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Impact of school feeding programmes on educational outcomes

Evidence from dry cereals in schools in Burkina Faso

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Abstract: Food for Education (FFE) programmes have been implemented in developing countries since the 1960s. This paper examines the impact of the Catholic Relief Services (CRS) school feeding programme on pupils' attendance and girls' enrolment rate within primary schools in northern Burkina Faso. Using difference-in-difference (DID) estimation with the data set on the Beoog Biiga programme, we find that take-home rations (THRs) increased school attendance for both boys and girls. Moreover, the findings show that girls' enrolment rate within schools increased by 3.2 per cent. This is driven by the increase in the number of newly enrolled girls compared with boys. We conclude that THRs have the potential to increase girls' educational attainment and gender equality within schools.

Keywords: school feeding programme, take home ration, enrolment, attendance, Burkina Faso

JEL classification: D04, I21, I25, O15

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Tables are at the end of the paper.

Tables'source: Author's calculations based on data from CRS and MENA

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1 Introduction

Improving educational outcomes is one of the top priorities in most countries, especially in the developing world, which lags behind high-income countries with respect to many educational indicators (Galiani and Perez-Truglia, 2011). This concern is partially driven by the idea that the training of human capital through education is one of the main drivers of economic growth. In the late 1980s and early 1990s, the endogenous growth theories (Romer, 1990; Aghion and Howitt, 1998) argued that differences in economic growth over time and across countries stems mainly from differences in investment in human capital including in terms of education, health and nutrition. For Lucas (1988), human capital is labour-augmenting and characterized by constant returns to scale which entail self-sustained growth driven by human capital accumulation. In the author's model, the 'engine' of growth is human capital, as human capital accumulation raises the productivity of both labour and physical capital. According to the human capital theory, there is a positive relationship between education (human capital accumulation) and economic growth (Schultz, 1961; Denison, 1962). Using school enrolment as a proxy of human capital accumulation, some empirical studies have found a positive linkage between the rate of human capital accumulation and economic growth (Barro, 1991; Lucas, 1988). Thus, Barro (1991) shows that a 10 per cent increase in educational attainment is associated with a 0.2 per cent increase in the growth rate per year.

To improve their human capital through education, many developing countries embarked on the path of universal education, joining the Education for All (EFA) by 2015 movement and working on the second Millennium Development Goal (MDG).[1] Policymakers have since undertaken measures to overcome the opportunity costs of sending children to school among poor and vulnerable households and increase enrolment and attendance among school-age children. Thus, some authors have found that Food for Education (FFE) programmes can be appropriate to improving school attendance and enrolment, particularly among the poor population. Indeed, Grantham-McGregor et al. (1998) found that, because the provision of school meals reduces the parents' costs of sending children to school, it promotes early enrolment and improves attendance. School Feeding Programmes (SFPs) are intended to alleviate short-term hunger, improve the nutrition and cognition of children, and transfer income to families (Jomaa et al., 2011).

School canteens were first introduced in the 1960s in Burkina Faso by the Catholic Relief Services (CRS)/Cathwell during severe famine which affected the Sahel region of West Africa and several SFPs have been implemented since this period. FFE is implemented in two forms: an on-site meal called daily meal (DM) and a take home ration (THR). Under the DM programme, breakfast and/or lunch is served at the school every school day and is available to both boys and girls. Under THR, a pupil receives a certain amount of food staples each period conditional on maintaining a specified attendance rate during that period.

These efforts in Burkina Faso raised the primary school gross enrolment rate from 45.9 per cent in 2000 to 81.3 per cent in 2012. Despite this increase, 13.7 per cent of pupils drop out before reaching the final grade (MENA, 2013). Furthermore, until 2012, the primary school completion rate stood at only 59.5 per cent (MENA, 2013). This result calls for further investigation into the circumstances under which SFPs could increase enrolment and attendance. In particular, this study assesses the impact of THR in comparison with on-site DM canteens to address the question of the impact of SFP on educational outcomes within schools in northern Burkina Faso. More

[1] The EFA movement not only calls for an investment in the duration of schooling, it also recommends that children acquire skills that they need to improve the quality of their social and economic later life.

specifically, it aims to address the extent to which THR affects 1) pupils' attendance rate and 2) girls' enrolment within schools.

The study uses data drawn from the CRS's latest School Feeding Programme in Burkina Faso, which provided assistance to more than 130,000 primary school pupils (grades 1-6). Two schemes were introduced: only DM versus a complementary THR for girls in schools where their enrolment rate is below 40 per cent. This allows us to compare the two schemes of programme intervention. The present study therefore differs from the previous by comparing an additional intervention — the THR — with DM or on-site meals. The study will contribute to orientating policymakers on the effectiveness of SFPs by assessing their attainment in a poverty context. Its results also have broader implications for the literature on efforts to improve educational outcomes through the implementation of SFPs.

Using the DID on the data set, we find that THR increased school attendance for both boys and girls. Also, girls' enrolment rate within schools increased. This means that THR leads parents to send more girls than boys to school because girls benefit more from THR. In addition, sending more girls means more food for the household. We perform robustness checks on the results, including regression on a second comparison group constructed with the third province in the northern region, where no school received a feeding programme.

The remainder of the paper is organized as follows: Section 2 provides a review of the literature surrounding theoretical and empirical research on SFPs; Section 3 gives a background of FFE and the feeding programme design in Burkina Faso; Section 4 summarizes the data and descriptive statistics; Section 5 reports on econometrics methods used; Section 6 discusses the estimations results and robustness checks; and Section 7 presents the conclusion.

2 Literature review

2.1 Theory on impact of school feeding on schooling

It has been claimed that SFPs increase school participation among people who are poor or facing food insecurity. Three goals are associated with SFPs as the pathways by which school meals could affect pupil learning (Levinger, 1986; Kazianga et al., 2009; Bundy et al., 2009). Firstly, SFPs are a conditional transfer to pupils. They may induce families and motivate parents to enrol their children, to enrol them sooner or, following enrolment, encourage regular attendance. Secondly, SFPs improve the nutritional status of school-age children over time, and alleviate short-term hunger in malnourished or otherwise well-nourished schoolchildren. As malnourishment has been shown to affect learning (Taras, 2005), SFPs can be expected to improve educational outcomes. Thirdly, SFPs improve cognitive functions and academic performance via reduced absenteeism and increased attention and concentration due to improved nutritional status. Indirectly, by increasing the amount of food available to the household, SFPs could improve the nutritional status of household members who are not in school, especially when SFPs entail THRs. In this way, SFPs are appealing because if properly designed and implemented they lead to an increased number of children being enrolled and improve their academic performance (Kazianga et *al.*, 2009).

In general, two schemes constitute SFPs and each scheme has its specific values. Meals served at schools (DMs) go directly to the pupils who are supposed to benefit from the programme. However, parents could react by reallocating food in the household away from these children. Food received by the household under THR is more likely to be shared by other household members, possibly reaching children who may be in as much or even greater need of additional food. For

Kazianga et al. (2012), because the nutritional benefits are diluted within the household, THR may have a lower impact on learning outcomes such as academic performance than a DM programme has.

Many works have attempted to confirm school feeding goals on educational outcomes and also on the health status of school pupils. Studies generally consider the following elements as school outcomes: enrolment, attendance, lateness, classroom behaviour, cognition, grade repetition, attainment levels and drop-out rate. Previous empirical works have found mixed evidence for the simultaneous impact of school feeding on enrolment, attendance and academic performance. Some evaluations of FFE programmes have shown that they can lead to increased access (of girls in particular), reduced drop-out rate, particularly in the lower primary school grades, and improved learning among pupils (Drèze and Kingdon, 2001; Ahmed, 2004; Taras, 2005; Vermeersch and Kremer, 2004; Kristjansson et al., 2007). This study focuses in particular on the impact of FFE programmes on enrolment and attendance.

2.2 Impact of FFE programmes on enrolment and attendance

Results are most compelling for school enrolment and attendance, particularly where initial rates of participation are low. Ahmed and del Ninno (2002) used a non-experimental design to assess the FFE programme set up in Bangladesh designed to transfer food to the poorest households through THR programmes in primary schools. The authors found that enrolment increased by 35 per cent over the one-year period between the programme start date and the end of its first year. This increase was driven by a 44 per cent increase in girl's enrolment and by a 28 per cent increase for boys. Ahmed and del Ninno (2002) also looked at the drop-out rate as affected by the programme, and found that from 1999 to 2000, 15 per cent of pupils from households who did not receive a THR dropped out, while only 6 per cent dropped out among those receiving the THR. Under the THR programme, food received is to be shared by other members in the household where pupils live, so using means as a method to evaluate the impact allows external factors that can influence the effect of the programme to be controlled.

Using an experimental design, Ahmed (2004) conducted a study in food-insecure areas of Bangladesh to assess the impact of SFP on school participation. The author found that SFPs have statistically significant positive impacts on both gross and net enrolment rates, with 14.2 per cent and 9.6 per cent increases respectively. Furthermore, pupils participating in the SFPs increased their attendance by 1.34 days per month. However, this finding does not take account of other unobservable characteristics of households in the treatment area that could affect a household's decision to enrol children. Therefore, without considering unobserved factors, it appears inconclusive to claim that the difference in enrolment between treatment and control groups was the result of the programme.

Afridi (2007) examined by non-experimental design the effects of the feeding programme on school enrolment and attendance. Using DID estimation, the author showed that girls' attendance increased by 10.5 per cent in schools that implemented the SFP in grade 1 in Madhya Pradesh (India). In Burkina Faso, Kazianga et al. (2009) found in their study of 'girl-friendly' schools in the Burkinabé Response to Improve Girls' Chances to Succeed (BRIGHT) school construction programme that both THR and DM interventions had a statistically significant impact on overall enrolment and on the enrolment of girls.[2] The reviews by Bundy et al. (2009) also found that the provision of FFE programmes increases the access to learning and education for schoolchildren

[2] The BRIGHT programme placed relatively well-resourced schools with a number of amenities directed at encouraging the enrolment of girls in 132 rural villages in Burkina Faso.

by improving enrolment and attendance rates. However, using a quasi-experimental design, Buttenheim et al. (2011) did not find a consistent effect of SFPs in Lao PDR. Indeed, they found minimal evidence that the school feeding schemes increased enrolment or improved children's nutritional status. Using the DID method, Cheung and Berlin (2014) found that school enrolment increased but the impact was largest from the full programme including on-site feeding, THR and de-worming.

3 Background of FFE programmes in Burkina Faso

School canteens were first introduced in 1962 in Burkina Faso by the Catholic Relief Services (CRS)/Cathwell in the aftermath of severe famine which affected the Sahel region of West Africa. Since this period, CRS has provided educational assistance and implemented several SFPs in vulnerable areas. The dry THR, which is a more recent intervention, was also initiated in Burkina Faso by the CRS/Cathwell. Only girls who attend school on a regular basis receive a food ration (flour) that they can take home each month. However, little is known about the effect of SFPs, because there have been no effective evaluations of their impact on education outcomes and pupil learning in Burkina Faso. Our present study aims to address this gap.

Our study covers the region served by the CRS, and all schools that were listed in the academic year 2011–2012, focusing on the central part of the northern region of Burkina Faso. Northern Burkina Faso is an appropriate context to evaluate the impact of FFE programmes for two main reasons. First, the region has low primary school participation. On average only 53.5 per cent of school-age children (6 to 11 years old) attend school (MENA, 2012). Therefore, there is much scope for increasing enrolment. Second, income levels are very low and severe food shortages are frequent. Hence, the value of the food offered should be a sufficient incentive to attract children to school. Households are largely dependent upon subsistence agriculture, and malnutrition is extremely high in the target area, with stunting occurring in 40 per cent of children under 5 years of age due to diet, poor hygiene practices and illness (ENAIM, 2009).[3] The project was implemented in two of the three provinces of the northern region: Bam and Sanmatenga.

The two provinces are characterized by periods of erratic rainfall, which result in food insecurity and increasing migration. Following the poor harvest of 2011, the northern region was declared an area prone to food insecurity risk. Additionally, Bam and Sanmatenga are characterized by low levels of girls' educational enrolment and achievement. In 2008, school enrolment stood at 75 per cent, with gender disparities (81 per cent boys and 70 per cent girls) and inequities between urban and rural areas (MENA, 2009). There are many challenges in access to education, including prohibitive school distances, financial costs, cultural barriers and the opportunity costs of sending girls to school who are expected to perform household chores and look after other children (such as siblings). These factors contribute to a high number of drop-outs at an early age. The grade five drop-out rate is 17 per cent in Bam and 15 per cent in Sanmatenga, often due to early marriage, puberty (and lack of proper sanitation facilities in schools) and work duties at home. In the last few years, gold mining has become widespread in the two provinces. This phenomenon has increased the pull of children from school, and households from their crops. In 2011, a new mine was implemented in Bam province which can hinder SFP impact.

[3] National Food Security Survey

Through its programme called Beoog Biiga ('Tomorrow Child' in the local language), CRS aimed to respond to food insecurity through the education, health and capacity-building sectors and to increase school access and continuation by improving pupil health and the school environment in Burkina Faso. This multisectoral programme was funded from 30 September 2011 to 31 December 2014 by the United States Department of Agriculture (USDA) and implemented in partnership with the Government of Burkina Faso and local development organizations.[4] The SFP and health initiatives were implemented in close collaboration with the Ministry of Primary Education and Literacy (MENA), the Ministry of Health (MoH) and the Ministry of Social Action and National Solidarity (MASSN).

The project targeted the provinces of Bam and Sanmatenga, covering 684 schools and 134,128 pupils, including 62,442 girls, in its first year. The project covered all schools in the two provinces served by the CRS in the academic year 2011–2012.[5] In this way, two main activities were carried out as project schemes under the project objectives. First, CRS distributed a DM to all pupils throughout the school year. Primary school pupils received a daily ration of 136 grams (g) of soy-fortified bulgur, 27 g of lentils and 18 g of vegetable oil per pupil, for a total of 726 kilocalories (kcal) and 31 g of protein per day. The second main activity was the distribution of THRs. CRS provided THRs to improve girls' enrolment and attendance and decrease drop-out rates in Bam and Sanmatenga. In each school where girls' enrolment rate was under 40 per cent, female pupils were given a food ration consisting of 10 kilograms (kg) of corn soy blend (CSB) for each month in which their attendance was 90 per cent or above. According to current figures, approximately 150 schools (excluding schools in the two big cities) had girls' enrolment rates of less than 40 per cent and benefit from THRs.[6]

We wish to stress at this point that the Beoog Biiga programme was not a randomized intervention. The schools were selected based on administrative criteria, which may correlate with other characteristics potentially influencing school enrolment and pupil attendance. Additionally, the local community was asked to voluntarily provide some wood or help preparing the food to complement the meals. As the programme was implemented at the school level, the potential biases will be negligible (whether or not a pupil brought wood, he/she received the DM at school).

4. Data and descriptive statistics of the SFP

4.1 Data

The data used in this study come from two main sources: CRS/Burkina Faso and MENA. Schools characteristics data are drawn from the annual MENA school survey (2010–2011 and 2011–2012 school years). The survey data set includes information on school location, status, number of teachers by gender, and other school facilities. Through the Beoog Biiga programme, CRS provides data on education outcomes such as enrolment and attendance. Attendance is measured by the average number of half-days of classes not missed by pupils in each school. Girls' enrolment rate

[4] United States Department of Agriculture (USDA)

[5] The 2011-2012 school year is from October 2011 to June 2012

[6] Generally, there are two kinds of school feeding programmes: daily meals (DM) and take-home ration (THR). So, an evaluation consists to assess the impact of DM in comparison with no feeding or comparing THR vs no feeding schools. But 'Beoog Biiga' programme is considered as a joint feeding programme with two schemes: the first scheme is DM (for all students) and the second scheme is the DM+THR (DM for all and THR only for girls with 90 per cent of attendance). Thus, to evaluate the impact of the programme, we have to compare DM schools' vs DM+THR schools. Thus, since, all schools receive DM, the work is to evaluate the impact of THR on girls' enrollment and attendance.

is measured by the percentage of female pupils in each school. CRS's baseline data for the project was collected in 2011 prior to the beginning of the school year.

Two steps were used to select schools. Step 1 consisted of dividing schools into two groups; the first group comprised all schools located in urban areas and the second group all schools in rural areas. In step 2, all rural schools where girls' enrolment rate was below 40 per cent were selected to benefit from the DM and THR for girls, while the remaining schools received only DMs. The baseline was constructed using data from MENA based on 2010–2011 and 2011–2012 school years and consisted of collecting school characteristics to complete data on enrolment and attendance already collected in the CRS database. Then we matched the two data sets by school name at the district level. Table 1 reports all school characteristics such as school facilities, location and school status. To all these variables, we added an exogenous variable to capture its impact on school enrolment and pupil attendance. Indeed, as noted in Section 3, Bam and Sanmatenga provinces are affected by gold mining, which can hinder the programme impact. Taking account of this factor would enable us to avoid a misleading estimation of programme impact. We identified our treatment and comparison group of schools on the basis of whether they received only a DM or a DM and THR during the 2011–2012 school year.

4.2 Descriptive statistics in baseline

Table 1 summarizes the key baseline characteristics of schools and pupils in all targeted schools. In Panel A, the statistics show that schools are characterized by a low attendance rate (51 per cent). On average, girls' enrolment rate is 45.67 per cent in each school, showing a persistent gender gap (about 0.881). Ninety-two per cent of schools are located in rural areas and 88 per cent of them are public schools. Pupil-teacher ratio is 58.33, meaning that there are on average 58 pupils in each class in each school. According to the Education for All Fast-Track Initiative (EFA-FTI), the standard ratio must be 40.[7] In this case, school classes are oversized.

Panel B shows the pupil characteristics in a sub-sample. MENA randomly interviewed pupils in grade 6 and grade 3 in selected schools, for details on their socio-economic characteristics such as parents' occupation, parent literacy, the distance from school and household chores. Panel B also shows that on average, pupils live 1.62 km from school, 82 per cent of pupils have a father who is a farmer, and that only 46 per cent of these men are literate. It appears here that mothers are less literate.

Table 2 reports the average school characteristics of the treatment and comparison group at the baseline. Prior to the treatment, schools were similar on some variables including attendance level for boys and girls, and pupil-teacher ratio. Also, before treatment, it appeared that there was no significant difference between schools in terms of the presence of electricity, a latrine, a library and an external restaurant. However, we observed significant differences in girls' enrolment, school status and location, and number of female teachers. On average, 36 per cent of girls were enrolled in THR schools against 48 per cent in the comparison group, because schools received THRs based on the girls' enrolment rate being below 40 per cent.

[7]FTI is established in 2002. Available on http://www.oecd.org/dac/37819963.pdf (accessed on 27 October 2017)

5 Methodology

Any impact evaluation attempts essentially to answer a counterfactual question (Duflo and Kremer, 2003): how would individuals who participated in the programme have fared in the absence of the programme? How would those who were not exposed to the programme have fared in the presence of the programme? Studies on impact evaluation usually resort to experimental and non-experimental evaluation methods, depending on the study design. Considered as the 'gold standard', experimental design randomly assigns individuals to treatment and control groups, thus overcoming the counterfactual problem by ensuring that the treatment status is uncorrelated with other variables so that the potential outcome can be attributed only to the programme. Other quasi-experimental and non-experimental methods can also be used to overcome the counterfactual problem. Our study uses difference-in-difference (DID) to estimate the THR impact on enrolment and attendance.

An important assumption of the DID method is the common time trend for both the treated and control groups. This assumes that in the absence of treatment, the average change in the outcomes would be the same for treated schools as for untreated schools. Thus, it means that unobserved heterogeneity between the treated and control groups are time invariant and uncorrelated with the treatment over time. This paper analyses a programme in which school participation was not randomized, as all schools received at least one SFP scheme. Indeed, based on administrative criteria, schools are divided into two groups. Our treatment group consists of 134 schools where all pupils received a DM and girls in addition received a THR. The second group, our comparison group, includes 550 schools where pupils only received a DM.

Therefore the paper analyses the effect of THRs, an additional school feeding scheme, on pupil enrolment and attendance.

Denote by Y_1 the outcome conditional on participation and by Y_0 the outcome conditional on non-participation, so the impact of participating in the programme is:

$$\Delta = Y_1 - Y_0$$

For each individual, only Y_1 or Y_0 is observed, so Δ is not observable. This missing data problem lies at the heart of the evaluation problem. So, let T = 1 for the group of individuals who applied and got accepted into the programme for whom Y_1 is observed and T = 0 for individuals who did not enter the programme for whom Y_0 is observed. Let X denote a vector of observed individual characteristics used as conditioning variables. The most common evaluation parameter of interest is the mean impact of treatment on the treated (TT):

$$TT = E(\Delta | X, T = 1) = E(Y_1 - Y_0 | X, D = 1) = E(Y_1 | X, T = 1) - E(Y_0 | X, T = 1) \quad (1)$$

TT estimates the average impact of the programme among those participating in it.

As the programme was offered at the school level, we estimate the average intent to treat (AIT), which is the impact of the programme, on the average of all pupils in a given school.

$$AIT = E(y_{1i} | T_i = 1) - E(y_{0i} | T_i = 1) \quad (2)$$

Or

$$E(y_{1i}|T_i = 1) = E(y_{0i}|T_i = 0), \text{ so}$$

$$AIT = E(y_{1i}|T_i = 1) - E(y_{0i}|T_i = 0)$$

DID estimation on attendance and enrolment rate can be written as:

$$Y_i = \beta_0 + \beta_1 t_i + \beta_2 THR_i + \beta_3 t_i * THR_i + \beta_k X_{k,i} + \cup_p + e_i \quad (3)$$

Where Y_{it} is the outcome of interest (attendance or enrolment) for school$i$.

t_i takes value 1 for all schools if observation is in follow-up and 0 for baseline. THR_i takes value 1 for all schools where all pupils received a DM and girls received a THR and 0 in schools where all pupils received only a DM. $X_{k,i}$ is a school characteristic, $\cup_p$ is a province-specific factor. The interaction $t_i * THR_i$ estimates the DID effect of THR on school attendance and enrolment.

The present study makes a contribution to the quasi-experimental literature in impact evaluation in developing countries. Indeed, the use of a retrospective analysis to evaluate an SFP differs from previous studies in a developing country such as Burkina Faso, where Kazianga et al. (2012, 2013) used randomized design. It also uses a unique data set from the first SFP in Burkina Faso on which there has been no previous evaluation.

6 Results

We now discuss our results from estimating equation (3). Table 3 and Table 4 show the effect of THRs on attendance and enrolment respectively, including control for all school characteristics. The coefficient of interest is the interaction term $THR\ x\ Year1$ which is the DID estimate of the THR effect on school enrolment and attendance. For all regressions, we estimate firstly the THR effect on attendance and enrolment with all schools; secondly we run the same estimation with rural schools. Given that, as shown in descriptive statistics, THR schools are all rural, the choice of the right comparison group follows this criterion in order to avoid some biases in the programme impact. Therefore, we restrict our interpretation to rural schools only. Nonetheless, we present the results alongside all schools and observe that results are similar.

6.1 Impact of THR on school attendance

Attendance is measured by the average number of half-days of classes not missed by pupils in each school as reported by the CRS survey. Table 3 presents the effect of THRs on school attendance. While column 4 shows the attendance rate for all pupils in rural schools, columns 5 and 6 report boys' and girls' attendance rates respectively. The DID results suggest that on average the THR programme has a positive impact on pupils' attendance rate, which shows an increase of 8.4 per cent. When estimating separately, both boys' and girls' attendance rates increased. However, boys' attendance rate is higher than that of girls suggesting spillover effect. Indeed, girls' attendance rate increased by 6 per cent against 8.4 per cent for boys, showing that school attendance in the THR programme is driven by boys. This can be explained by the fact that initially the boys' attendance rate was lower than that of girls and the presence of girls after the programme implementation keeps more boys. Also, boys in either DM schools or in THR schools received a meal. Some authors have found similar spillover effects in their study (Kazianga et al, 2012 for the Sahel region in Burkina Faso; Kim et al*,* 1999 in Pakistan case and Kremer et al, 2009 in Kenya). For Kazianga

et al. (2012), while this relatively large effect on boys' attendance for an intervention that targeted girls is puzzling, it provides more suggestive evidence that the THR intervention did not crowd out boys.

While controlling for school characteristics, we find that pupil-teacher ratio has a negative and significant effect on overall and boys' attendance. Meanwhile, public school has a positive impact on overall attendance, increasing all pupils' attendance by 9 per cent, although its effect is not significant on girls' attendance. Parents may prefer to send their boys to public schools in which school fees are generally affordable. At the province level, we control for the presence of an additional exogenous factor which affects pupils and their household, particularly vulnerable ones. Indeed, newly opened mines can lead to absenteeism and thus drop-out, as the presence of mining increases child labour. Table 1 shows that 82 per cent of fathers are farmers, so poor harvests can act as an incentive for parents to send more children to work in mines to increase household financial resources. Mining is thus considered a source of income to support family needs. Further results show that the presence of mining impacts negatively on attendance, decreasing boys' and girls' attendance by 25 per cent and 15 per cent respectively.

6.2 Impact of THR on school enrolment

Table 4 reports the impact of THRs on enrolment. Enrolment rate is defined as the number of boys or girls enrolled as a percentage of all pupils within schools. So, interpreting change in girls' enrolment rate or boys' enrolment rate has the same significance. Results reveal that girls' enrolment rate increased significantly — by 3.2 per cent — with THR. This means a simultaneous decrease in boys' enrolment rate by 3.2 per cent. However, we know that enrolment could increase if girls' numbers increased more than boys or if boys' numbers decreased significantly. To check this, we compute the change in pupil numbers within schools. Columns 4, 5 and 6 report the change in the number of pupils within schools, the change in girls' number and the change in boys' number respectively. While girls' enrolment rate increased with THRs, the number of enrolled girls increased more than boys (six girls versus five boys). We conclude that girls' enrolment rate increased due to the fact that their numbers increased more than boys' numbers within the schools.

The presence of female teachers has a positive and significant impact on girls' enrolment rate, as parents have more confidence sending their daughters to school if there are female teachers. Girls and their parents may regard a female teacher as proof of success, demonstrating that girls are not confined only to domestic tasks but can become more literate and practice a good job in the future. In contrast, mining has a negative impact on boys' enrolment, decreasing the number of boys by three pupils per school on average.

Nevertheless, these numbers need to be interpreted with caution. Indeed, in some cases, enrolment numbers cannot be trusted because the schools might have incentives to inflate them in order to receive more funds. On the other hand, it is possible for a child to attend without being enrolled, perhaps because of incomplete school records (Cheung and Berlin, 2014). Although column 4 shows that pupil numbers increased on average by 11 pupils per school, while girls' figures increased significantly, the number of boys did not.

These results are in line with previous findings. Indeed, Cheung and Berlin (2014) found that THRs boosted school enrolment in the short term by 5 per cent, while Ahmed and del Ninno (2002) found that THRs were effective in increasing enrolment and attendance in Bangladesh. The authors found that the increased enrolment was driven by a 44 per cent increase in girl's enrolment and by a 28 per cent increase for boys. Contrary to Kazianga et al. (2009) in the Sahel region, who found that THRs increased enrolment for girls by six percentage points at the household level, our

results show that the CRS food programme had a smaller effect. This is due to the fact that this particular programme targeted the school level, thus reducing the effective impact.

Overall, these results appear to be consistent with those shown in previous works and can be explained by the fact that THRs can be considered a reallocation of food between girls and their household members. As households receive more food to be shared with all members, this could lead parents to enrol other girls not yet in school in order to increase the food ration. At the same time, parents may retain some boys for labour, either in farming or in mining, in order to increase household resources. However, the increase in the school attendance rate for boys is due to the fact that by sending them to school parents can at least ensure that they receive a meal.

6.3 Robustness

Given that as described earlier, all schools in our sample received at least one SFP scheme, we used in addition an external comparison group to check the robustness of our results. Indeed, for the programme that was implemented in two of the three provinces of the northern region, we can use the third province where no school received the programme as another comparison group: the non-feeding (NF) schools. Prior to using the third province, we have to ensure that this province can be considered as similar to the other provinces in order to form a good NF comparison group. On the one hand, the administrative zoning in Burkina Faso forms regions with provinces based on their geographic and socio-economic characteristics, thereby suggesting that the third province is comparable to the other provinces. Table 5, on the other hand, shows that on average the third province is similar to the targeted ones. Columns 2 and 3 show that girls' enrolment rate, proportion of rural schools, and the number of schools where girls' enrolment is low (below 40 per cent as defined in programme criteria) are similar. In this section we therefore use the NF schools as a second comparison group in two different ways.

Firstly, we took all the NF schools and the previous DM group and ran the DID estimation on the number of newly enrolled pupils. The results in Table 6 show that we obtained the same results as our main results in Table 4 (with only DM as the comparison group). This means that taking the NF schools in the third province into account did not change our results. The previous findings reflect the programme impact on newly enrolled figures well. Indeed, pupil numbers increased significantly by 12, but while the number of girls rose significantly (6.53), the number of boys did not. Also, public schools increased their numbers by 24 new pupils (against 22 in Table 4).

Secondly, our robustness check involved comparing THR schools and NF schools where girls' enrolment rate was below 40 per cent. In Table 7, the results show that girls' enrolment rate increased by 3.8 per cent (against 3.2 per cent in Table 4). Controlling for public schools, we found that public schools increased girls' enrolment rate by 1.8 per cent. As shown in Table 4, the THR programme had the same effect on enrolment. So, we found that the value of the coefficient of interest THR x year1 did not differ from our main results and that the impact of THRs on educational outcomes was causal.

Our robustness check also compared only schools where girls' enrolment was below 40 per cent i.e. THR schools in rural areas compared with DM schools in urban areas (which did not receive THRs for girls due to their location in urban areas). Table 8 shows that the results do not vary widely from the results found in Table 4. Indeed, girls' enrolment rate increased by 2.5 per cent (against 3.2 per cent in Table 4). Overall, the group of NF schools allowed us to corroborate the study's main results on enrolment: the THR programme improves school enrolment.

7 Conclusion

This study provides an ex-post evaluation of a Food for Education (FFE) programme implemented in Burkina Faso. It is an insight into the impact of an additional feeding scheme on educational outcomes. Specifically, the study evaluates the impact of take home rations (THRs) on school attendance and girls' enrolment in northern primary schools. THRs were targeted only at girls where their enrolment rate was below 40 per cent and were conditional on 90 per cent attendance. As we rely on a baseline and follow-up, we use DID regression to estimate the impact of the THR programme. As we have no experimental data, we control for schools and province-level characteristics to find an estimated impact that can be interpreted as causal. We find that attendance rate within schools increased by 8.4 per cent more in the THR group (6 per cent for girls and 8.4 per cent for boys). In addition, the results show that girls' enrolment rate increased by 3.2 per cent and was driven by the increase in the number of girls in THR schools. Moreover, our results suggest that school characteristics influenced the extent to which THR improved school attendance and girls' enrolment. Pupils in schools that had more female teachers and pupils in public schools gained significantly more from the programme.

Overall, our results show that school feeding through the THR programme in a specific context of food insecurity can increase school attendance and girls' enrolment. However, the impact of this programme on nutrition and health remains to be investigated. Moreover, given that THRs are targeted at the school level, this calls for more investigation at the household and individual levels of the circumstances under which THRs impact attendance and enrolment. Indeed, programmes succeed when they consider household or individual behaviour. This, combined with programme design, is a major determinant of a programme's impact. These are open questions for future research. The findings of this research have policy relevance: THRs improve school attendance for both boys and girls and increase girls' enrolment within schools. This carries long-term implications for gender equality in schools and girls' educational attainment.

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TABLES

Table 1: Summary baseline statistics of school characteristics in targeted provinces

	Variables	Mean	SD[2]	Min	Max
Panel A	Public schools	0.881	0.322	0	1
	Rural schools	0.917	0.275	0	1
	Pupil attendance	0.506	0.218	0	
	Enrolled students	216.68	140.97	18	755
	Girls' enrolment rate	0.456	0.079	0.18	0.80
	Gender gap	0.881	0.306	0.22	4
	Teachers	3.53	2.33	0	11
	Female teachers	1.35	1.64	0	7
	Pupil/teacher ratio	58.33	19.29	11.5	154
	Schools facilities (presence or not)				
	Electricity	0.099	0.299	0	1
	Running water	0.542	0.498	0	1
	Library	0.055	0.229	0	1
	Latrine	0.644	0.448	0	1
	Parents' association	0.902	0.297	0	1
	External restaurant	0.742	0.437	0	1
	Mining area in 2011	0.358	0.479	0	1
	Pupils characteristics (sub-sample)				
Panel B	Distance from school (km)	1.625	0.668	1	3
	Repeaters	0.376	0.515	0	1
	Keeping child at home	0.604	0.489	0	1
	Household chores	0.785	0.410	0	1
	Father is farmer	0.820	0.384	0	1
	Father is literate	0.463	0.499	0	1
	Mother is literate	0.293	0.456	0	1

Notes: Panel A shows summary statistics for the 684 targeted schools where 134,128 pupils, including 62,442 females, are enrolled. Panel B shows pupil characteristics obtained for a sub-sample of 876 pupils (grades 3 and 6) in 24 schools randomly selected by MENA. [2]SD = standard deviation

Table 2: Average school characteristics by treatment status

	DM	THR	
School characteristics	**N=550**	**N=134**	**Difference**
	-1	**-2**	**(2) – (1)**
Public schools	0.896	0.824	-0.072 **
Rural location	0.896	1.000	0.104***
Pupil attendance	0.509	0.496	-0.014
Girls' attendance	0.767	0.774	0.007
Boys' attendance	0.510	0.496	-0.014
Girls' enrolment rate	0.480	0.362	-0.119***
Pupil/teacher ratio	57.827	60.256	2.429
Female teachers	1.520	0.687	- 0.833***
Drilling	0.625	0.512	-0.113**
Electricity	0.119	0.078	-0.041
Latrine	0.724	0.674	-0.050
Library	0.061	0.062	0.001
External Restaurant	0.826	0.806	-0.020
New mining area	0.389	0.231	-0.158***

Notes: Summary statistics for schools targeted in the 2011–2012 school year.

Standard errors not presented. *** Significant at 1%; ** significant at 5%; * significant at 10%.

Table 3: Programme impact on attendance

	All schools			Rural schools		
	[1]	[2]	[3]	[4]	[5]	[6]
	All	Girls	Boys	All	Girls	Boys
Baseline	0.648**	0.820***	0.647***	0.668***	0.863***	0.668***
	(0.041)	(0.036)	(0.041)	(0.037)	(0.034)	(0.037)
THR	-0.045*	-0.008	-0.045*	-0.046*	-0.008	-0.046*
	(0.024)	(0.022)	(0.024)	(0.025)	(0.022)	(0.025)
THR*year1	0.088***	0.064**	0.088***	0.084***	0.060**	0.084***
	(0.028)	(0.026)	(0.028)	(0.028)	(0.026)	(0.028)
Public school	0.081***	-0.004	0.082***	0.089***	-0.006	0.090***
	(0.023)	(0.021)	(0.023)	(0.025)	(0.022)	(0.025)
Rural zone	0.033	0.045**	0.034			
	(0.025)	(0.023)	(0.025)			
Pupil/teacher ratio	-0.001***	-0.000	-0.001***	- 0.001***	-0.000	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female teacher	-0.000	-0.001	-0.000	-0.002	-0.001	-0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Electricity	0.028	0.030*	0.029	0.032	0.032*	0.033
	(0.019)	(0.017)	(0.019)	(0.020)	(0.019)	(0.020)
Latrine	-0.021	-0.010	-0.021	-0.027*	-0.010	-0.027*
	(0.014)	(0.0183)	(0.014)	(0.015)	(0.001)	(0.015)
Running water	-0.003	0.004	-0.003	0.000	0.004	0.000
	(0.013)	(0.012)	(0.013)	(0.013)	(0.012)	(0.013)
Library	-0.016	-0.008	-0.015	-0.033	-0.019	-0.032
	(0.025)	(0.023)	(0.025)	(0.026)	(0.024)	(0.026)
Ext. restaurant	-0.083***	-0.011	-0.082***	-0.071***	-0.006	-0.071 ***
	(0.018)	(0.020)	(0.018)	(0.019)	(0.017)	(0.019)
Girl enrol.<40	-0.012	0.020	-0.012	-0.010	-0.019	-0.009
	(0.019)	(0.121)	(0.019)	(0.019)	(0.018)	(0.019)
Mining	-0.245***	-0.146***	-0.245***	-0.250**	-0.148***	-0.252***
	(0.012)	(0.011)	(0.012)	(0.013)	(0.012)	(0.013)
R-squared	**0.5636**	**0.1910**	**0.5638**	**0.5734**	**0.1963**	**0.5734**
Observations	**1131**	**1139**	**1131**	**1056**	**1060**	**1056**

Notes: Robust standard errors in parentheses, clustered at school level

*** Significant at 1%; **significant at 5%; * significant at 10%.

Regressions control for school characteristics. The dependent variable is the school average attendance rate.

Average attendance = number of half-days attended by pupils divided by the total number of half-day classes.

Table 4: Programme impact on enrolment (newly enrolled and enrolment rate)

	Newly enrolled						**Enrolment rate**			
	All schools			**Rural schools**			**All schools**		**Rural schools**	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
	All	Girls	Boys	All	Girls	Boys	Girls	Boys	Girls	Boys
Baseline	-202.7***	-85.78***	-116.9***	-199.6***	-86.35***	-113.33***	0.431***	0.569***	0.439***	0.561***
	(7.629)	(4.243)	(4.591)	(6.782)	(3.756)	(4.182)	(0.011)	(0.011)	(0.011)	(0.011)
THR	-5.261	-8.469***	3.207	-6.166	-9.665***	3.500	-0.103***	0.103***	-0.104***	0.104***
	(4.891)	(2.721)	(2.943)	(4.723)	(2.615)	(2.912)	(0.006)	(0.012)	(0.006)	(0.006)
THR*year1	10.653*	5.600*	5.053	10.842**	5.701*	5.142	0.033***	-0.033***	0.032***	-0.032***
	(5.734)	(3.189)	(3.450)	(5.507)	(3.049)	(3.395)	(0.009)	(0.009)	(0.009)	(0.009)
Public school	26.471***	13.516***	12.955***	22.448***	10.249***	12.199***	0.036***	-0.036***	0.027***	-0.027***
	(4.028)	(2.240)	(2.424)	(4.185)	(2.318)	(2.581)	(0.006)	(0.006)	(0.007)	(0.007)
Rural zone	-10.535**	-9.263***	-1.272				-0.001	0.001		
	(4.671)	(2.598)	(2.811)				(0.007)	(0.007)		
Pupil/teacher ratio	3.065***	1.409***	1.656***	2.943***	1.331***	1.612***	-0.000	0.000	-0.000	0.000
	(0.060)	(0.033)	(0.036)	(0.059)	(0.033)	(0.036)	(0.000)	(0.000)	(0.000)	(0.000)
Teachers	59.285***	27.316***	31.969***	59.417***	27.140***	32.278***	-0.001	0.001	-0.001	0.001
	(1.018)	(0.566)	(0.613)	(1.021)	(0.566)	(0.630)	(0.002)	(0.002)	(0.002)	(0.002)
Female teacher	-3.091***	0.984	-4.076***	-4.187***	0.459	-4.646***	0.010***	-0.010***	0.009***	-0.009***
	(1.196)	(0.665)	(0.720)	(1.205)	(0.667)	(0.743)	(0.002)	(0.002)	(0.002)	(0.002)
Electricity	8.907**	6.958***	1.949	11.423***	8.817***	2.606	0.006	-0.006	0.009	-0.009
	(3.835)	(2.133)	(2.308)	(4.025)	(2.229)	(2.482)	(0.006)	(0.006)	(0.006)	(0.006)
Latrine	-6.085**	-4.230**	-1.856	-7.581**	-4.989***	-2.591	-0.010**	0.010**	-0.010**	0.010**
	(2.980)	(1.657)	(1.793)	(2.937)	(1.626)	(1.811)	(0.005)	(0.005)	(0.005)	(0.005)
Running water	2.057	-0.034	2.091	1.944	0.245	1.699	0.002	-0.002	0.003	-0.003
	(2.648)	(1.473)	(1.593)	(2.635)	(1.459)	(1.625)	(0.004)	(0.004)	(0.004)	(0.004)
Library	15.205***	6.016**	9.190***	17.377***	7.905***	9.472***	-0.013*	0.013*	-0.007	0.007
	(5.044)	(2.805)	(3.035)	(5.163)	(2.859)	(3.183)	(0.008)	(0.008)	(0.008)	(0.008)
Ext. restaurant	10.594***	4.080**	6.515***	8.788**	3.964**	4.824**	0.007	-0.007	0.012**	-0.012**
	(3.513)	(1.954)	(2.114)	(3.528)	(1.954)	(2.175)	(0.005)	(0.005)	(0.006)	(0.006)
Girl enroll.<40	0.410	-16.918***	17.328***	0.704	-15.957***	16.661***				
	(3.671)	(2.042)	(2.209)	(3.583)	(1.984)	(2.209)				
Mining	-4.916**	-1.532	-3.384**	-3.091	-0.276	-2.815*	0.020***	-0.020***	0.020***	-0.020***
	(2.492)	(1.386)	(1.499)	(2.462)	(1.364)	(1.518)	(0.004)	(0.004)	(0.004)	(0.004)
R-squared	**0.9188**	**0.9033**	**0.8886**	**0.9160**	**0.8980**	**0.8835**	**0.3692**	**0.3692**	**0.3678**	**0.3678**
Observation	**1228**	**1228**	**1228**	**1129**	**1129**	**1129**	**1228**	**1228**	**1129**	**1129**

Notes: Robust standard errors in parentheses, clustered at school level

* Significant at 10%; **significant at 5%; *** significant at 1%

Dependent variables are attendance and enrolment rates. Regressions control for school and province-specific characteristics.

Table 5: Key school variables between provinces

School characteristics	All provinces	Bam & Sanmatenga	Namentenga	Bam	Sanmatenga
Number of schools	**N=927**	**N=684**	**N=243**	**N=245**	**N=439**
	[1]	**[2]**	**[3]**	**[4]**	**[5]**
Public schools	0.902	0.881	0.962	0.864	0.892
Rural schools	0.922	0.917	0 .934	0.917	0.916
Girls' enrolment rate	0.460	0.456	0.458	0.470	0.448
Girls' enrolment <40	0.216	0.217	0.271	0.122	0.271
Enrolled pupils	202.26	216.68	167.25	212.76	218.89
Pupil/teacher ratio	52.62	58.33	44.59	56.20	59.63
Female teachers	1.39	1.35	1.17	1.13	1.47
Schools facilities [2]	1.435	1.34	1.58	1.35	1.33
Electricity	0.096	0.099	0.082	0.102	0.097
Running water	0.586	0.542	0.679	0.526	0.551
Latrine	0.706	0.644	0.802	0.661	0.635
Library	0.046	0.055	0.024	0.061	0.052
Parents' association	0.946	0.902	1	0.951	0.874
Mining area in year 2011^			No	Yes	No

Notes: Bam & Sanmatenga = targeted provinces.

Namentenga = third external province (as a second comparison group of schools)

[2] School facilities = electricity + running water + latrine + library

^ Mining area = Yes if newly opened in 2011 and mining area = No if mining opened before 2011

Table 6: Programme impact on enrolment: THR group vs. (DM + NF) group

	Enrolled pupils					
	[1]	[2]	[3]	[4]	[5]	[6]
	All schools			Rural schools		
	All	Girls	Boys	All	Girls	Boys
Baseline	210.53***	-90.723***	-119.81***	-206.51***	-90.573***	-115.94***
	(6.800)	(3.687)	(4.088)	(6.093)	(3.270)	(3.775)
THR	-6.400	-9.893***	3.493	-5.696	-9.822***	4.126
	(4.434)	(2.404)	(2.666)	(4.209)	(2.259)	(2.607)
THR*year1	11.839**	6.618**	5.221	11.993**	6.533**	5.459*
	(5.587)	(3.030)	(3.360)	(5.303)	(2.846)	(3.285)
Public school	25.513 ***	13.671***	11.842***	24.317***	11.89***	12.419***
	(3.736)	(2.026)	(2.247)	(3.892)	(2.089)	(2.411)
Rural zone	-7.650*	-7.470***	-0.180			
	(4.111)	(2.229)	(2.472)			
Pupil-teacher ratio	3.245***	1.485***	1.760***	3.105***	1.397***	1.708***
	(0.052)	(0.028)	(0.031)	(0.051)	(0.027)	(0.031)
Teachers	53.511***	24.991***	28.519***	53.501***	24.796***	28.705***
	(0.856)	(0.464)	(0.515)	(0.851)	(0.456)	(0.527)
Female teacher	0.276	2.092***	-1.815***	-0.038	1.938***	-1.975***
	(1.018)	(0.552)	(0.612)	(1.017)	(0.546)	(0.630)
Electricity	6.029*	4.423**	1.607	8.661**	6.044***	2.617
	(3.407)	(1.847)	(2.049)	(3.544)	(1.902)	(2.196)
Latrine	-3.494	-3.235**	-0.259	-5.695**	-4.439***	-1.257
	(2.621)	(1.421)	(1.576)	(2.558)	(1.373)	(1.585)
Running water	2.023	0.004	1.737	2.681	1.057	1.624
	(2.268)	(0.012)	(1.364)	(2.226)	(1.195)	(1.379)
Library	15.922***	6.287**	9.635***	16.004***	6.833***	9.171***
	(4.696)	(2.546)	(2.824)	(4.772)	(2.561)	(2.956)
External restaurant	15.807***	6.825***	8.981***	13.843***	6.422***	7.421***
	(3.196)	(1.733)	(1.922)	(3.218)	(1.727)	(1.993)
Girl enroll.<40	3.396	-14.501***	17.897***	2.899	-14.339***	17.237***
	(2.824)	(1.531)	(1.698)	(2.712)	(1.456)	(1.680)
Mining	3.395	2.239*	1.156	4.618**	3.193***	1.425
	(2.293)	(1.243)	(1.378)	(2.249)	(1.207)	(1.393)
R-squared	**0.9062**	**0.8937**	**0.8717**	**0.9039**	**0.8903**	**0.8657**
Observations	**1714**	**1714**	**1714**	**1583**	**1583**	**1583**

Notes: Robust standard errors in parentheses, clustered at province l level. ***significant at 1%; ** significant at 5%; * significant at 10%

Table 7: Programme impact on school enrolment rate: THR vs. NF schools in rural areas (control for schools where girls' enrolment rate is below 40%)

	School enrolment rate		Enrolled pupils	
	[1]	**[2]**	**[3]**	**[4]**
	Girls	Boys	Girls	Boys
Baseline	0.314***	0.686***	-67.392***	-77.468***
	(0.019)	(0.019)	(4.758)	(5.014)
THR	0.010	-0.010	8.555***	4.861*
	(0.011)	(0.011)	(2.764)	(2.912)
THR*year1	0.038***	-0.038***	5.346	-2.231
	(0.014)	(0.014)	(3.478)	(3.665)
Public school	0.018*	-0.018*	8.561***	2.544
	(0.011)	(0.011)	(2.849)	(3.002)
R-squared	**0.2183**	**0.2183**	**0.8665**	**0.9087**
Observations	**180**	**180**	**180**	**180**

Notes: Robust standard errors in parentheses, clustered at province l level

***significant at 1%; **significant at 5%; * significant at 10%

NB: all covariates are not significant, but their inclusion gives the same results

Table 8: Programme impact on enrolment: THR vs. DM (in only schools where girls' enrolment rate is below 40%)

	School enrolment rate		**Enrolled pupils**	
	[1]	**[2]**	**[3]**	**[4]**
	Girls	Boys	Girls	Boys
Baseline	0.314***	0.686***	-26.776**	-43.051***
	(0.015)	(0.015)	(7.400)	(12.381)
THR	-0.031***	0.031***	-6.666	2.192
	(0.009)	(0.009)	(4.653)	(7.784)
THR*year1	0.025**	-0.025*	6.116	0.172
	(0.012)	(0.012)	(6.237)	(10.434)
Public school	0.039***	-0.039***	6.116	-6.222
	(0.008)	(0.007)	(6.237)	(6.426)
R-squared	**0.2046**	**0.2046**	**0.5803**	**0.5755**
Observations	**263**	**263**	**263**	**263**

Notes: Robust standard errors in parentheses, clustered at province level

*** Significant at 1%; ** significant at 5%; * significant at 10%. Covariates are not presented in the table