)	0.000951 (0.0243)	-0.0273 (0.0254)	-0.0257 (0.0349)	-0.0495 (0.0372)	-0.108*** (0.0395)	-0.136*** (0.0416)	-0.116*** (0.0397)	-0.154*** (0.0448)	-0.0452 (0.0280)	-0.00745 (0.0167)	-0.0472 (0.0322)	-0.0117 (0.0258)	0.0300 (0.0351)	-0.0894** (0.0399)	-0.0902*** (0.0345)	-0.101*** (0.0364)
Higher Plateau	0.00833 (0.0340)	-0.00667 (0.0358)	-0.0432** (0.0207)	-0.0308 (0.0250)	-0.0393 (0.0331)	-0.0940*** (0.0345)	-0.00997 (0.0300)	0.0212 (0.0268)	0.0215 (0.0291)	-0.0296 (0.0353)	-0.0361 (0.0241)	0.0183 (0.0119)	-0.00327 (0.0274)	0.0278 (0.0213)	0.0635** (0.0321)	0.0399 (0.0336)	-0.157*** (0.0309)	-0.208*** (0.0324)
Central	-0.0255 (0.0324)	-0.0424 (0.0348)	-0.00581 (0.0227)	-0.00151 (0.0268)	-0.110*** (0.0299)	-0.138*** (0.0329)	-0.134*** (0.0386)	-0.0766** (0.0359)	-0.104*** (0.0419)	-0.125*** (0.0291)	-0.0622** (0.0194)	-0.0263 (0.0275)	0.00379 (0.0199)	0.0483** (0.0339)	0.00778 (0.0339)	-0.0606 (0.0377)	0.0742** (0.0359)	0.00568 (0.0381)
Higher Plateau East	0.0259 (0.0345)	0.00706 (0.0367)	-0.0365* (0.0210)	-0.0103 (0.0265)	0.0276 (0.0351)	-0.0556 (0.0362)	-0.0115 (0.0302)	0.00637 (0.0286)	0.0107 (0.0302)	-0.0250 (0.0361)	-0.00705 (0.0194)	0.0167 (0.0123)	0.0152 (0.0266)	0.0280 (0.0215)	0.00377 (0.0339)	-0.0656* (0.0378)	-0.0142 (0.0352)	-0.000157 (0.0384)
Higher Plateau West	-0.0695** (0.0295)	-0.0494 (0.0337)	-0.0796*** (0.0169)	-0.0848*** (0.0201)	-0.0942*** (0.0298)	-0.0884** (0.0345)	-0.0901*** (0.0343)	-0.0621* (0.0339)	-0.107*** (0.0351)	-0.0806** (0.0384)	-0.0822*** (0.0306)	-0.0307 (0.0196)	0.00318 (0.0265)	0.0332 (0.0209)	0.0160 (0.0324)	-0.0358 (0.0360)	-0.0323 (0.0333)	-0.0520 (0.0364)
<b>Mother's education (ref: without instruction)</b>																		
Primary	0.139*** (0.0349)	0.0832** (0.0348)	0.0913*** (0.0316)	0.0614** (0.0300)	0.129*** (0.0345)	0.125*** (0.0348)	0.0389** (0.0184)	0.0628*** (0.0160)	0.00797 (0.0227)	0.0131 (0.0224)	0.00345 (0.0108)	-0.00502 (0.0114)	-0.00761 (0.0227)	0.0515*** (0.0165)	-0.0821*** (0.0297)	0.0431* (0.0256)	-0.0405 (0.0300)	-0.0768** (0.0305)
Below secondary	0.143*** (0.0325)	0.131*** (0.0320)	0.106*** (0.0290)	0.0782*** (0.0273)	0.167*** (0.0323)	0.133*** (0.0322)	0.00869 (0.0193)	0.0358** (0.0173)	-0.0126 (0.0227)	-0.00520 (0.0219)	0.00111 (0.0110)	0.00423 (0.0104)	0.0223 (0.0211)	0.0210 (0.0176)	-0.0222 (0.0282)	0.0345 (0.0248)	0.0132 (0.0296)	-0.0500* (0.0296)
Secondary	0.205*** (0.0352)	0.194*** (0.0354)	0.136*** (0.0329)	0.0846*** (0.0306)	0.201*** (0.0346)	0.165*** (0.0351)	0.0233 (0.0200)	0.0132 (0.0196)	-0.0123 (0.0244)	0.0182 (0.0234)	0.0152 (0.0108)	0.0158 (0.0104)	0.0167 (0.0226)	0.0192 (0.0192)	-0.0435 (0.0306)	0.0178 (0.0274)	-0.0245 (0.0313)	-0.0803** (0.0315)
Higher education	0.213*** (0.0481)	0.218*** (0.0509)	0.120*** (0.0442)	0.0700* (0.0421)	0.273*** (0.0458)	0.251*** (0.0487)	0.0220 (0.0268)	0.0180 (0.0279)	0.00781 (0.0320)	-0.00444 (0.0361)	-0.0325 (0.0229)	0.00840 (0.0162)	0.0177 (0.0305)	0.0184 (0.0276)	0.00284 (0.0417)	-0.00664 (0.0408)	-0.0269 (0.0418)	-0.0748* (0.0437)
<b>Wealth (ref: Poorest)</b>																		
Poorer	0.0273 (0.0333)	0.0116 (0.0339)	-0.00979 (0.0233)	0.0164 (0.0275)	0.0271 (0.0336)	0.0516 (0.0360)	0.0260 (0.0199)	0.0141 (0.0196)	-0.0115 (0.0241)	0.0229 (0.0222)	-0.0115 (0.0137)	0.00587 (0.0109)	-0.0306 (0.0262)	0.0375** (0.0180)	-0.00511 (0.0298)	-0.000463 (0.0287)	-0.0107 (0.0317)	-0.0669** (0.0318)
Middle	0.0589* (0.0358)	0.0269 (0.0363)	-0.00620 (0.0245)	0.00529 (0.0284)	0.0135 (0.0352)	0.121*** (0.0389)	0.0277 (0.0212)	0.0347* (0.0203)	0.0242 (0.0240)	0.0275 (0.0240)	-0.0171 (0.0158)	-0.0133 (0.0146)	-0.0484* (0.0292)	0.0202 (0.0206)	-0.0132 (0.0324)	-0.0222 (0.0321)	-0.0226 (0.0337)	-0.0905*** (0.0342)
Richer	0.0718** (0.0362)	0.0552 (0.0380)	-0.00803 (0.0242)	0.0160 (0.0296)	0.0957*** (0.0366)	0.152*** (0.0401)	0.0115 (0.0226)	0.0280 (0.0216)	0.0160 (0.0250)	0.0480** (0.0238)	-0.00867 (0.0152)	0.00803 (0.0127)	-0.0338 (0.0287)	0.0101 (0.0223)	-0.0154 (0.0329)	-0.0323 (0.0337)	-0.0463 (0.0340)	-0.0159 (0.0370)
Richest	0.0752** (0.0378)	0.0554 (0.0394)	0.00676 (0.0260)	0.0495 (0.0323)	0.0853** (0.0383)	0.180*** (0.0414)	0.0179 (0.0238)	0.0264 (0.0228)	0.00552 (0.0270)	0.0429* (0.0254)	-0.0168 (0.0176)	-0.00300 (0.0152)	-0.0177 (0.0296)	0.0535*** (0.0204)	0.0526 (0.0335)	0.000798 (0.0342)	0.0362 (0.0373)	0.00447 (0.0392)
<b>Observations</b>	<b>2,856</b>	<b>2,621</b>	<b>2,859</b>	<b>2,618</b>	<b>2,856</b>	<b>2,626</b>	<b>2,832</b>	<b>2,586</b>	<b>2,801</b>	<b>2,563</b>	<b>2,822</b>	<b>2,577</b>	<b>2,819</b>	<b>2,594</b>	<b>2,831</b>	<b>2,592</b>	<b>2,695</b>	<b>2,434</b>

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Source:** Computed by the author from the 2012 MICS.

## Appendix D

**Table D1:** Determinants of development activities - 2006 – logit

	Lire des livres ou regarder des livres illustrés			Raconter des histoires			Chanter des chansons			Emmener en promenade en dehors de la maison			Jouer avec			Passer du temps		
	Boy	Girl	Total	Boy	Girl	Total	Boy	Girl	Total	Boy	Girl	Total	Boy	Girl	Total	Boy	Girl	Total
<b>Enrollment into Pre-school program</b>	<b>0.750***</b> (0.147)	<b>0.617***</b> (0.161)	<b>0.689***</b> (0.108)	<b>0.172</b> (0.171)	<b>0.109</b> (0.193)	<b>0.143</b> (0.128)	<b>0.0308</b> (0.180)	<b>0.0513</b> (0.211)	<b>0.0495</b> (0.136)	<b>0.314</b> (0.346)	<b>0.152</b> (0.318)	<b>0.228</b> (0.233)	<b>-0.192</b> (0.271)	<b>0.144</b> (0.327)	<b>-0.0632</b> (0.207)	<b>0.569***</b> (0.159)	<b>0.735***</b> (0.188)	<b>0.639***</b> (0.121)
<b>Sex</b>	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Boy			-0.0626 (0.0624)			-0.0812 (0.0654)			-0.210*** (0.0710)			0.164 (0.104)			0.107 (0.118)			-0.115* (0.0596)
Girl (ref)																		
<b>Milieu</b>																		
Urban	0.431*** (0.108)	0.392*** (0.110)	0.414*** (0.0769)	0.0351 (0.111)	0.168 (0.114)	0.103 (0.0794)	0.0230 (0.118)	0.0861 (0.127)	0.0553 (0.0864)	0.464** (0.194)	0.00643 (0.174)	0.206 (0.129)	0.0378 (0.203)	0.202 (0.201)	0.119 (0.142)	0.138 (0.102)	0.267** (0.105)	0.202*** (0.0725)
Rural (ref)																		
<b>Region (ref: Nord-Cent)</b>																		
Northeast	-0.108 (0.148)	-0.284* (0.152)	-0.196* (0.106)	-0.455** (0.177)	-0.384* (0.200)	-0.422*** (0.132)	-0.0862 (0.177)	-0.406** (0.206)	-0.217 (0.134)	0.146 (0.306)	-0.276 (0.278)	-0.0816 (0.204)	0.140 (0.421)	-0.453 (0.436)	-0.135 (0.299)	-0.105 (0.150)	-0.0141 (0.164)	-0.0598 (0.110)
North West	-1.062*** (0.147)	-1.107*** (0.152)	-1.078*** (0.105)	-0.748*** (0.162)	-1.102*** (0.119)	-0.913*** (0.165)	-0.146 (0.165)	-0.604*** (0.192)	-0.341*** (0.124)	0.346 (0.303)	0.180 (0.298)	0.273 (0.212)	-0.687** (0.326)	-0.976** (0.381)	-0.812*** (0.247)	-0.569*** (0.138)	-1.017*** (0.149)	-0.781*** (0.101)
Higher Plateau Central	-0.861*** (0.149)	-0.747*** (0.150)	-0.796*** (0.105)	-0.848*** (0.161)	-0.874*** (0.178)	-0.853*** (0.119)	0.0287 (0.169)	-0.581*** (0.191)	-0.239* (0.125)	-0.229 (0.260)	-0.425* (0.257)	-0.311* (0.182)	0.814* (0.483)	-0.167 (0.436)	0.306 (0.314)	-0.507*** (0.140)	-0.317** (0.151)	-0.410*** (0.102)
Higher Plateau East	-0.720*** (0.170)	-0.873*** (0.169)	-0.788*** (0.119)	-0.876*** (0.183)	-0.904*** (0.194)	-0.874*** (0.132)	-0.291 (0.188)	-0.460** (0.214)	-0.344** (0.140)	-0.811*** (0.263)	-0.726*** (0.267)	-0.748*** (0.187)	-0.824** (0.355)	-0.930** (0.407)	-0.849*** (0.266)	0.0171 (0.167)	-0.297* (0.168)	-0.134 (0.118)
Higher Plateau West	-0.991*** (0.211)	-1.125*** (0.206)	-1.051*** (0.147)	-0.720*** (0.219)	-1.452*** (0.218)	-1.082*** (0.153)	0.00278 (0.237)	-0.805*** (0.242)	-0.373** (0.167)	-1.247*** (0.286)	-1.188*** (0.293)	-1.195*** (0.203)	-1.574*** (0.348)	-2.209*** (0.382)	-1.866*** (0.254)	-0.448** (0.194)	-1.241*** (0.196)	-0.850*** (0.137)
South	-0.791*** (0.135)	-1.051*** (0.144)	-0.911*** (0.0982)	-1.035*** (0.152)	-1.217*** (0.168)	-1.117*** (0.112)	-0.463*** (0.150)	-0.815*** (0.179)	-0.608*** (0.114)	-0.172 (0.251)	-0.358 (0.248)	-0.257 (0.176)	-1.518*** (0.285)	-2.024*** (0.335)	-1.746*** (0.216)	-0.643*** (0.131)	-0.874*** (0.142)	-0.750*** (0.0959)
<b>Mother's education (ref: without instruction)</b>																		
Primary	0.593*** (0.128)	0.319** (0.132)	0.463*** (0.0914)	0.259** (0.122)	0.152 (0.129)	0.213** (0.0885)	-0.0777 (0.127)	0.207 (0.145)	0.0500 (0.0950)	0.567*** (0.217)	-0.0943 (0.192)	0.209 (0.143)	0.499** (0.242)	0.132 (0.224)	0.317* (0.164)	0.270** (0.115)	0.427*** (0.121)	0.355*** (0.0828)
Below secondary	0.487*** (0.131)	0.515*** (0.128)	0.494*** (0.0912)	0.343*** (0.132)	0.443*** (0.137)	0.389*** (0.0947)	0.284** (0.143)	0.430*** (0.156)	0.352*** (0.105)	0.416* (0.230)	0.155 (0.213)	0.275* (0.156)	0.146 (0.245)	0.150 (0.241)	0.152 (0.172)	0.321*** (0.121)	0.532*** (0.123)	0.425*** (0.0859)
Secondary	0.738*** (0.140)	0.942*** (0.138)	0.835*** (0.0979)	0.550*** (0.154)	0.946*** (0.170)	0.728*** (0.114)	0.472*** (0.167)	0.404** (0.176)	0.441*** (0.121)	0.322 (0.258)	0.190 (0.249)	0.249 (0.179)	0.286 (0.285)	0.612** (0.311)	0.441** (0.209)	0.339** (0.135)	0.791*** (0.142)	0.560*** (0.0971)
Higher education	1.206*** (0.279)	1.582*** (0.255)	1.416*** (0.188)	0.462 (0.344)	0.895*** (0.333)	0.709*** (0.238)	0.997** (0.450)	0.702* (0.376)	0.847*** (0.288)	0.786 (0.765)	0.984 (0.742)	0.911* (0.530)	1.653 (0.582)	1.653 (1.033)	0.716 (0.488)	0.234 (0.289)	1.588*** (0.329)	0.928*** (0.212)
<b>Wealth (ref: Poorest)</b>																		
Poorer	0.117 (0.160)	0.252 (0.165)	0.187 (0.115)	-0.0813 (0.134)	0.143 (0.142)	0.0246 (0.0972)	0.0445 (0.140)	0.208 (0.154)	0.113 (0.103)	0.189 (0.201)	0.337* (0.196)	0.274* (0.140)	-0.171 (0.232)	0.109 (0.230)	-0.0320 (0.163)	0.193 (0.129)	0.307** (0.136)	0.243*** (0.0931)
Middle	0.483*** (0.162)	0.655*** (0.165)	0.576*** (0.115)	0.164 (0.150)	0.372** (0.156)	0.253** (0.108)	0.451*** (0.161)	0.491*** (0.172)	0.454*** (0.117)	0.803*** (0.269)	0.864*** (0.235)	0.849*** (0.176)	0.601** (0.298)	0.591** (0.273)	0.587*** (0.201)	0.587*** (0.140)	0.417*** (0.145)	0.489*** (0.100)
Richer	0.637*** (0.169)	0.631*** (0.176)	0.638*** (0.122)	0.501*** (0.166)	0.397** (0.172)	0.437*** (0.119)	0.571*** (0.175)	0.566*** (0.191)	0.543*** (0.129)	0.379 (0.269)	0.978*** (0.264)	0.713*** (0.187)	0.422 (0.303)	0.602** (0.304)	0.507** (0.214)	0.621*** (0.150)	0.503*** (0.159)	0.547*** (0.109)
Richest	1.110*** (0.182)	1.076*** (0.187)	1.091*** (0.130)	0.923*** (0.196)	0.695*** (0.201)	0.797*** (0.140)	0.919*** (0.208)	0.805*** (0.222)	0.851*** (0.151)	1.142*** (0.365)	1.539*** (0.337)	1.368*** (0.247)	0.781** (0.363)	0.752** (0.357)	0.746*** (0.253)	1.304*** (0.176)	0.770*** (0.179)	1.020*** (0.125)
Constant	-1.254*** (0.146)	-1.127*** (0.154)	-1.163*** (0.111)	1.168*** (0.147)	1.232*** (0.163)	1.241*** (0.115)	0.963*** (0.144)	1.386*** (0.172)	1.261*** (0.117)	1.855*** (0.216)	2.010*** (0.225)	1.835*** (0.165)	3.038*** (0.293)	3.169*** (0.340)	3.029*** (0.229)	-0.109 (0.127)	0.0142 (0.138)	0.0114 (0.0988)
<b>Observations</b>	<b>2,717</b>	<b>2,581</b>	<b>5,298</b>	<b>2,736</b>	<b>2,597</b>	<b>5,333</b>	<b>2,730</b>	<b>2,592</b>	<b>5,322</b>	<b>2,727</b>	<b>2,592</b>	<b>5,319</b>	<b>2,736</b>	<b>2,596</b>	<b>5,332</b>	<b>2,718</b>	<b>2,577</b>	<b>5,295</b>

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Source:** Computed by the author from MICS survey 2006.

## Appendix D

**Table D2:** Determinants of development activities – 2012 – logit

	Lire des livres ou regarder des livres illustrés			Raconter des histoires			Chanter des chansons			Emmener en promenade en dehors de la maison			Jouer avec			Passer du temps		
	Boy	Girl	Total	Boy	Girl	Total	Boy	Girl	Total	Boy	Girl	Total	Boy	Girl	Total	Boy	Girl	Total
<b>Enrollment into Pre-school program</b>	<b>1.019***</b> (0.124)	<b>0.581***</b> (0.126)	<b>0.805***</b> (0.0881)	<b>0.651***</b> (0.152)	<b>0.0262</b> (0.144)	<b>0.339***</b> (0.104)	<b>0.440***</b> (0.149)	<b>0.137</b> (0.149)	<b>0.291***</b> (0.105)	<b>0.197</b> (0.193)	<b>-0.228</b> (0.169)	<b>-0.0284</b> (0.126)	<b>-0.317</b> (0.243)	<b>-0.0665</b> (0.244)	<b>-0.187</b> (0.172)	<b>0.907***</b> (0.223)	<b>0.379*</b> (0.209)	<b>0.646***</b> (0.152)
<b>Sex</b>	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Boy			-0.0102			-0.0423			-0.0983			0.185**			0.0106			-0.0752
Girl (ref)			(0.0589)			(0.0621)			(0.0632)			(0.0768)			(0.106)			(0.0782)
<b>Milieu</b>																		
Urban	0.0365	0.416***	0.230***	0.00464	0.260**	0.130*	0.111	0.353***	0.226***	0.163	0.0352	0.103	0.400**	-0.0124	0.200	0.0832	0.102	0.0924
Rural (ref)	(0.105)	(0.108)	(0.0750)	(0.108)	(0.110)	(0.0765)	(0.108)	(0.112)	(0.0777)	(0.135)	(0.132)	(0.0939)	(0.183)	(0.184)	(0.129)	(0.134)	(0.140)	(0.0967)
<b>Region (ref: Nord-Cent)</b>																		
Northeast	-0.101	-0.0709	-0.0740	0.312	0.350	0.334**	0.0478	-0.0119	0.0187	0.918***	1.468***	1.154***	0.574	1.044**	0.778**	0.446	0.273	0.379*
	(0.169)	(0.179)	(0.123)	(0.213)	(0.226)	(0.155)	(0.209)	(0.217)	(0.150)	(0.315)	(0.405)	(0.247)	(0.440)	(0.526)	(0.336)	(0.274)	(0.329)	(0.210)
North West	-0.606***	-0.910***	-0.748***	-0.342*	-0.282	-0.311**	-0.142	-0.108	-0.138	0.936***	0.250	0.563***	0.713	0.0830	0.339	1.165***	0.274	0.723***
	(0.164)	(0.173)	(0.118)	(0.186)	(0.195)	(0.134)	(0.196)	(0.203)	(0.140)	(0.302)	(0.266)	(0.196)	(0.439)	(0.372)	(0.278)	(0.320)	(0.307)	(0.216)
Higher Plateau Central	-0.396***	-0.543***	-0.458***	-0.770***	-0.669***	-0.718***	-1.119***	-0.867***	-1.003***	-0.472**	-0.958***	-0.714***	-0.781***	-0.575*	-0.679***	-0.685***	-1.030***	-0.824***
	(0.153)	(0.163)	(0.111)	(0.167)	(0.181)	(0.123)	(0.170)	(0.183)	(0.124)	(0.206)	(0.218)	(0.149)	(0.295)	(0.315)	(0.215)	(0.200)	(0.243)	(0.153)
Higher Plateau East	-0.445***	-0.477***	-0.454***	-0.529***	-0.750***	-0.632***	-0.651***	-0.600***	-0.629***	-0.807***	-1.080***	-0.938***	-0.848***	-1.014***	-0.932***	-0.552***	-1.095***	-0.795***
	(0.155)	(0.166)	(0.113)	(0.175)	(0.185)	(0.127)	(0.178)	(0.190)	(0.130)	(0.207)	(0.222)	(0.151)	(0.303)	(0.311)	(0.216)	(0.208)	(0.248)	(0.158)
Higher Plateau West	-0.656***	-0.973***	-0.804***	-0.854***	-0.904***	-0.874***	-0.550***	-0.502***	-0.534***	0.0371	-0.183	-0.0693	-0.274	0.257	-0.0474	-0.290	-0.680***	-0.451***
	(0.156)	(0.169)	(0.114)	(0.169)	(0.184)	(0.124)	(0.175)	(0.190)	(0.129)	(0.221)	(0.239)	(0.162)	(0.316)	(0.365)	(0.237)	(0.209)	(0.254)	(0.161)
South	-0.995***	-1.194***	-1.085***	-0.677***	-0.451**	-0.574***	-0.704***	-0.476**	-0.604***	-0.658***	-0.817***	-0.737***	-0.722**	-0.728**	-0.725***	-0.430**	-0.647**	-0.517***
	(0.152)	(0.167)	(0.112)	(0.167)	(0.183)	(0.123)	(0.170)	(0.186)	(0.125)	(0.202)	(0.219)	(0.148)	(0.295)	(0.312)	(0.214)	(0.205)	(0.253)	(0.158)
<b>Mother's education (ref: without instruction)</b>																		
Primary	0.558***	0.351**	0.448***	0.242*	0.200	0.222**	0.397***	0.468***	0.421***	0.233	0.361**	0.304***	0.431**	0.423**	0.437***	0.0824	0.286*	0.185
	(0.133)	(0.137)	(0.0948)	(0.126)	(0.131)	(0.0902)	(0.128)	(0.135)	(0.0926)	(0.153)	(0.156)	(0.109)	(0.207)	(0.215)	(0.149)	(0.155)	(0.166)	(0.113)
Below secondary	0.728***	0.385***	0.550***	0.439***	0.328***	0.385***	0.460***	0.376***	0.414***	0.559***	0.357**	0.458***	0.599***	0.460**	0.536***	0.176	0.200	0.196*
	(0.127)	(0.129)	(0.0901)	(0.125)	(0.127)	(0.0886)	(0.126)	(0.129)	(0.0900)	(0.161)	(0.153)	(0.110)	(0.216)	(0.215)	(0.152)	(0.155)	(0.160)	(0.111)
Secondary	0.976***	0.790***	0.876***	0.718***	0.895***	0.793***	0.716***	0.846***	0.768***	0.547***	0.650***	0.602***	0.654***	0.712***	0.687***	0.388**	0.402**	0.408***
	(0.136)	(0.139)	(0.0967)	(0.141)	(0.154)	(0.103)	(0.143)	(0.155)	(0.105)	(0.178)	(0.184)	(0.128)	(0.244)	(0.262)	(0.178)	(0.177)	(0.189)	(0.129)
Higher education	1.104***	1.151***	1.101***	0.357*	0.651***	0.488***	0.453**	0.382*	0.425***	0.761**	0.386	0.574***	1.112**	0.870*	1.010***	0.385	1.420***	0.740***
	(0.186)	(0.211)	(0.139)	(0.202)	(0.238)	(0.153)	(0.207)	(0.227)	(0.153)	(0.300)	(0.282)	(0.205)	(0.460)	(0.463)	(0.326)	(0.272)	(0.443)	(0.225)
<b>Wealth (ref: Poorest)</b>																		
Poorer	0.445***	0.154	0.303***	0.146	-0.0860	0.0370	0.0317	0.104	0.0691	0.571***	0.351**	0.458***	0.671***	0.413*	0.534***	0.417**	0.207	0.309***
	(0.141)	(0.145)	(0.101)	(0.132)	(0.135)	(0.0942)	(0.133)	(0.137)	(0.0953)	(0.160)	(0.157)	(0.112)	(0.225)	(0.218)	(0.155)	(0.166)	(0.168)	(0.118)
Middle	0.646***	0.418***	0.540***	0.492***	0.0458	0.280***	0.317**	0.304**	0.313***	0.624***	0.579***	0.605***	0.302	0.417*	0.365**	0.344*	0.286	0.316**
	(0.149)	(0.154)	(0.107)	(0.147)	(0.151)	(0.105)	(0.148)	(0.155)	(0.107)	(0.179)	(0.179)	(0.126)	(0.234)	(0.245)	(0.168)	(0.180)	(0.190)	(0.130)
Richer	0.774***	0.642***	0.710***	0.482***	0.474***	0.473***	0.447***	0.492***	0.468***	0.852***	0.904***	0.875***	0.478*	0.788***	0.624***	0.300	0.438**	0.360***
	(0.151)	(0.159)	(0.109)	(0.150)	(0.164)	(0.110)	(0.153)	(0.167)	(0.112)	(0.192)	(0.197)	(0.137)	(0.254)	(0.278)	(0.187)	(0.184)	(0.204)	(0.137)
Richest	0.856***	0.790***	0.816***	0.898***	0.816***	0.858***	0.842***	0.722***	0.785***	1.130***	1.243***	1.186***	1.020***	0.964***	0.996***	0.602***	0.871***	0.713***
	(0.159)	(0.167)	(0.115)	(0.169)	(0.182)	(0.124)	(0.174)	(0.183)	(0.126)	(0.225)	(0.227)	(0.159)	(0.324)	(0.319)	(0.226)	(0.212)	(0.240)	(0.158)
Constant	-1.052***	-0.763***	-0.911***	0.551***	0.625***	0.601***	0.649***	0.515***	0.644***	0.925***	1.182***	0.947***	1.926***	2.064***	1.975***	1.322***	1.691***	1.509***
	(0.160)	(0.171)	(0.121)	(0.163)	(0.179)	(0.125)	(0.165)	(0.181)	(0.127)	(0.194)	(0.217)	(0.150)	(0.280)	(0.306)	(0.214)	(0.198)	(0.244)	(0.159)
<b>Observations</b>	<b>2,821</b>	<b>2,583</b>	<b>5,404</b>	<b>2,860</b>	<b>2,615</b>	<b>5,475</b>	<b>2,855</b>	<b>2,620</b>	<b>5,475</b>	<b>2,868</b>	<b>2,620</b>	<b>5,488</b>	<b>2,869</b>	<b>2,621</b>	<b>5,490</b>	<b>2,857</b>	<b>2,606</b>	<b>5,463</b>

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Source:** Computed by the author from the 2012 MICS.

## Appendix E

**Table E1:** Do preschool enrollments influence the behavior of parents towards children? – Index

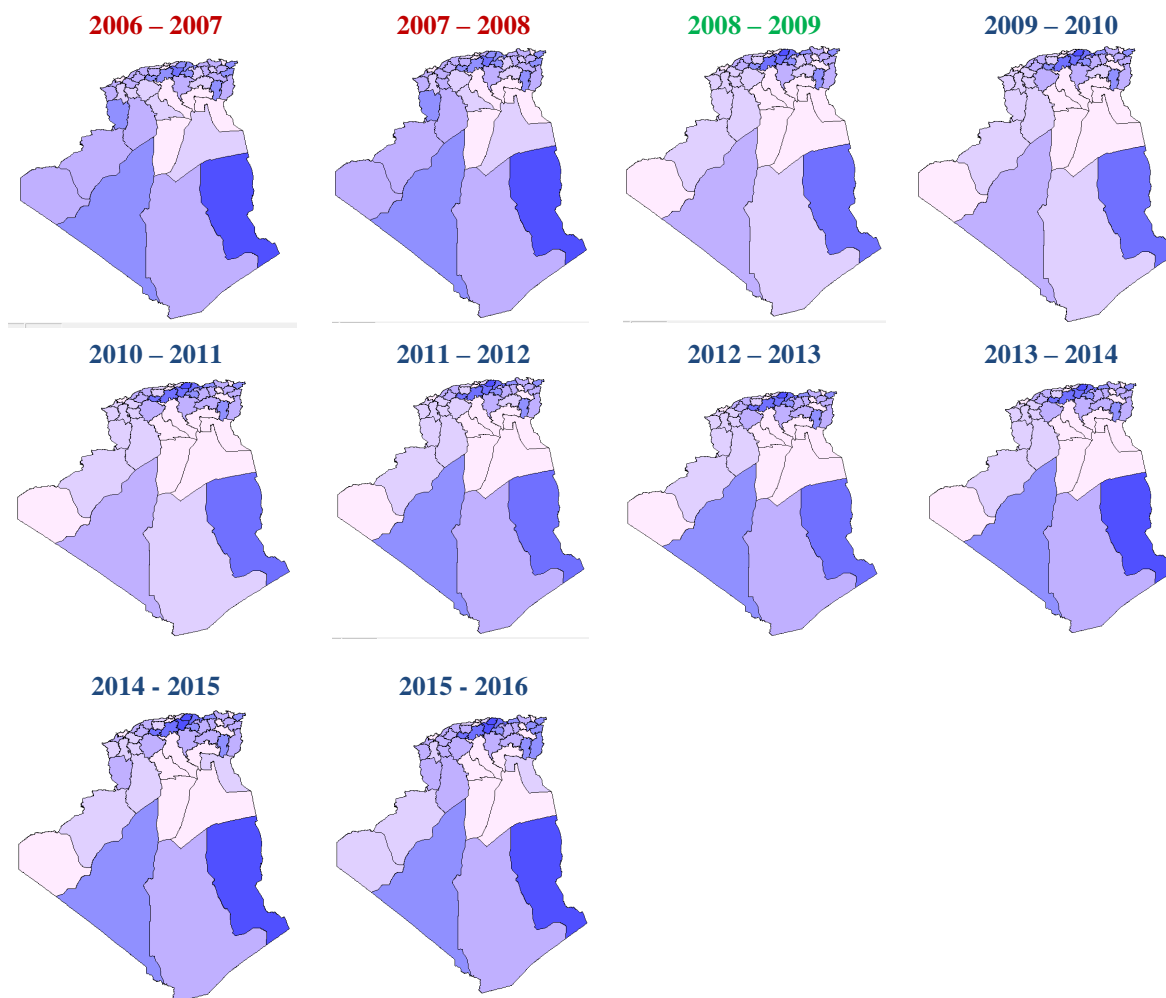
	Reduced form					Instrumental equation					Main stage regression equation				
	Quality of interaction Parents – Childs					Preschool enrolment					Quality of interaction Parents – Childs				
	Mother Interaction	Father Interaction	At least one of family members	All household members	Mother + Father Interaction	Mother Interaction	Father Interaction	At least one of family members	All household members	Mother + Father Interaction	Mother Interaction	Father Interaction	At least one of family members	All household members	Mother + Father Interaction
<b>Enrollment into Pre-school program</b>											<b>2.340</b> (1.930)	<b>1.358</b> (1.608)	<b>-0.208</b> (1.578)	<b>2.780</b> (4.373)	<b>5.316</b> (4.456)
<b>Sex</b>															
Boy	-0.0367 (0.0466)	0.159*** (0.0407)	-0.00847 (0.0409)	0.0664 (0.0797)	0.134* (0.0721)	-0.00873 (0.00941)	-0.00873 (0.00941)	-0.00873 (0.00941)	-0.00779 (0.00924)	-0.00779 (0.00924)	-0.0163 (0.0526)	0.167*** (0.0438)	-0.00716 (0.0430)	0.0888 (0.0884)	0.172* (0.0901)
Girl (ref)															
<b>Milieu</b>															
Urban	0.0483 (0.0602)	-0.118** (0.0526)	0.164*** (0.0528)	-0.0360 (0.103)	-0.0795 (0.0929)	0.0726*** (0.0122)	0.0726*** (0.0122)	0.0726*** (0.0122)	0.0695*** (0.0119)	0.0695*** (0.0119)	-0.130 (0.145)	-0.223* (0.121)	0.185 (0.119)	-0.223 (0.309)	-0.459 (0.314)
Rural (ref)															
<b>Region (ref: Nord-Cent)</b>															
Northeast	-0.0611 (0.0978)	-0.287*** (0.0855)	0.183** (0.0858)	-0.150 (0.167)	-0.417*** (0.151)	0.0679*** (0.0198)	0.0679*** (0.0198)	0.0679*** (0.0198)	0.0663*** (0.0193)	0.0663*** (0.0193)	-0.211 (0.162)	-0.379*** (0.135)	0.200 (0.132)	-0.296 (0.324)	-0.737** (0.330)
North West	-0.182* (0.0951)	-0.253*** (0.0831)	-0.135 (0.0835)	-0.421*** (0.162)	-0.511*** (0.147)	-0.000117 (0.0192)	-0.000117 (0.0192)	-0.000117 (0.0192)	-0.00101 (0.0188)	-0.00101 (0.0188)	-0.183* (0.102)	-0.252*** (0.0852)	-0.133 (0.0836)	-0.404** (0.167)	-0.496*** (0.170)
Higher Plateau Central	-1.207*** (0.0901)	-1.074*** (0.0787)	-0.711*** (0.0791)	-2.321*** (0.155)	-2.264*** (0.140)	-0.0694*** (0.0182)	-0.0694*** (0.0182)	-0.0694*** (0.0182)	-0.0704*** (0.0180)	-0.0704*** (0.0180)	-1.035*** (0.178)	-0.974*** (0.148)	-0.707*** (0.145)	-2.105*** (0.370)	-1.874*** (0.377)
Higher Plateau East	-0.546*** (0.0921)	-0.652*** (0.0805)	-0.585*** (0.0809)	-1.708*** (0.158)	-1.195*** (0.143)	-0.0244 (0.0186)	-0.0244 (0.0186)	-0.0244 (0.0186)	-0.0262 (0.0183)	-0.0262 (0.0183)	-0.483*** (0.115)	-0.612*** (0.0956)	-0.579*** (0.0938)	-1.635*** (0.211)	-1.051*** (0.215)
Higher Plateau West	-0.859*** (0.0907)	-0.857*** (0.0793)	-0.526*** (0.0796)	-1.685*** (0.155)	-1.711*** (0.140)	-0.0625*** (0.0183)	-0.0625*** (0.0183)	-0.0625*** (0.0183)	-0.0636*** (0.0180)	-0.0636*** (0.0180)	-0.699*** (0.161)	-0.761*** (0.134)	-0.528*** (0.131)	-1.494*** (0.333)	-1.350*** (0.339)
South	0.0112 (0.0881)	-0.427*** (0.0770)	-0.592*** (0.0773)	-0.882*** (0.151)	-0.439*** (0.137)	0.130*** (0.0178)	0.130*** (0.0178)	0.130*** (0.0178)	0.127*** (0.0175)	0.127*** (0.0175)	-0.291 (0.256)	-0.597*** (0.213)	-0.561*** (0.209)	-1.228** (0.552)	-1.103** (0.563)
<b>Mother's education (ref: without instruction)</b>															
Primary	0.283*** (0.0737)	0.222*** (0.0644)	0.383*** (0.0647)	0.558*** (0.126)	0.484*** (0.114)	0.0208 (0.0149)	0.0208 (0.0149)	0.0208 (0.0149)	0.0213 (0.0146)	0.0213 (0.0146)	0.240*** (0.0891)	0.198*** (0.0743)	0.395*** (0.0729)	0.510*** (0.161)	0.381** (0.164)
Below secondary	0.749*** (0.0704)	0.422*** (0.0615)	0.485*** (0.0618)	0.964*** (0.120)	1.149*** (0.109)	0.0611*** (0.0142)	0.0611*** (0.0142)	0.0611*** (0.0142)	0.0634*** (0.0139)	0.0634*** (0.0139)	0.620*** (0.141)	0.347*** (0.118)	0.502*** (0.116)	0.812*** (0.305)	0.842*** (0.311)
Secondary	1.085*** (0.0763)	0.600*** (0.0667)	0.720*** (0.0670)	1.342*** (0.130)	1.636*** (0.118)	0.0869*** (0.0154)	0.0869*** (0.0154)	0.0869*** (0.0154)	0.0876*** (0.0151)	0.0876*** (0.0151)	0.896*** (0.187)	0.496*** (0.156)	0.757*** (0.153)	1.143*** (0.405)	1.209*** (0.412)
Higher education	1.246*** (0.106)	0.794*** (0.0931)	0.707*** (0.0934)	1.734*** (0.183)	2.044*** (0.165)	0.193*** (0.0215)	0.193*** (0.0215)	0.193*** (0.0215)	0.196*** (0.0212)	0.196*** (0.0212)	0.805*** (0.390)	0.538* (0.325)	0.759** (0.319)	1.199 (0.875)	1.011 (0.892)
<b>Wealth (ref: Poorest)</b>															
Poorer	0.0902 (0.0770)	0.248*** (0.0673)	0.292*** (0.0676)	0.563*** (0.132)	0.356*** (0.119)	0.0250 (0.0156)	0.0250 (0.0156)	0.0250 (0.0156)	0.0246 (0.0152)	0.0246 (0.0152)	0.0286 (0.0974)	0.210*** (0.0811)	0.294*** (0.0796)	0.490*** (0.176)	0.222 (0.179)
Middle	0.293*** (0.0836)	0.373*** (0.0731)	0.487*** (0.0734)	0.947*** (0.143)	0.667*** (0.129)	0.0417** (0.0169)	0.0417** (0.0169)	0.0417** (0.0169)	0.0413** (0.0165)	0.0413** (0.0165)	0.188 (0.122)	0.310*** (0.102)	0.479*** (0.0998)	0.801*** (0.235)	0.429* (0.240)
Richer	0.284*** (0.0857)	0.408*** (0.0749)	0.622*** (0.0753)	1.131*** (0.146)	0.704*** (0.132)	0.0501*** (0.0173)	0.0501*** (0.0173)	0.0501*** (0.0173)	0.0525*** (0.0170)	0.0525*** (0.0170)	0.157 (0.137)	0.334*** (0.114)	0.621*** (0.112)	0.972*** (0.281)	0.415 (0.286)
Richest	0.494*** (0.0901)	0.447*** (0.0788)	0.843*** (0.0791)	1.416*** (0.154)	0.952*** (0.139)	0.117*** (0.0182)	0.117*** (0.0182)	0.117*** (0.0182)	0.115*** (0.0179)	0.115*** (0.0179)	0.216 (0.248)	0.283 (0.207)	0.852*** (0.203)	1.066** (0.534)	0.327 (0.544)
<b>IV - Number of preschool class (per child age 0 – 4) at municipality level</b>	0.000871 (0.000647)	0.000497 (0.000566)	-0.000106 (0.000568)	0.000714 (0.00103)	0.00135 (0.000930)	<b>0.000360***</b> (0.000130)	<b>0.000360***</b> (0.000130)	<b>0.000360***</b> (0.000130)	<b>0.000241**</b> (0.000119)	<b>0.000241**</b> (0.000119)					
Constant	2.251*** (0.101)	1.609*** (0.0885)	3.893*** (0.0889)	5.770*** (0.172)	3.849*** (0.172)	-0.0125 (0.0205)	-0.0125 (0.0205)	-0.0125 (0.0205)	-0.00650 (0.0200)	-0.00650 (0.0200)	2.283*** (0.102)	1.629*** (0.0849)	3.883*** (0.0833)	5.794*** (0.168)	3.891*** (0.171)
<b>Observations</b>	<b>5318</b>	<b>5318</b>	<b>5318</b>	<b>5483</b>	<b>5483</b>	<b>5,289</b>	<b>5,289</b>	<b>5,289</b>	<b>5,440</b>	<b>5,440</b>	<b>5,289</b>	<b>5,289</b>	<b>5,289</b>	<b>5,440</b>	<b>5,440</b>

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Source:** Computed by the author from the 2012 MICS.

## Appendix F

**Figure F1:** Number of **primary school** per child age 0 - 4 constructed by governorates between 2006 and 2016



**Source:** Computed by the author from data from the Ministry of Education.

