Do In-School Feeding Programs Have an Impact on Academic Performance?
The Case of Public Schools in Argentina

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Abstract: As Argentina presents problems of malnutrition, the federal in-school feeding program has become a key policy because it provides an important nutritional intervention during a relevant growth period. This paper estimates the effect of the program on academic performance -measured by standardized test scores- with a difference in difference model, which exploits the change over time in the supply of the in-school feeding program during the end of the nineties. We build an original panel using the ONEE corresponding to the years 1997, 1999 and 2000. Our findings suggest that the program has successfully targeted the most disadvantaged schools. However, only partial improvement in school performance has been found. Language test scores were the only ones to show a statistically significant improvement, with no noticeable effects reported in math scores. These results are consistent with the characteristics of the federal in-school feeding program in Argentina, which do not compensate for the nutritional deficit the children bring from their homes. This implies that having an in-school feeding program –even that reaching the most needy populations- does not necessarily address the desired goals of compensating for nutritional deficits and correlating to improved test results for students.
Keywords: School Meals Program, fixed-effects, academic performance, Argentina

¿Impactan los comedores escolares en el rendimiento académico? El caso de las escuelas públicas en Argentina.

Resumen: El programa de comedores escolares provee una importante intervención nutricional en un período relevante del desarrollo y se ha convertido en una política relevante en Argentina ya que existen problemas de malnutrición. Este trabajo estima el efecto del programa de comedores escolares sobre el rendimiento académico –medido a través de test estandarizados- con un modelo de diferencia en diferencia que explota el cambio en el tiempo de la oferta del programa durante los años finales de la década del noventa. Se utiliza un panel original construido en base a los Operativos Nacionales de Evaluación Educativa (ONEE) de los años 1997, 1999 y 2000. Los resultados muestran que el programa está satisfactoriamente focalizado en las escuelas más desfavorecidas. Sin embargo, los resultados muestran sólo una mejora parcial en el rendimiento académico, pues únicamente los de lengua muestran un incremento estadísticamente significativo, mientras que los de matemática no registran ningún efecto. Estos resultados son consistentes con las características del programa de comedores escolares en Argentina que no compensan el déficit nutricional que los niños traen de sus hogares, implicando que la mera existencia de comedores escolares –aun aquellos bien focalizados- no necesariamente alcanza para compensar esos déficits ni está correlacionado con una mejora en el rendimiento académico.
Palabras-clave: comedores escolares; efectos fijos, rendimiento académico, Argentina

Comedores escolares? Impactam o desempenho acadêmico? O caso das escolas públicas na Argentina.
Resumo: O programa de alimentação escolar fornece intervenção nutricional importante em um período importante de desenvolvimento e tornou-se uma política relevante na Argentina, porque há problemas de desnutrição. Este trabalho estima o efeito do programa de alimentação escolar sobre o desempenho acadêmico medido por testes padronizados, com uma diferença no modelo de diferença que explora a mudança no tempo da oferta do programa durante os últimos anos da década de noventa . Ele usa um painel original construído sobre a Operação Nacional de Educação Avaliação (onee) para os anos de 1997, 1999 e 2000. Os resultados mostram que o programa é sucesso focada nas escolas mais desfavorecidas. No entanto, os resultados mostram apenas melhora parcial no desempenho acadêmico, como falar apenas mostram um aumento estatisticamente significativo, enquanto registro de matemática nenhum efeito. Estes resultados são consistentes com as características do programa de alimentação escolar na Argentina, que não compensam o déficit nutricional que as crianças trazem de suas casas, o que implica que a mera existência de escola refeições, mesmo aqueles bem orientada, não necessariamente o suficiente para compensar esses déficits ou está correlacionada com a melhoria do desempenho acadêmico.
Palavras-chave: comedores escolares, efeitos fixos; desempenho académico; Argentina.

Introduction

> … [I]n the end, it is social justice and human rights work to provide nourishment and education to the children of the world. (Robert & Weaver-Hightower, 2011, p. 19).

Food for education programs, including meals served in school and take-home rations conditional on school attendance, have recently received renewed attention as a policy instrument for achieving the Millennium Development Goals of universal primary education and the reduction of hunger in developing countries. In-school meals provide an important nutritional intervention

during an often-overlooked growth period. These programs aim to attract children to school by providing nutritious meals in exchange for school participation, an incentive for school attendance directly to the child (Caldes & Ahmed, 2004). If children are undernourished,[1] the programs may also boost learning and cognitive development by improving attention spans and nutrition. The attraction of these programs is their potential to improve both school participation and cognitive outcomes by increasing the consumption of nutritious food by undernourished children (Adelman et al., 2008). Therefore, the impact of in-school meals on learning appears to operate both through improvements in school attendance, and through better learning efficiency while in school. Thus, well-run programs that provide reasonably nutritious meals should have positive impacts on school participation, learning, and child dietary intake. However, the extent of these effects depends on various programmatic and contextual factors. In some cases, they may be small or even null.

Research in both developed and developing nations during the past few decades has analyzed the links between educational outcomes and school physical resources, teacher quality and children's demographic and family background. Formichella (2011) presents a detailed review of empirical studies that explore the determinants of academic performance in schools for the case of Argentina. This work synthesizes that there is a consensus view as to the impact of the household's socioeconomic environment on academic performance, as well as the school environment. In this study we intend to complement those studies and we focus particularly in the evaluation of one of the factors that improve student academic achievement: in-school feeding programs. Additionally, Robert and Kovalskys (2011) argue that the case of Argentina is important to examine because it reflects the nutritional concerns of a developed and developing nation. Firstly, Argentina presents undernourishment like developing countries and malnourishment like developed ones. Secondly, the school-feeding program suffers from the challenges of high rates of poverty and the ills of the modern food system in a decentralized context of governance

Hence, the aim of this paper is to estimate the effect of the in-school feeding program on academic performance -measured by standardized test scores in Argentina from 1997 to 2000. We would like to compare the test scores in schools that participate in school meals program[2] with the test scores of the same schools had they not participated in the program. Since the counterfactual[3] is never observed, and we do not have a controlled randomized trial, we are forced to turn to non-experimental methods, which mimic the counterfactual under reasonable conditions. Our identification strategy relies on the fact that the increase in the number of children that attend to the in-school feeding program in a given school and time are likely to be uncorrelated with the unobserved characteristics that jointly determine academic performance.

The organization of the paper is as follows. Section 2 presents a literature review of the empirical impacts of in-school feeding programs on education and nutrition. The following section introduces the basic features of the program in Argentina. Section 4 presents the data used in the empirical analysis, illustrates the methodology and presents the results. Finally, we summarize our conclusions and discuss the implications of our findings in section 5.

Literature Review

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[1] Undernourishment is associated with hunger and lack of essential nutrients, while malnourishment refers to cases of enough or excessive calories, but lack of certain nutrients, exposure to pesticides and food additives.
[2] The school meals program in Argentina consists in the provision of breakfast and/or lunch to the students within the school.
[3] The counterfactual measures what would have happened to beneficiaries in the absence of the intervention.

Robert and Weaver-Hightower (2011) mention that no matter the state of development, the school feeding problem changes but does not disappear. Developing countries tend to have undernourishment, while developed ones malnourishment; still, in both developed and developing contexts, the two concerns coexist, fighting obesity and hunger simultaneously. From Argentina to Tanzania to the United States, groups of parents, teachers, and community members are struggling against the unequal distribution of school food, and the social goods that come with healthy nutrition: physical health, improved learning, human rights and dignity. Additionally, they detail many reasons to argue that school food is a crucial topic to consider for educators, policymakers, researchers and citizens. One of them is that school food can play an important role in students' academic achievement.

Regarding school feeding literature, there are different reviews that analyze the empirical evidence of the diverse impacts it has. In this sense, Kristjansson et al. (2007) include eighteen studies in their review; nine were performed in high-income countries and nine in low income ones. In addition Adelman et al. (2008) present a rationale for food for education programs and undertake a critical review of the causal evidence on the impact of these programs on education participation and attainment, learning, cognitive development and nutrition.

In summary, the goals of school feeding programs differ, but often include relieving short-term hunger (Allen & Gillespie, 2001), improving micronutrient status (Allen and Gillespie, 2001), growth (Allen & Gillespie, 2001; Levinger, 1986), cognition (Levinger, 1986) academic performance (Allen & Gillespie, 2001; Levinger, 1986) and school attendance (Caldes & Ahmed, 2004) in both high and low-income countries. As Sandler (2011) suggests, who is fed, who does the feeding, what is served, where and when, are all questions of importance in looking at school food.

Most empirical findings suggest that school feeding programs have a positive impact on learning achievement, as measured by increases in test scores. As with all school feeding outcomes investigated empirically, there are several econometric issues that raise questions about the validity of these results. Furthermore, the subject of the achievement test seems to matter. We will focus on the results of three studies carried out in developing countries.

Firstly, Ahmed (2004) evaluated the impact of a school feeding program implemented by the Government of Bangladesh in food-insecure areas. The evaluation took place in 2003, after most children in program schools had been receiving school feeding every school day they attended, for more than 1 year. The school feeding program provided a mid-morning snack of fortified wheat biscuits to children in primary schools in these communities at the cost of US$18 per child per year. The author evaluated the impact of the in-school meal program in Bangladesh on test scores using data on achievement test scores for 1,648 students in grade 5 attending primary school. Using an econometric specification to isolate the effects of the program, he finds that students in program schools scored 16 percent higher than did students in the control schools. Of the three subjects that make up the total score, the improvement was due mainly to an increase in the mathematics test score.

Secondly, Tan et al. (1999) evaluate the impact of the Dropout Intervention Program in 1990–1992 in the Philippines, which included a school feeding program being randomly assigned to 10 schools in low-income areas of the country. Data were collected for all students in all grades. They evaluated the impact of the school feeding program on the school performance of only first grade students. The impacts of the school feeding program were not significant at the school level. At the student level, the authors found that school feeding, either alone or with parent– teacher partnerships, had a positive and statistically significant effect on English test scores. Furthermore, school feeding coupled with parent–teacher partnerships had a positive and significant impact on mathematics test scores. One difficulty with this study is that each program, school feeding alone

and with parent–teacher partnerships, was only implemented at five schools. Therefore, it is hard to rule out the possibility that individual school characteristics biased the results.

Thirdly, Kremer and Vermeersch (2004) used data from a randomized school feeding evaluation in Western Kenyan preschools between 2000 and 2002 to evaluate program impacts on school participation and achievement. This study had an extremely well-planned randomized field-study evaluation design. Twenty-five preschools were randomly selected from 50 to receive a fully subsidized in-school breakfast. Prior to the introduction of the breakfast program, the treatment and control preschools had very similar characteristics. The sample of children consisted in all children between the ages of 4 and 6 who lived within walking distance of a school in their sample, and they would like to have known which school parents would have chosen for their child in the absence of the program. This choice is unobservable, but Kremer and Vermeersch spent considerable effort trying to identify an estimate of this population. The authors find that the treatment impact alone is not significantly different from zero. However, school meals increase test scores in schools where the teacher is experienced. This result was found by regressing the test score on both a treatment variable as well as a treatment variable interacted with the teacher's experience.

For learning achievement, studies show that school meals may cause improvements in some test scores. The impact of in-school meals on learning appears to operate both through improvements in school attendance and through better learning efficiency while in school, though no study has separately identified the relative contribution of these effects. However, the size and nature of the impacts vary greatly by program, micronutrient content of the food, and the measure of cognitive development used (Adelman et al., 2008).

The Case of Argentina: Background and Program Information

Argentina is a federal country organized in 24 autonomous political jurisdictions (23 Provinces and the Autonomous City of Buenos Aires); each province carries out its own in-school feeding program. The process of educational decentralization began in 1978 and was completed in 1991. While school feeding program became the responsibility of the provinces and City of Buenos Aires, the national government continues to provide limited funding. According to Robert and Kovalskys (2011), this decentralization does not seem to change school feeding and food quality continued to suffer as a result of limited funding.

The goal of universal primary education has been achieved because net enrollment rate has been over 99 percent for primary school children (SEDLAC, 2012) for the lasts decades. However, many of these children live in poverty and are undernourished or malnourished.[4] From 1994 onwards, poverty rates started to increase steadily, mainly influenced by the impact of the 1994 Mexican financial crisis (which produced a decline in the GDP and a sharp rise in unemployment) and the Brazilian Devaluation in 1999 (Argentina's largest trading partner). Poverty rates increased from 16 percent in 1994, to 26 percent in 1997 and to 32 percent by the end of 2000. As a result of this, the number of children that assist to the in-school feeding program increased during the period.

After the decentralization the program placement depends on political negotiations between the provincial government, municipal government and schools and on decisions inside each school.

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[4] Orlicki (2009b) compares the intake of nutrients and vitamins distributions with the recommended intake levels by the health authorities for the Argentinean children aged 4 and 5 years old. The study reports that the fiber intake for most children is clearly below the recommended levels, additionally children at the 10th-25th quantile of the distributions of calcium, iron, energy and vitamin A have less than the recommended intake per capita consumption for each of them respectively.

The program has the following characteristics: a) there is not a legal framework that fixes goals of energy and nutrient intake; b) menus are monotonous; c) they provide a similar nutrient intake to the one received in the households, instead of a complementary one to household deficits; d) they concentrate mainly on lunch (only a few provide breakfast) (Britos et al., 2003).

Furthermore, the Argentine provinces provide a variety of ways in which the in-school feeding program is delivered: (i) the transfers go directly to the schools where teachers, cooks and other school members buy the food and decide the daily menu, which are the most common ones; (ii) the Provinces or the Municipalities buy the food and then they distribute to each school where the meal is prepared; (iii) there are organizations that buy and prepare the meals and then they distribute them to each school; (iv) there are firms that offer directly the meal service (catering). In other words, what local programs serve has varied dramatically from school to school (Robert & Kovalskys, 2011). Additionally, Britos (1995) exposes that in theory most of the provinces aim to attend the food shortage and promote attendance and academic performance of poor children, though in practice the school feeding program does not differentiate according to the necessity of the scholars. The tendency in Argentina consists on maximizing the coverage without any criteria for targeting and selecting the beneficiaries.

As regards school feeding program coverage, there are no national official statistics of either schools or children that attend a school feeding program. Hence, we have extracted information from the school directors' surveys corresponding to the National Educational Assessment Operation (Operativo Nacional de Evaluación Educativa) or ONEE. We define a school as "Participating" in the school meals program if most of its students aged between six and twelve years, receive a compensatory[5] lunch or breakfast in the school.

The ONEE reported that 76 percent of the 13.146 schools surveyed were public.[6] In the case of private schools, as expected, only 7 percent participated in the school meal program, whereas in public schools that percentage increased to 65 percent. In the latter case, the schools that participate in the program were situated 33 percent in the urban area, 19 percent in the suburban area and 48 percent in the rural area. Finally, only 18 percent of public schools had double shift or longer school day.

In Table 1 we report the amount of public schools interviewed and the participating school rates by province using data from the ONEE corresponding to the years 1997, 1999, and 2000. As can be seen in the table, while no observations were reported for Corrientes and Tierra del Fuego for the year 1999 and for Neuquén for the year 2000, all jurisdictions show observations for at least two years. The growth in school participating rate between 1997 and 2000 is noticeable, since the average participating rate was 30 percent in 1997 and increased to 65 percent in three years. Additionally, the participating rate varied substantially across regions. While in 1997 it was 30 percent on average, it presented enrollment over 70 percent in Misiones and Formosa and lower than 7 percent in San Juan, San Luis and Tierra del Fuego. Regarding 1999 and 2000, an important increase can be seen in almost all the jurisdictions, in most of the cases, more than doubling the proportion existing in 1997.[7]

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[5] We call compensatory lunch or breakfast to indicate it is free and oriented undernourished children.
[6] A school is defined as public if it is run by the State.
[7] Even though for the years 1997 and 1999 the information corresponds to samples, they were randomly selected stratified samples (Berlinski et al., 2009).

Table 1.
Number and Percentage of Participating Schools by Province

Province	1997		1999		2000	
	Schools Interviewed	Participating Schools	Schools Interviewed	Participating Schools	Schools Interviewed	Participating Schools
Capital Federal[†]	28	28.6%	26	88.5%	385	86.5%
Buenos Aires	77	11.7%	56	39.3%	2016	48.3%
Catamarca	57	63.2%	57	84.2%	122	94.3%
Cordoba	51	21.6%	40	42.5%	785	47.5%
Corrientes	64	26.6%			313	87.2%
Chaco	74	25.7%	74	73.0%	372	79.6%
Chubut	69	20.3%	40	75.0%	144	65.3%
Entre Ríos	64	25.0%	43	32.6%	364	42.9%
Formosa	74	70.3%	73	86.3%	273	96.3%
Jujuy	64	15.6%	43	39.5%	175	61.7%
La Pampa	59	22.0%	27	81.5%	104	76.0%
La Rioja	49	14.3%	47	36.2%	84	71.4%
Mendoza	43	7.0%	25	32.0%	381	63.5%
Misiones	77	79.2%	4	100.0%	469	81.7%
Neuquén	43	18.6%	29	86.2%		
Río Negro	47	14.9%	28	53.6%	155	58.1%
Salta	64	28.1%	43	83.7%	258	84.9%
San Juan	66	1.5%	25	28.0%	117	26.5%
San Luis	48	6.3%	166	64.5%	76	38.2%
Santa Cruz	19	21.1%	21	19.0%	35	22.9%
Santa Fe	47	19.1%	35	77.1%	698	76.1%
Santiago del Estero	81	69.1%	72	76.4%	405	92.8%
Tucumán	71	31.0%	27	66.7%	340	71.8%
Tierra del Fuego	26	0.0%			29	37.9%
Total	1362	29.7%	1001	63.2%	8100	65.3%

Source: Own estimation based on ONEE 1997, 1999 and 2000. [†]It is not a province, but an autonomous jurisdiction.

Study Developed

Sample and Descriptive Statistics

As we mentioned above, the ONEE is our primary source of information. The ONEE for 1997 and 1999 consists of a randomly selected stratified sample of primary schools across the country (Berlinski et al., 2009), and for the year 2000 a census.[8] The sample of schools changed every year, but a large number appear in more than one wave and can be matched from wave to wave using a unique school identifier. Within each school, the ONEE consists of teachers' and directors' surveys as well as students' tests and surveys.

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[8] The province of Neuquén was the only jurisdiction that did not take part in the census.

The information on schools and meals services is obtained from the directors' surveys for each year, which were set up to analyze the overall functioning of the school system. In addition, we use the results of the standardized test scores of primary or general basic education (GBE) of third grade students.[9] In Argentina, the standardized test scores are uniform monotonic measures of schools performance administered nationally at the end of the scholar year. However, teachers could intentionally train students to maximize test scores instead of teaching general skills and knowledge. In this case, the test scores would not reflect school quality, but rather how well schools prepared students to take the test. This, however, is unlikely in Argentina where there are no rewards or punishments for students, teachers or schools based on test outcomes (Berlinski et al., 2009).

Using the surveys of the ONEE, an original database was constructed as a way to integrate the average outcomes of the standardized test scores for each school and year with those obtained from the surveys of directors for the same years. The databases were integrated forming a panel using the school as the unit of measurement; therefore, each database entry, also called observation, represents a school in a particular year and shows its characteristics, including the meal service provided, the characteristics and opinions of the director of the school and the average of the third grade students' test scores and characteristics.

We will work with the subsample consisting of those schools that were observed at least twice. As the treatment group, we use those that started to participate in the school meals program; and as the control group, those that never participated. Therefore, we work with 1793 observations (843 schools), the control group consists of 1146 observations (544 schools) and the treated group of 647 observations (299 schools).

The ONEE provided information about the possession of durable goods, the utilization of public services, the number of family members and the parents' educational level, but not about households' income or consumption. Following Adrogué (2009a), Schumacher (2003) and Elbers et al. (2003), the National Household Expenditure Survey (Encuesta Nacional de Gastos de Hogares or ENGH) was selected to provide the income and consumption patterns in order to calculate a variable of socioeconomic status (SES) of the children in the sample. This survey has similar questions to the ones corresponding to the ONEE as well as information regarding households' income and consumption. It also has the advantage of representing the whole population of the country, not as other commonly used surveys that only represent urban population. Therefore, we estimated the socioeconomic status of the households in the ONEE database using the spending patterns obtained from the ENGH and the characteristics of the households, including the number of members, the educational level of the household head, and the purchasing habits regarding durable goods and public services from the ONEE.[10] And as our concern is about the effect of compensatory school meals program, we have focused the study on the public schools, due to the fact that the private ones already charge fees, which may indicate that the children that attend to them can also afford a minimum diet.

We summarize the mean SES and test scores for the year 1997 in Table 2. The SES is higher for the non-participating schools and statistically significant. The test scores in math and language are higher in non-participating schools than in participating ones. From the table we can say that the in-school feeding program is located in the schools with lower SES, and in those that have lower academic performance. Next, we intend to evaluate the impact that the school meals program has on these variables by controlling for time-invariant unobserved heterogeneity of the schools and by restricting the sample to schools with similar characteristics.

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[9] Third grade students at primary school in Argentina are approximately eight years old and it is the first grade that students take a national test at the end of the year.
[10] See Annex A for further details of this variable.

Table 2.
Descriptive Statistics of Test Scores

Variables	Period	Mean	Std. Dev.	Min	Max	Treated group's mean (I)	Control group's mean (II)	(I-II)	
Pretreatment									
SES	1997	44.4	8.6	24.0	70.3	43.6	44.9	-1.25	**
Outcome									
Math score	1997	52.1	12.6	18.1	94.9	49.8	53.4	-3.56	***
Language score	1997	56.3	11.6	20.8	93.8	54.3	57.5	-3.17	***

***significant at 1%, ** significant at 5%
Source: Own estimation based on ONEE 1997, 1999 and 2000.

Econometric Strategy

We estimate the effect of school meals program on academic performance -measured by standardized test scores. Random assignment of the program would be the most convincing way to form a comparison group for an impact evaluation. However, often it is not possible for logistical, ethical, or political reasons. In these cases, it may still be possible to conduct a rigorous evaluation by constructing a statistical comparison group from among non-beneficiary children. There are many of these non-experimental approaches to impact evaluation, including matching methods, regression discontinuity design, or instrumental variables. The appropriate choice of technique depends on the design of the program, the targeting method used and the data available. In most cases, an evaluation is stronger if outcomes can be measured before and after the program begins, so that impact estimates can be constructed as the difference in the average change in outcomes between the treatment and comparison groups, or the difference in difference (DID)[11] in outcomes. DID estimates remove bias caused by unobserved fixed characteristics that are systematically different between the treatment and comparison groups.

We propose to use the non-participating schools in the school meals program during the period of analysis as a control group for the schools that started to participate. However, we realize that the treated schools could have been somehow different from the non-participating schools, and these differences may be correlated with their test scores. In principle, many of the unobservable characteristics which may complicate comparison across schools are fixed over time. A common method to control for time-invariant unobserved heterogeneity is to use panel data and estimate DID models. We use this identification strategy and compare the change in outcomes in the treatment group –the schools that began to participate in the school meals program– to the change in outcomes in the control group –the nonparticipating schools– during the period under observation. By comparing changes, we control for observed and unobserved time-invariant school characteristics as well as for time-varying factors common to both control and treatment groups which might be correlated with school meals program, as well as with the schools' test scores. The change in the control group is an estimate of the true counterfactual – i.e., what would have happened to the treatment group if there were no school meal program. In other words, the change in outcomes in the treatment group controls for fixed characteristics

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[11] Difference-in-differences methods compare a treatment and a comparison group (first difference) before and after the intervention (second difference).

and the change in outcomes in the control group controls for time-varying factors common to both control and treatment schools. Formally, the difference-in-differences model can be specified as a two-way fixed effect linear regression model. We estimate it for two dependent variables: Math Test Score and Language Test Score.

In order to evaluate the impact of the school meals program on test scores, we estimate the following equations using panel data on schools of the form:

$$Y_{ijt} = \alpha_0 + \varphi\, Meal\Pr ogram_{ijt} + \gamma\ Z_{ijt} + \mu_i + c_t + \varepsilon_{it} \qquad (1)$$

$$Y_{ijt} = \alpha_0 + \varphi\, Meal\Pr ogram_{ijt} + \gamma\ Z_{ijt} + \mu_i + \Pr ovincialTrend_{jt} + \varepsilon_{it} \qquad (2)$$

where:

Y_{ijt} = Math Test Score or Language Test Score in school i, in province j in year t;
$MealProgram_{ijt}$ = the explanatory variable of interest, a dummy defined as 1 if the school i in province j in year t participates in a school meal program during year t. Therefore, if the presence of meal-program increases (decreases) Y_{ijt} at the school level, we would expect φ to be positive (negative); Z_{ijt} = school-specific control variable, the SES;[12] μ_i = is a school fixed-effect. These fixed effects control for school characteristics that are constant over time. In particular, they control for the fact that the program allocation was systematically related to pre-treatment municipal and school characteristics; c_t = time dummies to control for unobservable effects which could have affected all schools in the same way over time, like economic conditions and the difficulty of tests across years. *Provincial Trend*$_{jt}$ = a variable controlling for other things which are affecting Y_{ijt} in each province to avoid confounding those effects with the effect of school meal program. These province-year effects control for factors such as the differences in changes of provincial school policies.

One of the major threats to the validity of our identification strategy is that there may be omitted non-common time-varying factors that are correlated with both the school meal program and test scores. In our case, bias from endogeneity of program placement is not likely to be an issue. The program placement depended on political negotiations between the Provincial Government, Municipal Government and schools and on decisions inside each school and not on test scores that in fact were not available at the time. Another way in which omitted time-varying factors could confound the analysis is if there were other location-specific time-varying policies or environmental factors that affect treatment observations differently than control ones. Again, in our study, this is unlikely to be true for two reasons. The schools in the control group are located in the same Provinces as the treated schools. Therefore, since both control and treated schools are located in geographic areas in the same governmental administrative regions, changes in policies and environmental factors that affected one group almost surely affected the other. In addition, we know of no explicit within-province differentiation in policy towards participating and non-participating schools.

A second concern is the possible composition effect caused by the children shifting to the schools to get the in-school meal service. But, since in the public schools in Argentina the address and the siblings-in-the school criteria have always been predominant, the freedom to choose the school has always been very limited. Though this does not preclude the possibility of composition effect, it reduces it considerably.

Main Results

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[12] See Annex A for details on the construction of this variable.

We present the results of our estimates of equations (1) and (2) in Table 3. Odd Columns (1) report the results for Math and Language test scores of a model with school and common year fixed-effects, but no time-varying province controls. We find that both Math and Language test scores in schools that participated in school meals program did not vary significantly relative to test scores in non-participating schools.

In the even columns (2) we add provincial time-varying fixed-effects, which control for time-varying shocks, both environmental and other policy interventions, at the provincial level that may affect school performance. Once we introduce these controls, the results for Math test scores are not significantly different from the baseline estimates reported in column (1). The result for Language test scores is positive and statistically significant. This finding is consistent with Adelman et al. (2008) who show that in general school feeding does not seem to have the same impact on all subjects.

In column (2) of Table 3 for Language test scores we find that participating in school meals program increases the results for Language test scores by near 2 points. Given that third graders had a mean of 56 and a standard deviation of 11.6 on Language test scores, these estimates imply that participating in the program increases performance by 3.5 percent of the mean or by 17.2 percent of the standard deviation of the distribution of Language test scores.[13]

Table 3.
The Effect of In-School Meals Program on Math and Language Test Scores in the Third Grade

	Math Test Score		Language Test Score	
	(1)	(2)	(1)	(2)
Meal Program	0,142	0,842	1,066	1,998
(se)	(0,758)	(0,793)	(0,703)	(0,731) ***
[cl se]	[0,833]	[0,914]	[0,736]	[0,826] **
Controls:				
SES	0,282	0,315	0,239	0,284
(se)	(0,086) ***	(0,095) ***	(0,080) ***	(0,087) ***
[cl se]	[0,103] **	[0,098] ***	[0,088] **	[0,081] ***
School Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	No	Yes	No
Province Trend	No	Yes	No	Yes
Number of Observations	1793	1793	1793	1793

Source: Own estimation based on ONEE 1997, 1999 and 2000.
Notes: OLS regressions with robust standard errors clustered by province.
* Significant at 10%, ** significant at 5%, *** significant at 1%.

Finally, in all the specifications the effect of the SES of the children on the school test scores is positive and statistically significant. These results suggest that, in rounded terms, an increase in the SES rate by one point increases the Math and Language test scores by about 0.22 points. These

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[13] In order to check the robustness of the assumptions made to construct the meal program variable, we have also replicated the analysis of Table 3, by analyzing the sensitivity of the results to the construction of the variable, and we could corroborate that the results remained the same.

estimates imply that an increase in 10 percent of the SES rate of the school increases performance by 4 percent of the mean of Math test scores and by 4 percent of the mean of Language test scores.
Robustness analysis

A possible concern is that the secular time trend in the treatment schools is different from the secular trend in the control schools. If true, then the change in the test scores of the control schools would not be an unbiased estimate of the counterfactual. While we cannot directly test the identification assumption that the change in the control schools is an unbiased estimate of the change in the treatment schools if they were not treated, we can restrict the sample so that the treatment and control schools are similar in other characteristics.

By restricting the sample to schools with similar characteristics we try to ensure that they are subject to the same external influences and have the same capabilities to react to them. Indeed, this is the basic idea of matched DID estimators (Heckman et al., 1997). SES in participating schools was lower than that in the control groups (see Table 2). Our models control for these differences by conditioning on school fixed-effects but it may be the case that richer schools not only depart in average performance but also in its performance over time confounding treatment effect with unobserved heterogeneous trends.

Table 4.
Robustness of the Estimated Effects to the Socioeconomic Status (SES) of the Schools by trimming the sample at the upper 99%-95%-90% and bottom 1%-5%-10% of the treatment and control distribution of the SES

	Math Test Score			Language Test Score		
	1%-99%	5%-95%	10%-90%	1%-99%	5%-95%	10%-90%
	i	ii	iii	iv	V	vi
Meal Program	0,776	0,873	1,121	1,966	2,065	2,245
(se)	(0,795)	(0,834)	(0,886)	(0,733) ***	(0,768) ***	(0,825) ***
[cl se]	[0,925]	[0,940]	[1,030]	[0,826] **	[0,862] **	[0,914] **
Controls:						
SES	0,370	0,389	0,312	0,322	0,328	0,300
(se)	(0,098) ***	(0,107) ***	(0,116) ***	(0,090) ***	(0,099) ***	(0,108) ***
[cl se]	[0,094] ***	[0,106] ***	[0,126] **	[0,085] ***	[0,091] ***	[0,109] ***
School Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	No	No	No	No	No	No
Province Trend	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	1759	1652	1510	1759	1652	1510

Source: Own estimation based on ONEE 1997, 1999 and 2000. Notes: OLS regressions with robust standard errors clustered by province. * Significant at 10%, ** significant at 5%, *** significant at 1%.

In order to control for this potential problem, we match schools by their SES in 1997, the first year in our sample. We restrict to schools whose SES is in the common support of the distribution for treated and control schools. To implement this, we drop schools with a SES in 1997 lower than the one at the bottom 1 percent of the distribution of control schools and higher than the one at the upper 99 percent of distribution of treated schools ((columns (i) and (iv) of Table 4). In addition, we report the estimates obtained by trimming the samples at the upper 95 percent and

bottom 5 percent (columns (ii) and (v)) and at the upper 90 percent and bottom 10 percent (columns (iii) and (vi)) of the treatment and control distribution of class size, respectively. All these estimates, reported in Table 4, are similar to those in Table 3.

Discussion and Policy Implications

Developing countries tend to have undernourishment, while developed ones malnourishment. As Argentina presents both problems, in-school feeding program is a relevant policy because it provides an important nutritional intervention during a significant growth period, as is childhood.

While evaluating the program, we observe that it is effectively located in the most disadvantaged schools, in those where the students with lower socioeconomic status attend and in those with the lower academic performance. Since 1991, the school meals program has been decentralized allowing each Argentinean province to provide its own variety of it. And at the end of the nineties the proportion of children that participate in the program has increased considerably in the whole country. The proportion of public schools where more than halve of the students receive a compensatory meal service increased from 30 percent in 1997 to 65 percent in three years.

As far as the authors know, this is the first study to evaluate the effects on academic performance of the in-school feeding program in Argentina. We build an original panel using the ONEE corresponding to the years 1997, 1999, and 2000 by integrating the average outcomes of the standardized test scores for each school and year with those obtained from the surveys of directors for the same years. One of the main conclusions of our work is that the presence of school meal service improves only the children's performance in Language tests scores, whereas it does not affect the Math test scores. Our estimates show that participating in the program increases performance by 4 percent of the mean or by 17 percent of the standard deviation of the distribution of Language test scores.

We think that it is a good start that the meal service is provided in the schools where the poorer children attend, though, as could be seen, that does not necessarily improve academic performance. Though we would have liked to find an improvement in all the indicators, what we found did not surprise us; these results are consistent with the characteristics of the in-school feeding program in Argentina, which do not compensate for the nutritional deficit the children bring from their homes. Hence, policymakers should be aware of the need of reviewing the nutritious content of the foods served at school and start retrieving the necessary information.

In addition consistently with the previous empirical research for Argentina we find that the effect of the socioeconomic status of the children on the school test scores is positive and statistically significant. Therefore, improving the socioeconomic status of the households is not only desirable per se, but also because of the great improvements there would be on the cognitive opportunities for the children.

Finally, as a future extension of this paper, it would be desirable to obtain further information in order to study if the school-meal program has an impact on relieving short-term hunger or improving micronutrient status, growth, cognition and school attendance in addition to academic performance; and whether the timing of the program produces different impacts, as well as the correlation between nutrients and cognition. Additionally, it could also be interesting to evaluate the performance of the school meals program since 2001 onwards. When Argentina devaluated the peso, the national currency, and failed to honor the foreign debt; which contributed to an economic collapse and added to the poor performance of welfare indicators during the previous decade; and the later recovery of the economy in the subsequent years.

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Annex A

The SES Index

So as to estimate the SES of the students the answers provided about the possession of durable goods, the utilization of public services, the number of family members and the parents' educational level were used. Following Adrogué (2009a), Schumacher (2003) and Elbers et al. (2003) a different data base containing the variable of interest was used so as to estimate its distribution. With the purpose of getting the spending patron of the households and their characteristics, the purchasing habits regarding durable goods and public services corresponding to the households of different SES were studied as well as how the household head education affected it. The chosen survey was the National Household Expenditure Survey because it has similar questions to the ones corresponding to the ONEE as well as information regarding households' income and consumption. It also has the advantage of representing the whole population of the country, not as other commonly used surveys that only represent urban population.

After selecting the source of information and the variables to use, so as to know which weight corresponds to each of the items, several regressions were run by region. And, as there are multiple variables that define the SES (dependant variable), as it may be the household income or expenditure, per capita household income or expenditure and their logarithms, several regressions were run and the explicative power of the model was measured through the R2. The logarithm of the per capita household income was selected as the dependent variable and the explanatory variables used in the regression were those selected from the ONEE that were as well in the ENGH.

The regression equation was as follows:

ln(ingpcf) = a0 + a1(edup) + a2(edusi) + a3(edus) + a4(eduui) + a5(eduu) + a6(car) + +a7(electricity) + a8(telephone) + a9(stove) + a10(gas) + a11(air conditioning) + +a12(hot water) + a13(toilet) + a14(water) + a15(2 members) + a16(3 members) + +a17(4 members) + a18(5 members) + a19(6 members) + a20(7 members or more)

The first five explanatory variables are intended to represent, using dichotomic variables, the maximum educational level attained by the head of the family: completed primary (edup), incomplete secondary (edusi), completed secondary (edus), incomplete tertiary (eduui) and completed tertiary (eduu). The subsequent nine variables represent the possession or not of durable goods and utilities. Finally, the last six variables are referred to the size of each household, only one of the last six variables is assigned the value "1" with the remaining valued at "0", depending on the number of members in the household.

Estimations of the households' expenditure patterns for each of the regions in the country (GBA, NEA, NOA, Cuyo, Pampeana and Patagonia) were obtained, which means, that a specific value was assigned to each of the coefficients for each of the regions. Later, with the estimated coefficients, the explanatory variables were replaced by the different vectors provided by the ONEE data base for each of the regions, and in this way, a prediction of the logarithm of per capita household income of each student surveyed was obtained, taking into account the expenditure pattern usual of his place of origin. Finally, the values were rescaled without altering the relative positions in order to assign zero value to the minimum and one hundred to the maximum. This was done by subtracting the minimum value from each prediction, dividing by the difference between

the maximum and the minimum values and multiplying by one hundred. It is worth mentioning that the SES has an economic dimension; it is the prediction of the logarithm of the household per capita income, and also a cultural dimension, captured by the level of education of the household head and the amount of members in the family. It is expected that the higher the SES of the student, the bigger will be the financial capacity of the household to invest in the children's education and there would be more cultural climate. In addition, the average SES for each section, institution and jurisdiction was calculated.

Annex B

Table B1.
Distribution and Mean of the SES by Province

	Observations	Mean	St. Dev.	CV	Range
All Jurisdictions	11237	41.82	8.52	0.20	62.24
Cap. Fed	525	59.37	3.87	0.07	22.21
Bs.As	3188	43.46	5.49	0.13	35.57
Catamarca	106	40.87	5.44	0.13	27.42
Córdoba	1030	43.87	5.72	0.13	46.73
Corrientes	384	37.29	8.21	0.22	50.60
Chaco	506	36.21	9.34	0.26	49.12
Chubut	180	49.75	6.70	0.13	36.50
Entre Ríos	440	41.22	6.50	0.16	41.96
Formosa	245	33.72	8.91	0.26	42.70
Jujuy	168	37.01	6.78	0.18	39.88
La Pampa	208	46.71	5.30	0.11	30.39
La Rioja	113	43.22	4.58	0.11	28.19
Mendoza	586	40.39	6.46	0.16	42.89
Misiones	563	36.25	8.20	0.23	43.78
Río Negro	219	42.61	7.80	0.18	39.66
Salta	469	37.38	7.63	0.20	42.13
San Juan	276	38.74	6.35	0.16	47.71
San Luis	156	40.22	5.88	0.15	38.14
Santa Cruz	100	53.31	3.63	0.07	19.47
Santa Fé	804	39.78	7.80	0.20	52.46
Sgo.del Estero	361	33.15	8.29	0.25	39.89
Tucumán	539	38.53	6.03	0.16	37.77
Tierra del Fuego	71	54.92	4.04	0.07	21.67

Source: Own estimation based on ONE2000.

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