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Deferred effects of nursery school on adolescents' school performance in Spain

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Abstract

This research analyses the long-term effects of nursery school attendance before the age of three in Spain. The effects are measured when the individuals are adolescents and attend secondary school. The article deals with the controversy over the long-term effects of nursery school attendance and its potential effect on reducing inequalities and social exclusion. The results estimate a significant long-term effect of nursery school attendance on improving educational performance, although the beneficial effects are lower among adolescents residing in the lower status households.

Keywords

Acknowledgements

1. Introduction

Women's influx into the labour market and the wage penalty suffered over the life-course of mothers when they stop working due to maternity (Ruhm, 1998; Waldfogel, 1998) push many families to enrol their children in nursery school in the first months of life. There is no question that this is an urgent need for single parents, who account for between 10 and 20% of households with children in most developed countries (Kenworthy, 2009). Hence, evaluating the effects of nursery school attendance on individuals' development emerged as a new field of research in the 1960s (see Gomby et al., 1995 for the USA; and Boocock, 1995 for Europe and Asia). However, this kind of research is still underdeveloped in southern European nations, where a specific combination of markets, family and the welfare state makes them a unique variant among conservative welfare regimes (Esping-Andersen, 1999; Liebfried, 1992, Ferrera, 1996). This study aims to remedy this lack of knowledge on early childhood programs in southern Europe by assessing the impact that nursery schools in Spain have on the subsequent development of adolescents who attended nursery school during the first half of the 1990s. The analysis focuses on data from the autonomous region of Catalonia, the only region with available data.

2. Predicted effects of nursery school attendance on adolescents' academic performance

Since the 1980s, there have been numerous assessments of the positive effects of nursery school attendance among children in the lower social classes, particularly in the USA. These assessments have driven the recommendations to use nursery school and family counselling services as an instrument in lowering social inequalities and the risk of future social exclusion (Karoly et al., 1998; Danziger and Walfogel, 2000; Carneiro & Heckman, 2003; Schütz et al., 2005, Garces et al., 2002). The main argument in favour of nursery school as an instrument in the struggle against inequalities is the defence of its efficacy in lowering the still-high proportion of individuals who have problems with reading comprehension, verbal expression, mathematical abstraction, social relations and self-control when they start compulsory education, which leads them to failure at school (Pianta et al., 2009). Most of the recommendations in favour of nursery school as a mechanism to combat social exclusion are grounded on studies which conclude that the benefits of nursery school are higher among children from a low socioeconomic status (SES) than among children from a higher SES (Garces et al., 2002; Gormley and Gayer, 2005; Magnuson, Ruhm and Walfogel, 2004; Magnuson, Ruhm and Waldfogel, 2007), and higher among children from racial and ethnic minority groups (Gormley and Phillips, 2005; Magnusom and Waldfogel, 2005). However, recent studies have demonstrated that nursery school attendance has positive effects on students' school performance regardless of their families' SES (Melhiuish et al., 2008). In view of these results, there is a surge in opinion in favour of extending nursery school to all children with the goal of improving aggregate human capital while also lowering inequalities. Yet there are also doubts as to how long the effects of nursery school attendance last over time.

The studies on the duration of the effects of nursery school are inconclusive (Magnuson and Waldfogel, 2005). Some of the earliest studies conducted in the United States concluded that the effect is diluted over time, and that three years after having begun compulsory education the effects had disappeared (McKey et al., 1985). The more optimistic reports detect that quality nursery school has effects that go beyond the children's immediate school performance and that it yields a higher probability of graduating from secondary compulsory education, entering the university, getting a job and earning a higher income at work, just as nursery school would lower the likelihood of criminal behaviours and conduct problems that are a risk to the health (Barnett and Belfield, 2006). An assessment of the effects of the *Perry Pre-school Program* shows that the positive effects last the entire adult life by improving individuals' opportunities for social mobility, despite the fact that nursery school's effect on IQ vanishes over time (Lazar and Darlington, 1982). Nor are there conclusive data on whether the effects last longer in certain social groups than in others. Magnuson, Meyers, Ruhm and Walfogel (2004) found that the effects of nursery school last longer in children from poor or undereducated families, but there is also evidence which claims that the improvements last less time among children living in socially disadvantaged households (Currie and Thomas, 1995). Using a methodology based on comparing the drop in the school performance distance separating students from different social backgrounds, Lee et al. (1988) conclude that the positive effects of nursery school last over time, so the distances separating less advantaged from more advantaged students are gradually narrowed. However, the long-term effect is conditioned by the quality of the school attended by the minor during compulsory education (Melhuish et al., 2008).

Kauerz (2006) offers a summary of the hypotheses available to explain the possible vanishing effect among more disadvantaged children. First, the length of the nursery school period must be prolonged, since it is illusory to think that only one or two years of nursery school in the minor's life is enough to offset other risk factors in the child's social and family setting. Secondly, the lack of universal coverage of nursery school services would mean that not all the students would be at the same level of preparation when they begin compulsory schooling, forcing the teachers to adapt the pace to the level of demands of the slowest to learn; as a result, the improvements in the learning capacity of children who had attended nursery school would be futile and lost over time. A third factor that might explain the disappearance of improvements from nursery school is in the low performance of the schools where students from a lower SES tend to study. Required to register in the schools located in the neighbourhoods where they live, the children who attended nursery school have to attend compulsory school sharing the classroom with a majority of low-performing classmates. Kauerz (2006) also offers a possible explanation for the discrepancies regarding how long the effects of nursery school last. She claims that the assessments that detect a decline in the improvements gained in nursery school take the scores students earn on standardised tests as the dependent variable to measure the degree to which cognitive skills are developed, a yardstick that is extremely technically complex and can give rise to disparate results. Then again, the studies which detect that the positive effects of nursery school last over time use other measurements as the dependent variables, such as the graduation rates at different educational levels, school dropout rates, the risk of police arrest and income mobility once the subjects have joined the job market.

In this study, we focus the analysis on the effects of nursery school attendance between birth and age two on adolescents' school performance. We have chosen the

nursery school period (age 0 to 2) because this enables us to make a more clear contrast between those who have and have not attended nursery school, a more difficult observation to make in preschool ages given that school attendance between ages three and five is virtually universal in Spain.

3. Nursery schools in Spain: The case of Catalonia

The Spanish educational system provides compulsory full-time education from ages 6 to 16. This period of compulsory education is divided in two stages: primary school (EGB: *Educació General Bàsica*) from ages 6 to 12, and compulsory secondary school (ESO: *Educació Secundaria Obligatòria*) from ages 12 to 16. Then, a two-year voluntary period is possible, with two different tracks: one oriented towards vocational training and the other (*Batxillerat*, or baccalaureate) that prepares students to enter the university. Before primary school, voluntary preschool from ages 3 to 6 (*parvulari*) is offered free-of-charge in public schools and has become almost universal, and the number of children who attend nursery school from ages 0 to 3 (*escola bressol*) is rising, specially in Catalonia where the coverage is higher and similar to the averages in northern European countries (see Table 1).

Table 1: Nursery school coverage
Proportion of children aged 0 to 2 years old in nursery school

Year 2005	%	Hours per week
Denmark	63	34
Sweden	45	29
Norway	42	31
Finland	26	35
Holland	54	17
France	43	30
Belgium	42	30
United Kingdom	40	18
Germany	14	22
Austria	10	23
Italy	29	30
Spain	34	28
Catalonia	**55**	**n.a.**
Portugal	44	40

Source: OECD Family Database. Catalonia, figures from
2008, IDESCAT.

However, this aggregate figure conceals an uneven distribution among social strata and regions (González and Vidal, 2005). There are not enough places at public nursery schools to cover the potential demand, and private nursery school options range from prices that are unaffordable for the majority of the population to day care centres of dubious educational quality. At public nursery schools, families have to pay around 25% of the total cost, but fewer than 50% of the children who attend nursery school before the age of three are at public centres according to the extraordinary report issued by the Ombudsman of Catalonia (Síndic de Greuges, 2007). Public nursery schools offer places at highly disparate prices depending on whether the town or the Catalan

government owns them. Municipal nursery schools that charge between 250 and 300 euros per child, including meals, are common, a cost that accounts for almost one-quarter of the gross salary of an uneducated worker between the ages of 30 and 39. Despite the relatively high cost of nursery schools for families, the quality of the services provided in Catalonia is not equivalent to that provided in countries where nursery school is more highly developed. Table 2 shows that the regulations in force in Catalonia (Decree 282/2006) stipulate a ratio of child per professional more than double the ratio in Denmark, Finland and the United Kingdom.

Table 2: Average ratio of children per professional

Denmark	3
United Kingdom	3.7
Finland	4
Holland	5
France	5.7
Sweden	6
Germany	7.5
Catalonia*	8 to 10
Spain	13.7

Source: De Henau et al., (2007)

* For Catalonia, author's own estimate based on the regulations in force.

4. Data and methodology

The data used to estimate the effects of nursery school attendance were obtained from CIIMU's (*Institut d'Infància i el Mon Urbà*) Panel on Families and Childhood. This panel is a survey conducted with a random sample of 3,000 students attending compulsory secondary school and born between 1990 and 1993. The survey was repeated three years in a row with interviews with the same students, their parents and teachers using different questionnaires that gathered retrospective data since the students' birth as well as current information. The sample was chosen using a multi-stage sampling procedure. First, 70 compulsory secondary schools were chosen from all over Catalonia, and then the students to be interviewed were taken from these schools.

4.1 Dependent variables that measure academic performance

We have measured academic performance with two indicators:

1. The average marks earned by students in the first year of compulsory secondary school, including the subjects of religion and gym. The range of this variable is 1 to 5, a scale that means the following: *5= Excellent, 4= Good, 3=Satisfactory, 2= Sufficient* and *1= Insufficient*.

2. The transition to the first year of baccalaureate in academic year 2006-2007 among students who were in their fourth year of compulsory secondary school in academic year 2005-2006. It would have been more effective to consider the

transitions to the first year of baccalaureate among all the students who were in their fourth year of compulsory secondary school in each wave of this study, but at this point the information on whether the students had attended nursery school or not is only available for the first wave of this survey, which limits the sample to slightly over 600 students.

4.2 Control variables

The **socioeconomic status** of the household has been measured by the equivalent disposable income and the mother's highest educational level. The effect of family income on students' educational performance is not linear; instead, it exerts a particular influence on both ends of the salary scale (Esping-Andersen, 2010). For this reason, we used two dichotomous variables as indicators of economic status, one whose value is 1 if the household has an income level within the lowest quartile of the income distribution scale, and the other whose value is 1 if the household has an income level within the highest quartile of the income distribution scale. As an indicator of the educational capital available in the household, we have used the highest educational level officially attained by the mother since a prior exploration conducted with the data base showed that the mother's educational level is more important than the father's in explaining students' educational performance. However, we should note that in the cases in which there has been divorce, separation or the mother's death and the father lives with another woman at the time the survey is administered, the educational level used was that of the stepmother. However, we have kept the biological mother's educational level when the goal was to measure the effect that this level might have had on the likelihood that the student attended nursery school before the age of two, since we have assumed that the majority of individuals still lived with their biological mothers until the age of two.

Students' academic performance is conditioned by the quality of their parents' relationships. Open conflicts that lead to home climates lacking in a parental partnership in the child's upbringing are particularly negative. One facet of these situations becomes particularly notorious when there is a **separation** or **divorce**. The parents' separation tends to be accompanied by alterations in everyday life coupled with situations of emotional tension that can lower minors' academic performance, even if temporarily. The drop in academic performance can become chronic in certain circumstances, especially if the separation means a drop in the adults' ability to monitor their children's conduct. In our models, we have controlled for whether the parents of the student are separated or divorced, distinguishing between three different situations: a) the relations between the parents are positive despite the family rupture, b) the relations are conflictive and c) there are no relations.

In the group of variables aimed at measuring the **parents' ability to monitor** their children's behaviour, we have included in the model three situations which can occur once the students finish their school day: a) the mother tends not to be at home when the minor gets back from school; b) the father tends not to be home; and c) the number of days of the week that the minor has to remain outside until an adult arrives home. With these variables, we assume that the higher the number of days of the week that a minor is not monitored by their parents or any adult, the higher the likelihood that their academic performance will be under par.

These variables are complemented by an indicator on the individual's **sex** and whether Catalan is the language with which they interact with any member of their family. Sex is relevant in that academic performance is usually higher among girls than boys, with the exception of mathematics. The use of **Catalan** as the language of family interaction was included because it is official language of schooling in Catalonia and it is well known that academic performance is lower among students whose mother tongue is not the official school language.

In addition, the **school** that the child attends has been controlled for under the assumption that there are heterogeneous factors affecting students' marks and behaviour linked to unobserved characteristics of the schools.

4.3 Basic descriptors and endogeneity suspicion

The values of the variables described in the previous section are shown in Table 3. This table shows that school performance is positively associated with nursery school attendance, but it is also positively associated with the parents' educational status. Furthermore, both variables are correlated such that the probability of nursery school attendance rises with the parents' educational status (see Table 4). Thus, more than 85% of the children of university graduates had attended nursery school before the age of three, a proportion that is only 58% among the children of parents with basic or lower educational levels. Therefore, this is a potential case of endogeneity that prevents us from accurately measuring the net effect of nursery school attendance unless we establish some sort of control over the factors that are simultaneously associated with school performance and the likelihood of attending nursery school.

Table 3: Descriptive statistics of the variables used in the models

Average marks, 1st year of compulsory secondary education	
All individuals in the first year	3.18
Attended nursery school before the age of 12 months	3.31
Attended nursery school between the ages of 12 and 24 months	3.23
Attended nursery school after the age of 24 months	3.01
Parents with university education	3.51
Parents with post-compulsory secondary education	3.29
Parents with vocational training	3.01
Parents with basic education	2.88
Year schooling started	percentages
1 year old or less	15.1
Between 1 and 3 years old	57.8
3 years old or more	27.1
Sex	
Boys	43.55
Girls	56.45
Mother's educational level	
University	14.81
Post-compulsory secondary	11.76

Vocational	13.72
Compulsory secondary	12.78
Primary or less	6.95
Don't know/No answer/Other	39.97
Relationship of biological parents	
Living together	86.62
Separated with a good relationship	5.21
Separated with a bad relationship	4.03
Separated with no relationship	4.14
Speaks Catalan with some family member	64.8
Mother's ideology (scale of 1 to 10)	
Left (1 to 3)	31.53
Centre (4 to 6)	54.84
Right (7 to 10)	3.37
Apolitical	10.26
Number of siblings	
None	23.72
One	61.4
Two or more	14.88
Number of days of the week the child has to remain outside until there is an adult at home	
None	93.82
One	3.52
Two	1.37
Three	0.65
Four	0.25
Five	0.4
When the student returns home from school...	
The mother is usually not home	22.4
The father is usually not home	64.62
Neither parent is usually home	11.73

Table 4: Frequency of nursery school attendance according to highest educational level in the household

Variables	University	Post-compulsory secondary	Vocational	Basic or less
Attended nursery school during the first year of life	21.01	17.01	11.79	9.08
Attended nursery school during the second year of life	64.67	60.59	57.09	48.36

4.4 The choice of sending children to nursery school before the age of three

The decision to send children to nursery school at such a young age as the first two years of life depends on the quality of the nursery school services available, the families' preferences and the structural constraints limiting the options available to households. It should be expected that if families have the chance to choose between sending their children to a nursery school or keeping them at home, one important factor will be the families' opinion on the quality of the schools. There are evidences that the quality of nursery school services is closely tied to the composition of the supply. In societies where most nursery schools are private, the overall quality of these schools tends to be lower than in nations where public nursery schools are predominant (Noailly

et al., 2007; Sosinsky et al., 2007; Cleveland et al., 2007). As we have seen in Table 2, Catalan nursery schools are not in the upper ranks of quality, which should discourage some mothers, and those with enough economic resources might tend more to hire childcare services at home (Sylva et al., 2007). Yet on the other hand, access to nursery school is largely conditioned upon families' disposable income, with the exception of those families poor enough to be eligible for free or partly-funded schools. Thus, families with more than one nursery school-aged child will have fewer opportunities to send them to school given the significant cost (Sylva et al., 2007).

Regardless of the quality of the supply and the income available to pay for it, families take their decisions by assessing other factors as well, such as the opportunity cost, the availability of alternative resources and their preferences in terms of their personal plans, especially the mothers'.

The opportunity cost has been measured by the mother's educational credentials in that they determine her potential income on the job market and therefore the short- and long-term cost of the time the mother spends with her child(ren) at the expense of paid work.

The alternative resources are those contributed directly in time by other members of the household and other family members, especially the children's grandparents, who might care for them while the mother is at work. The most extreme cases of a lack of resources are households where there has been separation or divorce and the relationship between the couple is conflictive or nonexistent. In these cases, the parent with custody of the child(ren), usually the mother, is likely to feel constrained to send the child(ren) to nursery school.

Regarding preferences, the decisions taken by households where there are minors are conditioned by the adults' values, and in this case the values on gender roles within the family are particularly important. Usually men and women with higher educational levels have a more egalitarian view of gender relations (Esping-Andersen, 2010), and they are therefore less likely to make the mother pay all the costs of parenthood. Thus, in these educated households the women are more likely to work, the parents are more likely to raise their children together and the children are more likely to attend nursery school. However, the educational level also captures the cultural values and opportunity costs; consequently, we have considered the political ideology of the interviewees as an indicator of gender values, since regardless of educational level, we expect that more politically conservative mothers are less likely to send their children to nursery school.

5. Results

5.1 Performance measured by average marks

Estimating the effects of nursery school attendance on academic performance requires us to use a two-stage regression model that helps to control for endogeneity. In the first stage, an exponential function model estimates families' likelihood to send their children to nursery school under the age of three, a decision that is conditioned upon the

household's socioeconomic status, the opportunity cost, the number of children and whether there has been separation or divorce. The second stage estimates a model of ordinary least squares in which the average marks earned by the students are the dependent variable and the likelihood of sending children to nursery school before the age of three is added to the model specified. In order to facilitate identification of the model, in the selection model of the individuals who have attended nursery school we included an additional independent variable: the mother's political ideology. This also works as a kind of instrumental variable in that it is associated with nursery school attendance, although we have no theoretical arguments leading us to believe that it has an effect on adolescents' school performance.

Table 5 shows the estimates of the first and second stages. We can see the variables associated with the likelihood that families decide to send their children to nursery school before the age of three. As we predicted, the likelihood that the child(ren) will attend nursery school before the age of three is higher among families in which the mother has a higher educational level and a higher income level and identifies more closely with progressive values. These factors are reinforced if the family has few children.

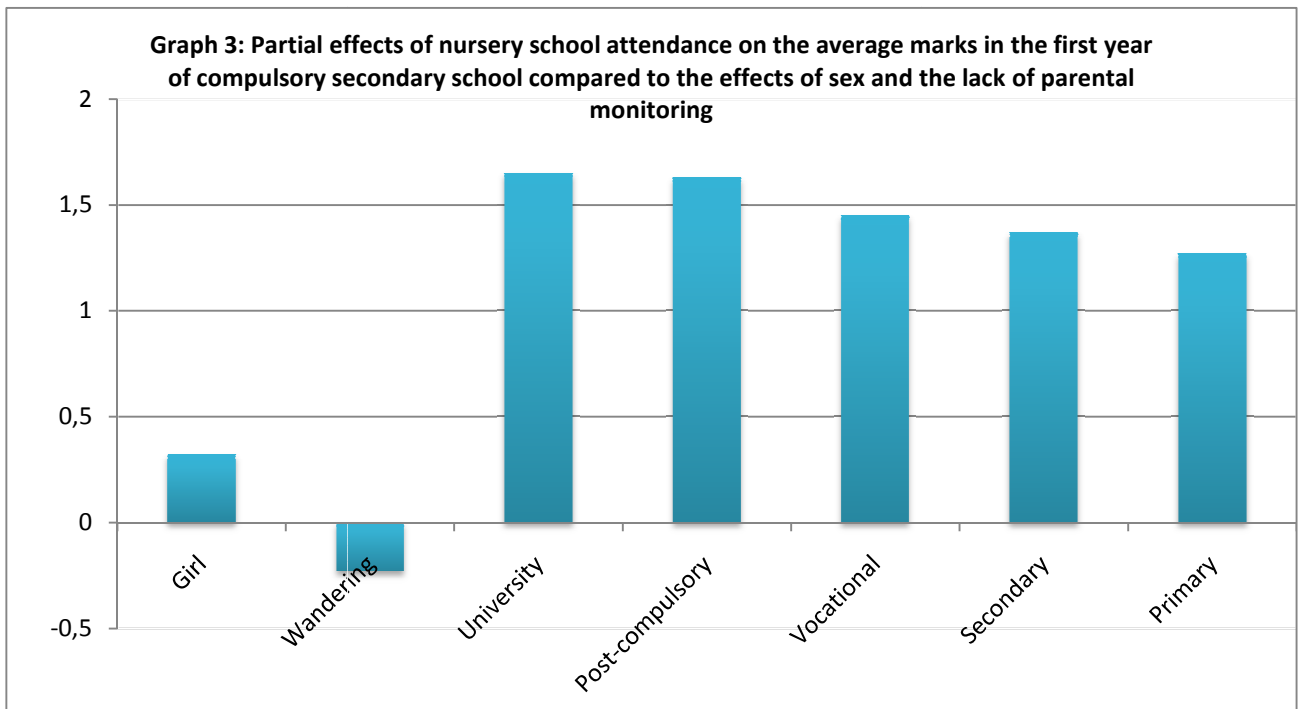**Table 5: Treatment effects regression: two-step estimates**
N= 707, Wald chi2(100) = 308.7, Prob > chi2 = 0.000

Average mark	coefficients	
Girls	0.32	***
Mother's educational level. University graduate as the reference		
Post-compulsory secondary	0.46	
Vocational training	0.20	
Compulsory secondary	0.72	+
Primary or less	0.48	
Other degrees	0.92	+
Nursery School (NS)	2.26	**
Interactions between NS and mother's educational level		
NS*Post-compulsory secondary	-0.43	
NS*Vocational	-0.32	
NS*Compulsory secondary	-0.85	**
NS*Primary	-0.74	*
NS*Other	-1.28	**
Couple's relationship. Not separated as the reference		
Separated with a good relationship	-0.18	
Separated with a bad relationship	-0.30	+
Separated with no relationship	-0.11	
Available income. Quartiles 2 and 3 as the reference		
1st quartile	-0.01	
4th quartile	0.01	
Interactions between NS and available income		
NS*1st quartile	-0.15	
NS*4th quartile	-0.16	

Number of siblings. 0 as the reference		
1	0.02	
2+	0.17	
Catalan as family language	0.18	**
After school		
The mother is not home	-0.02	
The father is not home	-	
The student must stay outside	-0.24	**
Constant	1.13	

Attending Nursery School		
Biological mother's educational level. University graduate as the reference		
Post-compulsory secondary	-0.61	**
Vocational training	-0.51	*
Compulsory secondary education	-0.97	***
Primary or less	-0.82	***
Other degrees	-0.93	***
Partnership breakdown before age 3	0.34	
Available income. Quartiles 2 and 3 as the reference		
1st quartile	-0.27	*
4th quartile	0.44	**
Number of siblings	-0.21	**
Political ideology: Left as the reference		
Center	-0.25	**
Right	-0.43	
Apolitical	-0.34	+
Constant	1.65	***

+ Statistical significance under 10%

* Statistical significance under 5%

** Statistical significance under 1%

*** Statistical significance under 0.01%

Once endogeneity has been controlled for, we see that having attending nursery school before the age of the three significantly increases the likelihood of improving the average marks in the first year of compulsory secondary school but, the children of mothers whose maximum credential is compulsory school or less, are the ones who benefitted less from attending nursery school, although they did display some benefits. Graph 3 shows the partial effect of nursery school attendance on the average marks in the first year of compulsory secondary school according to the mother's educational level and compared to the partial effects of sex and the lack of parental monitoring. We can see that having attended nursery school before the age of three raises the average marks in the first year of compulsory secondary school by 1.65 points (on a five-point scale ranging from 1= insufficient to 5 = excellent) if the student's mother is a university graduate. The effect of nursery school attendance drops as the mother's educational level is lower, and the effect of nursery school attendance on the children of less educated mothers marks an average of 1.27 points higher. Even though the positive effect of nursery school is lower for the children of less educated mothers, it is still quite high if we compare it to the effect of being a girl or living in a household in which the parents monitor their children little. Girls earn marks that are 0.32 points higher than those of boys, and students who cannot go home after school because there is no adult at

home have marks that are an average of 0.23 points lower for each day of the week that they cannot go home. In other words, under equal conditions, a boy whose mother is uneducated and has to stay wandering the streets five days a week until an adult arrives home would show school performance similar to or slightly higher than a boy who goes directly home after school if the former had attended nursery school while the latter had not.

Graph 3: Partial effects of nursery school attendance on the average marks in the first year of compulsory secondary school compared to the effects of sex and the lack of parental monitoring

5.2. Performance measured by the transition to baccalaureate:

The sample for which we have information includes 675 students who were registered in the fourth year of compulsory secondary school in academic year 2005-2006. Of them, the following year almost 75% were attending the first year of some track of baccalaureate, 38 students (5.6% of the total) were repeating their fourth year of compulsory secondary school and 49 (7.3%) were in their first year of vocational training. Just a handful of students (15) had left the educational system entirely. However, more importantly in methodological terms is the fact that 70 students had disappeared from the sample the following year, making it impossible to ascertain the status of more than 10% of the initial sample. This attrition is not overly worrisome if it is randomly distributed among the population studied; however, it does pose a problem that is difficult to resolve if its distribution is biased. This would mean that the sample from the ensuing year of the study would no longer be statistically random, thus posing the possibility that the bias is correlated with one of the variables in the model developed to explain the transition to baccalaureate.

A logistical regression of the sample attrition over the variables from the explanatory model on school performance shows that, indeed, the attrition was not random and was instead associated mainly with students whose mothers have no academic degrees and with children whose mothers have other degrees. Students who showed high symptoms of a lack of emotional control in the first wave of the survey were also more likely to disappear from the sample the second year, and students who had attended nursery school before the age of three showed a higher propensity to survive in the sample.[1] Given the fact that all three variables, namely the mother's educational level, the lack of emotional control and nursery school attendance, are associated with school performance, we can suspect that there is a selective effect in the surviving sample that should be corrected in order to yield a more accurate estimate of the effect of nursery school attendance on the likelihood of transitioning to baccalaureate. The problem is that it is not easy to correct for both the selective effect of the individuals who have survived in the sample and the endogeneity effect derived from a non-random sample of students who attended nursery school before the age of three. However, we have chosen to separately estimate a biprobit model that corrects for the endogeneity, since the results of the *heckprob* model shows that the selective effect of the sample is insignificant (chi2=0.56).

In this biprobit model, we have eliminated the variables of Catalan as a mother tongue, as well as the variables on the students' degree of monitoring by adults when school is over due to the fact that once the marks earned in language and mathematics are included in the model, these variables become redundant and cease to be significant. We have included the number of siblings since there are indications that the higher the number of siblings, the lower the parents' ability to invest in education and the lower the probability that the students will make the transition to non-compulsory education (Sarasa and Sales, 2008). However, this hypothesis is not confirmed with the data available, since the number of siblings shows no negative effects.

Table 6 shows the results of the biprobit model; the results tell us that nursery school attendance before the age of three has a positive effect on the transition to baccalaureate, especially among children from well-to-do families, since even though we can observe no significant differences in the effect of nursery school attendance on students whose mothers have different educational levels, we can indeed detect significant differences according to the disposable household income. Thus, the advantages of nursery school attendance decrease as the family income drops.

Table 6: Seemingly unrelated bivariate probit regression. Transition to first course of baccalaureate

N= 574,   Wald chi2(37)=14478.31,   Prob > chi2= 0.000

	Coefficient
Girl	0.15
Mother's educational level. University graduate as the reference	
Post-compulsory secondary	-0.81 +
Vocational training	-0.27
Compulsory secondary	-0,19

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[1] We have not shown the results of this regression.

Primary	-0.94	+
Other degrees	-1.05	+
Nursery School (NS)	2.73	***
Interactions between NS and mother's educational level		
NS*Post-compulsory secondary	0.24	
NS*Vocational	-0.46	
NS*Compulsory secondary	-0.41	
NS*Primary	-0.31	
NS*Other	8.93	***
Available income. Quartile 4th as the reference		
2th and 3th quartiles	0.28	
1st quartile	0.60	
Interactions between NS and available income		
NS*2th and 3th quartile	-0.78	+
NS*1st quartile	-1.44	**
Number of siblings. Reference 0		
One	0.30	+
Two or plus	0.09	
Maths marks	0.20	**
Catalan language marks	0.23	**
Spanish language marks	0.21	**
Couple's relationship. Not separated as the reference		
Separated with a good relationship	0.61	+
Separated with a bad relationship	0.25	
Separated with no relationship	0.01	
Constant		
	-2.48	***
Attending Nursery School		
Mother's educational level. University graduate as the reference		
Post-compulsory secondary	0.04	
Vocational training	-0.20	
Compulsory secondary	-0.60	***
Primary	-0.29	
Other degrees	-0.52	+
Available income. Quartile 4 as the reference		
2th and 3th quartiles	-0.07	
1st quartile	-0,17	
Partnership breakdown before age 3	0.45	
Number of siblings. Reference 0		
One	-0.07	
Two or plus	-	
Political ideology: Left as the reference		
Centre	-0.20	
Right	-0.16	
Apolitical	-0.55	**
Constant	1.16	***

rho: -0.82   Prob > chi2= 0.12

+ Statistical significance under 10%

* Statistical significance under 5%

** Statistical significance under 1%

*** Statistical significance under 0.01%

In order to better illustrate the effects of nursery school on the likelihood of entering the first year of baccalaureate, Graph 4 shows the partial effect of having attended nursery school before the age of three. Taking adolescents who live with their biological parents, have no siblings and have earned marks in mathematics and languages near the average of all students in the fourth year of ESO as the point of reference, the graph shows the percentage rise among those who had attended nursery before the age of three in the likelihood that an adolescent of this characteristics registers in the first year of baccalaureate the following academic year. The percentages are shown by the mothers' educational levels and by household income. It is interesting to note how the unequal impact of nursery school attendance translates into the fact that the children who attended nursery school whose mothers are university graduates and earn higher incomes are 60% more likely to attend the first year of baccalaureate than the children whose mothers are wealthy and university graduates but who did not attended nursery school before the age of three. This likelihood is only 43% higher if we compare the children of mothers who graduated from university but are poor. The trend linked to income remains the same regardless of the mothers' educational level, so the children of mothers with basic education are 22% more likely to register in baccalaureate if they attended nursery school and their families are wealthy; however, this probability drops to 11% of the families are poor.

Graph 4: Partial effect of nursery school attendance on the probability of attending baccalaureate depending on household income and mother's educational credentials
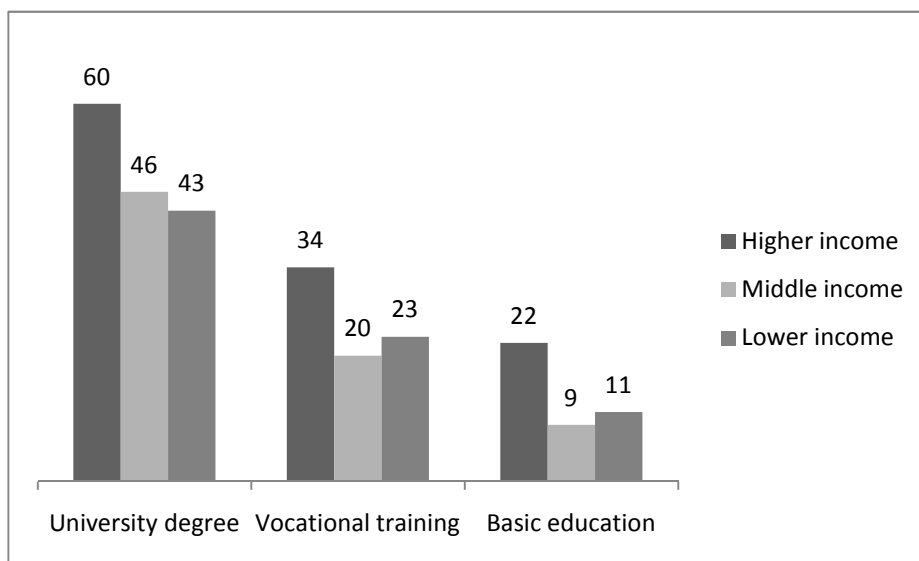
6. Conclusions

Our estimates are consistent with the hypothesis that early nursery school attendance benefits children's cognitive development and that the positive effects of nursery school attendance last until adolescence and influence students' and their families' decisions on whether or not to continue post-compulsory education.

However, the estimates in our model indicate that the effects are not homogeneous among social strata. The beneficial effect of nursery school attendance, as measured by the average marks in the first year of ESO, is lower for children whose mothers' educational level is compulsory secondary education or lower, regardless of the available household income. When the dependent variable is the likelihood that students in the 4th year of compulsory secondary education continue their education in any track of baccalaureate, we can see a similar pattern. In this case, the available household income seems more significant than the mother's educational level, but it confirms the pattern that the effect of nursery school attendance diminishes the lower the social stratum of the students' family.

This heterogeneity of effects among social strata is not consistent with the prediction derived from the study by Magnuson, Ruhm and Walfogel (2004) that the effects of nursery school attendance are more positive among more disadvantaged social sectors. To the contrary, in line with the results of Currie and Thomas (1995), students from the lower social strata notice improvements from nursery school attendance, but these improvements are weaker than those noticed in students from families with a higher socioeconomic status.

We can posit three alternative hypotheses to explain this phenomenon. First, the quality of the nursery schools is heterogeneous, and access to the higher-quality ones is determined by the family's socioeconomic status. In this case, the improvements in children's cognitive development would vary according to the families' social status, and our study would have captured this inequality as it endures over time. A second hypothesis is based on the assumption that the result of nursery schools is the outcome of the interaction between teachers, children and family. In this case, even assuming that all children go to nursery schools with a similarly high quality, the families' educational levels are heterogeneous, and homogenous results will never be obtained without complementary interventions by social and educational services in families where the deprivation is more noticeable. A third possibility in line with Krauer's (2006) explanations is that we are witnessing a bias in the effect of nursery school attendance among the lower social strata due to the fact that the advantages of nursery school attendance are subsequently lost when compulsory education begins in lower-quality schools than the ones attended by the middle classes. In this case, the quality and results of nursery schools may be homogeneous and benefit any child equally regardless of their parents' social class, but our study might be detecting the deterioration resulting from a classist structure in the compulsory education system. Still, we are lacking crucial information such as the quality of the nursery schools and the intensity with which individuals attend them, which truly makes it difficult to answer these questions and instead calls for further, more specific research in the future.

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