Food for Thought: Evaluating the Impact of India's Mid-Day Meal Program on Educational Attainment

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Undergraduate Honors Thesis

May 2012

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Abstract

Given the correlation between educational attainment and economic growth, policies that both effectively and efficiently decrease the financial barriers to primary school education in developing countries are of extreme interest to government and non-government organizations alike. In 1995, the Government of India implemented a school-feeding program to incentivize children to attend primary school through the provision of a subsidized mid-day meal. This paper evaluates the Mid-Day Meal Program by estimating the impact of receipt of the program on primary school enrollment. A propensity score matching method is used, and the dataset is from India's 2004 Socio-Economic Survey. Results indicate that the school feeding program was extremely successful in raising enrollment rates, particularly among children from the lowest socio-economic backgrounds. This evidence reaffirms the positive impact of government transfer programs on educational outcomes, and suggests hopeful results for the implementation of similar programs in other regions.

* Acknowledgements: I would like to thank Professor Frederico Finan for contributing his time and invaluable advice throughout the research process. I would also like to thank Professor Roger Craine for his guidance during the beginning stages, as well as Harrison Decker for his assistance in acquiring data. Finally, I wish to acknowledge the statistical office that provided the underlying data making this research possible: Ministry of Statistics and Programme Implementation, India.

1 Introduction

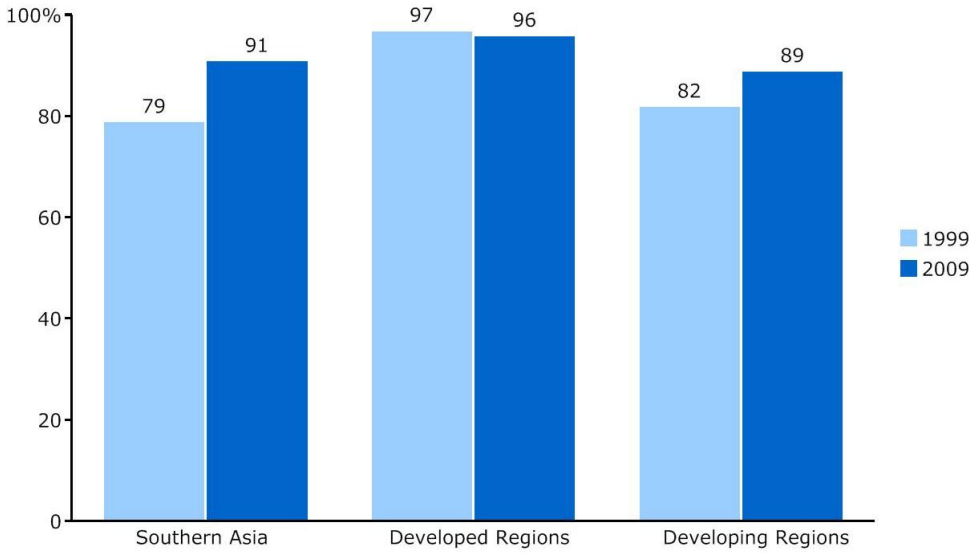
With much optimism for a new century of progress, the United Nations held the 2000 Millennium Summit with the goal of eradicating global poverty by 2015. A central idea of this Summit was the creation of eight Millennium Development Goals-- which, if achieved, would hopefully reach that noble end (United Nations 2011). Particularly important to reducing global inequality is the second of those eight goals, universal access to primary education, which would ensure that children receive a basic foundation of knowledge and increased accessibility to a living wage[1] later in life.

However, despite the prioritization of educational advancements, recent statistics indicate that 69 million children worldwide are not enrolled in primary school. Half of these children live in Sub-Saharan Africa, and more than a quarter of them live in South Asia (United Nations 2010). In an increasingly competitive and technology-driven global market, the job and overall economic prospects for those without even a primary school education are slim, further widening the gap between the top few and the bottom billion.

While the percentage of children enrolled in school in developing countries has increased from 82% to 89% since 1998 (Figure 1), far more action addressing this issue is needed. Achieving universal primary education requires a combination of rigorous evaluation and policy action, to successfully eliminate financial barriers to schooling for low-income and other marginalized children. A few policy approaches that have the potential to decrease the cost of schooling include the elimination of school fees, the expansion of transportation infrastructure to remote areas, an increased focus on improving overall classroom quality, and the provision of subsidized school lunches.

[1] A living wage is the minimum amount of income necessary to meet basic human needs.

Figure 1: Adjusted Net Enrollment Ratio in Primary Education



Source: 2011 United Nations Millennium Development Report

In an effort to motivate further policy action, this paper evaluates the impact of India's Mid-Day Meal Program on the educational enrollment of primary school-aged children, using data from India's 2004 Socio-Economic Survey. A propensity score matching method is used to calculate an unbiased treatment on the treated effect. The educational impact of the Mid-Day Meal program is both economically and statistically significant: average enrollment rates of Mid-Day Meal program beneficiaries are 22.68 percentage points higher than those of non-beneficiaries, all else equal. When restricted to public school children only, the program effect rises to a 29.53 percentage point enrollment increase. Additionally, stratifications by both parental education level and monthly per capita expenditure levels indicate a high differential effect for those in the lowest socio-economic group.

The rest of the paper is organized as follows: Section 2 provides a review of the literature surrounding empirical research on education transfers; Section 3 provides a background of the

Mid-Day Meal program; Section 4 summarizes the data and econometric methods used; Section 5 reports program impacts and results; Section 6 discusses the policy implications; and Section 7 concludes.

2 Literature Review

The importance of education to economic development cannot be overstated, considering its impact on several critical development measures. Not only does education provide better job market opportunities, leading to higher wages and an improved standard of living, but evidence also suggests that improved schooling inputs can lead to a greater sense of political awareness, reduced acceptance of traditional authority, and increased gender equality (Friedman et al 2011). However, the poor health, low welfare levels, and overall underdevelopment characterizing cyclical poverty are often the factors that impede access to schooling in the first place.

The decision to send a child to school, like other household investment decisions, can be modeled by a cost-benefit framework (Dreze and Kingdon 2001). Schooling requires an initial investment, composed of both the direct cost of schooling—such as transportation, textbooks, meals, and other classroom fees—and the opportunity cost of schooling. This opportunity cost reflects the foregone benefits a child could provide his or her family if not in school, through labor market income or household chores. While education reduces poverty in the long run by providing greater job access and higher wages, the short-run costs of schooling can be very steep, particularly for families living below the poverty line. Thus, many families find that the future benefits of education do not justify its immediate cost.

Numerous research studies support this correlation between poverty and low educational attainment, and find that entrenched, household characteristics are highly predictive of children's

academic success. In their analysis of the determinants of school participation in rural North India, Dreze and Kingdon (2001) find that the probability of school participation increases with higher levels of parental education, and that this relationship is particularly strong between parents and children of the same gender. Additionally, the effects of caste status, household wealth, and level of parental motivation are highly significant. Research conducted in Brazil supports a positive relationship between parent and child education levels, and suggests that higher levels of maternal education reduce intrahousehold gender biases that may prevent females from attending school (Emerson and Souza 2007). Finally, in their study of child labor and schooling decisions in Ghana, Canagarajah and Coulombe (1997) find that education decreases and child labor increases as household wealth declines, supporting the theory that schooling can be a financial burden for poorer families. If these results hold across regions, then the 69 million children not enrolled in school worldwide (United Nations 2010) and the 1.4 billion people living below the poverty line (World Bank 2008) will be less likely to afford education for their children, further perpetuating the cycle of poverty through future generations. Policy intervention is therefore needed to achieve the Millennium Development Goal of universal primary education and ensure that all children have equal access to education.

An important policy response to this issue has been to target the cost of education itself, providing subsidies and in-kind or conditional cash transfers when a household would otherwise be unable to afford education. For example, the PROGRESA program, initiated by Mexico in 1997, provided cash transfers to rural households conditional on satisfactory school attendance by their children, and it has been estimated to increase school attendance of treatment children by 0.66 years on a baseline of 6.80 years (Schultz 2002). Furthermore, PROGRESA increased enrollment even for children who were ineligible for the program, but benefitted from the influence of peers, particularly those from the poorest households (Bobonis and Finan 2002). In

Bangladesh, a targeted school stipend administered through Bangladesh's Food-for-Education program had strong effects on school participation, leading to an average of a 17.3 percentage point increase in attendance rate for boys and a 16 percentage point increase for girls (Ravallion and Wodon 2000).

The particular policy intervention evaluated in this paper is a government-sponsored school feeding program, which partially mitigates the cost of schooling by offering a free or subsidized meal or snack, conditional on a child's enrollment and attendance. This type of intervention improves school participation by addressing both the financial and health factors that contribute to lower attendance rates. Past research finds that children who are suffering from disease, infection, or poor nutrition have significantly lower school participation rates than children who are healthy (Miguel and Kremer 2004, Bobonis et al 2006). Even if a child is able to attend school, they are unlikely to be focused and productive if they are undernourished and weak. By providing free and nutritious food during the school day, India's mid-day meal program has been shown to significantly increase daily caloric intake as well as levels of protein and iron for recipient children (Afridi 2007). Therefore, provision of an in-class meal has the added benefits of keeping children in school who would otherwise be too sick or weak to attend, and improving academic achievement for those enrolled in school. As the results of these studies cannot be extrapolated outside of the area of study, it is useful to analyze similar programs in different regions.

One counter-point to the provision of government feeding programs is the idea that a child will not actually benefit from the program if they receive fewer calories later in the day as a response. This "theory of altruism" (Becker 1974) describes the practice of reallocating all or part of transfers away from the intended recipient and towards other household members. For example, a potential scenario is one in which a credit-constrained parent withdraws calories from

a child later in the day because the child already received a subsidized school meal. In this case, the transfer merely substitutes for the calories the child would have received later in the day, and instead benefits other members of the household. Jacoby (2002) examines this intrahousehold reallocation of resources in his analysis of a school feeding program in the Philippines, to test for the presence of an "Intrahousehold Flypaper Effect (IFE)", which is the degree to which a government transfer sticks to a particular individual.

Jacoby interviewed a random sample of children about their diet the previous day, and utilized random variation in interview dates to determine the exogenous effect of a school meal on caloric intake. Interestingly, he finds an IFE significantly different from zero; that is, parents do not withdraw calories from their children in response to the provision of a school meal. When the poorest households are examined, the IFE is slightly weaker, but still statistically significant, indicating that school feeding programs do succeed in reallocating resources towards their targeted recipients (Jacoby 2002).

Evidence from the field supports the notion that school feeding programs do work, and do shift resources to those who are most in need. An exploration of school feeding programs in a greater diversity of regions will continue to shed light on the effects of such programs, particularly on the educational advancement of youth.

3 Program Background

The National Program of Nutritional Support to Primary Education, commonly known as the Mid-Day Meal Program, was launched by the Indian government in August of 1995 to boost enrollment, retention, and attendance rates for children, while also improving nutrition and health outcomes (Government of India). The first programs were established in 2,408 particular blocks

of the country, but the government eventually extended its reach nationwide in 1997, to cover all primary-school aged children in government and local body public schools. The original program provided 100 grams of food grains per child per day, with the objectives of improving the nutritional status of public school children, encouraging poor children from disadvantaged areas to attend school more regularly, helping children concentrate on classroom activities, and providing nutritional support to children in drought affected areas during summer breaks (Government of India). In September of 2004, the program transitioned from raw grains to cooked meals, consisting of a minimum of 300 calories and 8-12 grams of protein per child. Finally, in July of 2006, the Program standards were increased, requiring 450 calories and 12 grams of protein per child per day, with special stipulations to provide iron, folic acid, and other essential stipends. The 2006 revision also provided subsidies to schools to cover cooking and preparation costs.[2]

Logistically, the central government provided free food grains, while state governments were responsible for converting these food grains into cooked meals. States that were unable to convert grain into meals due to resource shortages were initially allowed to distribute the raw free grain to children, conditional on attendance. However, in 2001, the Supreme Court mandated that all public schools provide cooked meals. To promote compliance, schools are required to publicly display information on the meals and to expect periodic visits by State Government officials, and it is estimated that approximately 25% of schools have been inspected (Government of India). However, analysis suggests a high degree of non-compliance, as a large amount of children in public schools did not receive the meal.

[2] These subsidies consisted of 1.80 rupees per child per school day for States in the North Eastern Region, conditional on the state governments contributing 0.20 rupees per child per school day, and 1.50 rupees per child per school day for all other states, conditional on these other state governments contributing 0.50 rupees per school day.

4 Data and Estimation Strategy

The dataset analyzed in this paper is from India's 2004 Socio-Economic Survey, conducted by the Government of India's National Sample Survey Organization from June 2004-June 2005. Raw data was compiled and made available through the Minnesota Population Center's Integrated Public Use Microdata Series- International (IPUMS) database. Using a two-staged, stratified sampling design,[3] the survey collected information on the demographics, educational level, labor status, and income brackets of 602,833 individuals across the country. One important factor to note is that well-off individuals are over-represented in the survey, and thus, the impact estimated in this paper is likely to be a lower bound of the program's effect on the entire population.

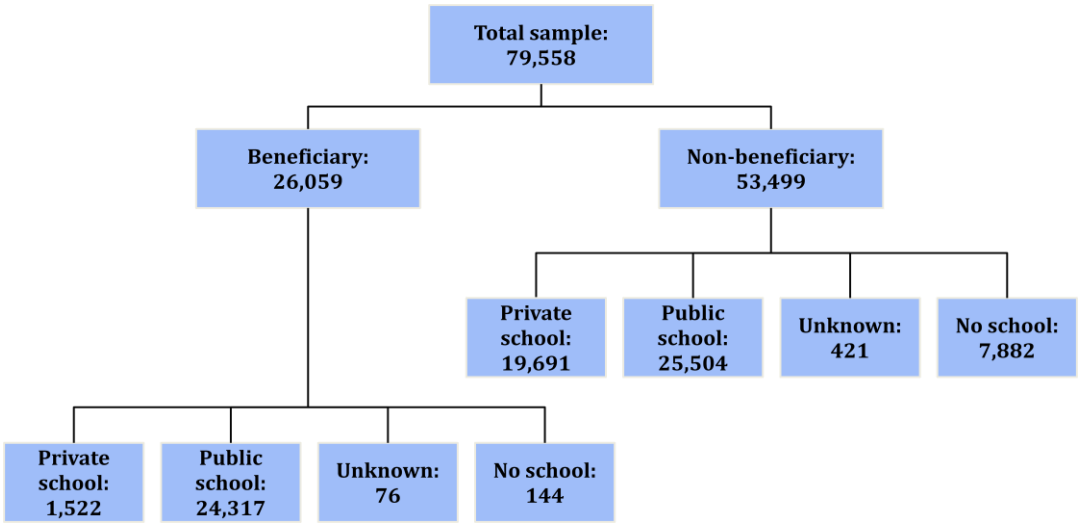
For the purpose of this paper, only the 79,558 primary school-aged children were extracted from the sample, in order to restrict analysis to those eligible for the Mid-Day Meal Program. Although provision of a mid-day meal was mandatory in all public, primary schools, only about 50% of the public school children in the sample who attended school reported benefitting from the program. (Figure 1) As program rollout was not made transparent, the exact factors preventing eligible children from receiving the meal are unobserved, but potential explanations are corruption, resource shortages, or implementation error. Due to the number of intermediaries involved in the program at the federal, state, and local levels, there are many

[3] Two-Staged Sampling Design: In Stage 1, rural sector regions were stratified based on population and crop patterns, and census villages were selected from these regions with probability proportional to the population. Urban sectors were stratified by population, where census blocks were selected with equal probability. In Stage 2, large villages were split up into hamlet-groups for rural areas, and sub-blocks for urban areas; some were randomly selected. Households were selected from these Stage 2 strata randomly. Affluent households are over-sampled: the ratio of affluent to other households is 2:8.

opportunities to siphon off funds or grain, and Indian media outlets have reported such corruption scandals taking place (Chhetri 2006).

Although private schools are not required to serve the Mid-Day Meals, a proportion of private schools participated in the program anyways; 1,522 children in both unaided and aided private schools reported receiving the program (Figure 2). As one cannot automatically infer that all children not attending school at the time of the survey would otherwise be attending public school, the aggregate effect of the Mid-Day Meal program on both public and private school attendees is analyzed. Additionally, since some private schools receive funding from the government or from community groups, it may also be of interest to examine the effect of mid-day meals on the overall primary school-aged population. However, to check for potential selection bias due to either wealthier (or poorer) private schools selecting into the Mid-Day Meal program, a disaggregated measure of the effect of the Mid-Day Meal program on public schools only is also reported in the Results section.

Figure 2: Breakdown of Research Sample



The binary dependent variable, enrollment, is an indicator for whether a child was attending school at the time of the survey, taking a value of one if the child attended, and zero

otherwise. The independent variable of interest, Mid-Day Meal, is also a binary variable taking a value of one if the child reported receiving a free or subsidized mid-day meal in the past year, and zero otherwise. The additional regressors are vectors of individual, household, and parental characteristics that affect allocation of the mid-day meal for a particular child. Individual characteristics include age and sex. Household variables are locality, income of the household head (rupees/ week), number of children under the age of five, household size, and religion. Parental-specific variables include mother's education and father's education, ranging from less than primary school to higher than secondary school (Appendix).

Summary statistics are presented in Table 1. On average, enrollment is 90%, although only 32.75% of children report receiving a mid-day meal. The ratio of girls to boys is roughly equal, and the majority of children report living in rural areas (two-thirds). Average family size is 6.6 members, while average number of siblings under the age of five is 0.49. With regards to parental education, roughly 57% of children's mothers have attained less than a primary school education, 25% have attained a primary school education, 10.9% have attained a secondary school education, and 3% have attained greater than a secondary school education. Furthermore, about 35% of children's fathers have attained less than a primary school education, 29% have attained a primary school education, 17.5% have attained a secondary school education, and 7.3% have attained more than a secondary school education. This low educational attainment for both males and females underscores the need for increased investment in human capital.

Table 1: Summary Statistics

Variable	# obs.	Mean	SD	Min	Max
Individual Characteristics:					
Enrollment	79216	0.903	0.296	0	1
MDM Beneficiary	79558	0.328	0.469	0	1
Sex	79558	0.528	0.499	0	1
Age 6	79558	0.173	0.378	0	1
Age 7	79558	0.161	0.368	0	1
Age 8	79558	0.196	0.397	0	1
Age 9	79558	0.133	0.340	0	1
Age 10	79558	0.214	0.410	0	1
Age 11	79558	0.123	0.329	0	1
Household Characteristics:					
Urban Locality	79558	0.312	0.463	0	1
Siblings <5	76789	0.486	0.719	0	4
Family Size	79558	6.600	2.931	1	36
Weekly Income	79558	307.452	835.917	0	128333
Hindu	79558	0.728	0.445	0	1
Muslim	79558	0.157	0.364	0	1
Buddhist	79558	0.010	0.102	0	1
Christian	79558	0.065	0.246	0	1
Other Religion	79558	0.040	0.196	0	1
Mother's Education:					
< Primary School	79558	0.572	0.495	0	1
Primary School	79558	0.254	0.435	0	1
Secondary School	79558	0.109	0.312	0	1
Post Secondary School	79558	0.030	0.172	0	1
Father's Education:					
< Primary School	79558	0.355	0.478	0	1
Primary School	79558	0.292	0.455	0	1
Secondary School	79558	0.175	0.380	0	1
Post Secondary School	79558	0.073	0.260	0	1

A comparison of variable means between beneficiaries and non-beneficiaries of the Mid-Day Meal program is presented in Table 2, revealing that prior to matching, there are significant differences between the two groups. On average, program beneficiaries are concentrated in rural areas, and have smaller families (both in terms of overall size and number of siblings under the age of five). The income wage of the household head is significantly lower for program

beneficiaries (a difference of 57 rupees/week). Program beneficiaries are more likely to be of Hindu and Buddhist religions, whereas non-beneficiaries are more likely to be Christian or Muslim. Finally, parents of children in the treatment group have significantly lower levels of education than those in the comparison group. The only characteristic that is not significantly different across groups is gender, as both participants and non-participants have roughly equal proportions of males and females. These statistics indicate that program beneficiaries tend to be poorer and from less educated families.

Table 2: Comparison in Means between Beneficiaries and Non-Beneficiaries

Variable	Treatment Mean	Comparison Mean	Difference in Means	Standard Error	T-Statistic
Individual Characteristics:					
Enrollment	0.996	0.858	0.138	0.002	-63.205***
Sex	0.515	0.535	-0.020	0.004	5.404***
Age 6	0.168	0.176	-0.008	0.003	2.724***
Age 7	0.175	0.154	0.021	0.003	-7.610***
Age 8	0.212	0.188	0.025	0.003	-8.235***
Age 9	0.155	0.123	0.032	0.003	-12.460***
Age 10	0.198	0.222	-0.023	0.003	7.529***
Household Characteristics:					
Urban Locality	0.204	0.365	-0.161	0.003	46.727***
Siblings <5	0.500	0.480	0.021	0.006	-3.721***
Family Size	6.549	6.624	-0.074	0.022	3.362***
Weekly Income	214.456	352.750	-138.294	6.296	21.966***
Hindu	0.792	0.697	0.096	0.003	-28.593***
Muslim	0.139	0.165	-0.026	0.003	9.494***
Buddhist	0.013	0.009	0.004	0.001	-5.540***
Christian	0.042	0.076	-0.034	0.002	18.408***
Mother's Education:					
Primary School	0.262	0.249	0.013	0.003	-3.931***
Secondary School	0.060	0.133	-0.073	0.002	31.214***
Post Secondary School	0.006	0.042	-0.036	0.001	27.742***
Father's Education:					
Primary School	0.325	0.276	0.049	0.003	-14.203***
Secondary School	0.124	0.200	-0.076	0.003	26.589***
Post Secondary School	0.030	0.093	-0.064	0.002	32.605***

*** denotes t>2.54, ** denotes t>1.96, * denotes t>1.64

In the absence of randomized treatment assignment, a method of propensity-score matching (PSM) is used to estimate the causal effect of the mid-day meal program on school participation. Two groups of children are observed: recipients of the Mid-Day Meal (T_i=1 for child *i*) and non-recipients of the program (T_i=0). Children who receive the meal (the treatment group) are matched to children who do not (the comparison group) on the basis of their propensity score (Rosenbaum and Rubin 1983), which is the predicted probability of receiving the program conditional on a vector of observed covariates:

$$P(x_i) = Pr(T_i = 1 \mid x_i), \quad P(x_i) \in [0, 1]$$

This propensity score for each observation is estimated from the logit regression of the binary treatment indicator variable on the vectors of observable characteristics. Once treatment groups are balanced by eliminating observations for which there is no match, Enrollment is regressed on Mid-Day Meal to calculate an unbiased estimate of the average treatment on the treated.

When evaluating the effect of a non-randomized program, there is a problem of observing the counterfactual, which is the schooling outcome of a child in the treatment group, had they not received the program. Of course, once they receive the program, it is difficult to disentangle the effect of the program itself on schooling, from the effect of some other variable, which may or may not be observable. Propensity score matching, however, eliminates bias under the conditions of (1) common support and (2) conditional independence (Lechner 2002, Imbens 2004).

The condition of common support requires there to be sufficient overlap in the covariate distribution of treatment and comparison observations. This condition is examined in the following section (Figure 3), and the average effect for the substantial subset of the space for which there is overlap in treatment and control characteristics is estimated. Secondly, conditional independence implies that given a set of observable covariates unaffected by the treatment (x_i),

potential outcomes (Y_i^T for treatment group, Y_i^C for comparison group), are independent of treatment assignment (T_i):

$$(Y_i^T, Y_i^C) \perp T_i \mid x_i$$

That is, conditional on all observable child, parental, and household characteristics, systematic differences in educational outcomes between treatment and comparison units can be attributed to the Mid-Day Meal program. While this exogeneity assumption is untestable, it is reasonable, given that we condition on child, household, and parental characteristics, which are most predictive of academic attainment (Dreze and Kingdon 2001, Canagarajah and Coulombe 1997, Emerson and Souza 2007). Within a particular subgroup identical in these characteristics, the conditional independence assumption allows us to attribute heterogeneity in schooling outcome to the effect of the treatment. Thus,

$$\begin{aligned} & E[Y_i^T - Y_i^C \mid T = 1,\, x_i] \\ &= E[Y_i^T \mid T = 1,\, x_i] - E[Y_i^C | T = 1,\, x_i] \\ &= E[Y_i^T \mid T = 1,\, x_i] - E[Y_i^C \mid T = 0,\, x_i] \quad (by\ 2) \end{aligned}$$

So the difference between outcome of the treated group and outcome of the comparison group is the average treatment on the treated effect. Potential limitations to this model will be addressed in the following section.

5 Econometric Analysis and Results

Results

The predicted propensity scores estimated by a logit regression of the binary dependent variable, indicating receipt of treatment, on a vector of covariates are reported in Table 3. The coefficient estimates indicate that there are a number of highly significant explanatory factors of program participation. Girls are more likely to receive the program than boys, and children living in rural areas are more likely to receive the program than children living in urban areas. On average, each additional sibling under the age of five is associated with an increase in likelihood of program participation, though each additional family member overall is associated with a decrease in likelihood. This indicates that program participants may have a higher family "dependency ratio"[4], which can impose a strain on family resources. Overall, prominent religions, with respect to the reference group, are significantly correlated with receipt of the program. Finally, likelihood of program participation decreases as parental education increases, with respect to the reference group. This effect is significant for both mother's and father's education.

Overall, it appears that children who receive the program are worse-off in development measures than those who do not. Program beneficiaries come from poorer, larger households in primarily rural areas, with both lower household income levels and lower levels of parental education. While, prior to matching, these impacts cannot be interpreted as causal, it does appear that the Mid-Day Meal program is extending its reach to areas that are most in need.

[4] A dependency ratio is the proportion of those that are not in the labor force (dependents) with those that are in the labor force (productive workers). In this context, a household that is small overall, but has a large proportion of children under 5, has a high intrahousehold dependency ratio.

Table 3: Logistic Regression of Mid-Day Meal on Observable Covariates

(Dependent Variable: Mid-Day Meal)

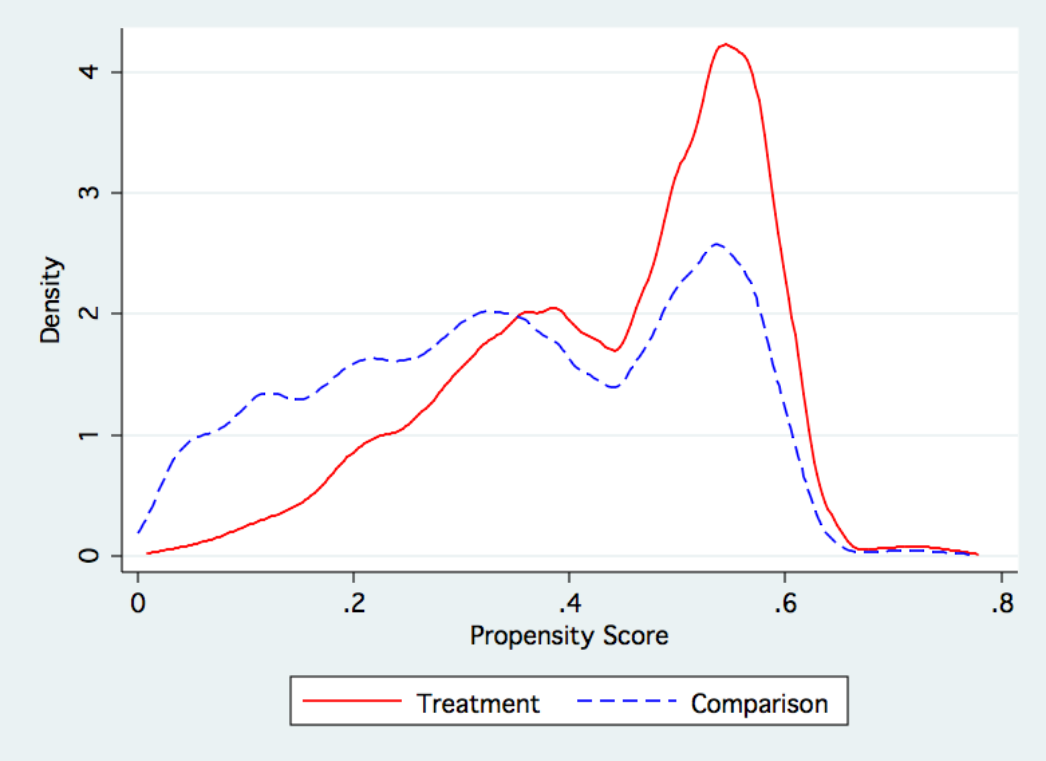
Variable	Coefficient	Standard Error	P>lzl	[95% Conf. Interval]	
Sex	-0.154***	0.025	0.000	-0.203	-0.105
Age 6	0.599***	0.049	0.000	0.503	0.695
Age 7	0.644***	0.048	0.000	0.550	0.739
Age 8	0.599***	0.046	0.000	0.508	0.690
Age 9	0.738***	0.050	0.000	0.641	0.835
Age 10	0.313***	0.046	0.000	0.224	0.403
Urban Locality	-0.882***	0.033	0.000	-0.947	-0.818
Siblings <5	-0.018	0.018	0.320	-0.054	0.018
Family size	-0.022***	0.004	0.000	-0.031	-0.013
Weekly Income	-0.000***	0.000	0.009	0.000	0.000
Hindu	1.775***	0.106	0.000	1.568	1.983
Muslim	1.574***	0.110	0.000	1.359	1.789
Buddhist	2.480***	0.229	0.000	2.031	2.929
Christian	1.626***	0.129	0.000	1.374	1.878
(M) Primary School	-0.026	0.032	0.400	-0.088	0.035
(M) Secondary School	-0.558***	0.053	0.000	-0.661	-0.455
(M) Post Secondary School	-1.459***	0.134	0.000	-1.723	-1.196
(F) Primary School	-0.161***	0.030	0.000	-0.219	-0.103
(F) Secondary School	-0.716***	0.041	0.000	-0.797	-0.636
(F) Post Secondary School	-0.974***	0.073	0.000	-1.117	-0.832
Constant	-1.872***		0.000	-2.098	-1.646
				Num. obs = 68790	
				R^2= 0.082	

Robust standard errors estimated

*** denotes p<0.01, ** denotes p<0.05, * denotes p<0.1

Figure 3 plots the estimated propensity scores for the beneficiaries and non-beneficiaries prior to matching. Out of the sample of 79,558 children, 2,858 observations were dropped due to a lack of sufficient support. After matching, the mean propensity scores for the two groups were 0.439 for treatment units and 0.35 for comparison units, indicating that the matching was successful in creating fairly balanced groups.

Figure 3: Distribution of Propensity Scores for Treatment and Comparison Groups



Once the treatment and comparison groups are sufficiently balanced, enrollment is regressed on Mid-Day Meal, in order to estimate the causal impact of the feeding program on educational enrollment (Table 4), using weights of 1 for participants and $\frac{P(\hat{x}_i)}{1-P(\hat{x}_i)}$ for non-participants:

$$Y_i = \beta_0 + \beta_1 T_i + X_i'\delta + u_i$$

where Y_i is the i[th] individual's enrollment level, T_i is a binary indicator for whether or not the i[th] individual benefitted from the Mid-Day Meal program, and x_i is a vector of household and child characteristics. u_i, the error term, is uncorrelated with T_i and is of mean zero. While robust standard errors are estimated, a lack of school indicators recorded in the survey makes it impossible to cluster at the school level, resulting in higher than usual standard errors. Despite this caveat, the coefficient estimates provide both interesting and relevant conclusions about the success of the Mid-Day Meal program in India. The coefficient estimate on T_i indicates that

children who report receiving a mid-day meal have a 22.68 percentage point higher attendance rate than children who do not. This coefficient is not only large, but also statistically significant at the 99% confidence level. Thus, the null that the program has a zero effect can be rejected.

Table 4: Regression of School Enrollment on Mid-Day Meal for Public and Private Primary School Children

(Dependent Variable: Enrollment)

Variable	Coefficient	Standard Error	P>ltl	[95% Conf. Interval]	
MDM Beneficiary	0.226***	0.004	0.000	0.220	0.234
Sex	0.043***	0.004	0.000	0.035	0.052
Age 6	-0.117***	0.008	0.000	-0.132	-0.102
Age 7	-0.040***	0.007	0.000	-0.054	-0.027
Age 8	-0.032***	0.007	0.000	-0.045	-0.020
Age 9	-0.015**	0.007	0.034	-0.030	-0.001
Age 10	-0.024***	0.006	0.000	-0.037	-0.013
Urban Locality	0.034***	0.004	0.000	0.027	0.042
Siblings <5	-0.028***	0.003	0.000	-0.035	-0.022
Family size	-0.001**	0.001	0.013	-0.003	0.000
Weekly Income	-1.00E-03	0.000	0.218	0.000	0.000
Hindu	-0.057***	0.008	0.000	-0.074	-0.041
Muslim	-0.072***	0.010	0.000	-0.092	-0.054
Buddhist	-0.014	0.030	0.642	-0.072	0.045
Christian	-0.062***	0.014	0.000	-0.089	-0.035
(M) Primary School	0.080***	0.004	0.000	0.073	0.087
(M) Secondary School	0.076***	0.005	0.000	0.067	0.086
(M) Post Secondary School	0.067***	0.010	0.000	0.047	0.087
(F) Primary School	0.105***	0.004	0.000	0.097	0.114
(F) Secondary School	0.106***	0.005	0.000	0.097	0.116
(F) Post Secondary School	0.109***	0.006	0.000	0.097	0.123
Constant	0.803***		0.000	0.781	0.825
					Num. obs = 68790
					R^2= 0.082

Robust standard errors estimated

*** denotes p<0.01, ** denotes p<0.05, * denotes p<0.1

To check the robustness of this positive result for public school children alone, the regression of educational enrollment on receipt of the Mid-Day Meal program is restricted to those children attending only government and local body private schools (Table 5). The coefficient on Mid-Day Meal indicates that receipt of the program increases educational enrollment by 29.53 percentage points, significant at the 99% confidence level.

Table 5: Regression of School Enrollment on Mid-Day Meal for Public School Children Only

(Dependent Variable: Enrollment)

Variable	Coefficient	Standard Error	P>ItI	[95% Conf. Interval]	
MDM Beneficiary	0.295***	0.004	0.000	0.287	0.304
Sex	0.043***	0.005	0.000	0.034	0.053
Age 6	-0.133***	0.008	0.000	-0.150	-0.116
Age 7	-0.050***	0.008	0.000	-0.066	-0.034
Age 8	-0.036***	0.008	0.000	-0.051	-0.022
Age 9	-0.019**	0.008	0.023	-0.036	-0.003
Age 10	-0.026***	0.007	0.000	-0.040	-0.012
Urban Locality	0.000	0.005	0.984	-0.009	0.009
Siblings <5	-0.026***	0.004	0.000	-0.034	-0.020
Family size	-0.004***	0.001	0.000	-0.006	-0.002
Weekly Income	-0.000	0.000	0.226	0.000	0.000
Hindu	-0.064***	0.010	0.000	-0.084	-0.045
Muslim	-0.086***	0.011	0.000	-0.109	-0.064
Buddhist	-0.019	0.037	0.590	-0.093	0.053
Christian	-0.082***	0.018	0.000	-0.118	-0.047
(M) Primary School	0.073***	0.004	0.000	0.065	0.082
(M) Secondary School	0.050***	0.006	0.000	0.038	0.063
(M) Post Secondary School	0.015	0.013	0.239	-0.010	0.041
(F) Primary School	0.107***	0.005	0.000	0.097	0.116
(F) Secondary School	0.099***	0.006	0.000	0.088	0.110
(F) Post Secondary School	0.100***	0.008	0.000	0.084	0.117
Constant	0.772***		0.000	0.747	0.798
					Num. obs = 55560
					R^2= 0.239

Robust standard errors estimated

*** denotes p<0.01, ** denotes p<0.05, * denotes p<0.1

Given the evidence suggesting that children have differential access to schooling due to household socio-economic characteristics, regressions were stratified by parental educational level in order to estimate the effect of the Mid-Day Meal Program within each group. Stratification by mother's education level is reported in Table 6, and stratification by father's education level is reported in Table 7. Interestingly, we see a strong, positive effect of the program for children with the least educated parents, significant for both mother's and father's education. On average, children of mothers that have completed post-secondary education experience a 1.5 percentage point increase in attendance rates as a result of the Mid-Day Meal program, holding all else equal. However, this increases to 2.97 percentage points for secondary

school-educated mothers, 3.91 percentage points for primary school-educated mothers, and a high 29 percentage point increase for children of mothers that did not even complete primary school. The estimates for secondary schooling and below are significant at the 99% confidence level, while the estimate for post-secondary schooling is significant at 90% confidence.

The overall pattern for the father's educational attainment parallel that of the mother, though the coefficients estimates on Mid-Day Meal are higher for father's education. For children of fathers who have completed post-secondary school education, receipt of the Mid-Day Meal results in an average of a 3.58 percentage point increase in attendance rates, all else equal. This increases to 5.3 percentage points for children of father's who have attained secondary school education, 9.8 percentage points for primary school education, and finally, an average 34.8 percentage point increase for children of fathers who have less than a primary school education. In this case, all four coefficient estimates are statistically significant at the 99% confidence level.

Finally, monthly per capita expenditure is divided into centiles, to determine the average effect of the program within each income group (Table 8). Once again, the regression output indicates differential effects of the program with decreasing socio-economic status. Conditional on the highest expenditure centile, the Mid-Day Meal program results in 8.22 percentage point average increase in attendance. The effect increases with each decrease in expenditure level, ranging from a 15.58 percentage point average increase in the ninth centile, to a 32.13 percentage point average increase in the second centile. Finally, in the lowest income centile, we see that receipt of the Mid-Day Meal program is associated with a 37.78 percentage point increase in attendance. Again, all these estimates are significant at the 99% confidence level. These high coefficient estimates, which are associated with lower levels of parental education and lower household welfare, suggest that an incentive scheme such as the Mid-Day Meal program can

successfully increase attendance rates for children whose parents may place a lower value on schooling for financial reasons.

Table 6: Regression of School Enrollment on Mid-Day Meal, Stratified by Mother's Education Level

(Dependent Variable: Enrollment)

Variable	Coefficient			
	< Primary School	**Primary School**	**Secondary School**	**Post Secondary School**
MDM Beneficiary	0.290***	0.039***	0.029***	0.015*
	(0.004)	(0.003)	(0.006)	(0.007)
Sex	0.055***	0.003	-0.002	0.001
	(0.005)	(0.003)	(0.006)	(0.007)
Age 6	-0.129***	-0.054***	-0.033***	-0.021
	(0.009)	(0.007)	(0.009)	(0.025)
Age 7	-0.046***	-0.009**	-0.010*	0.010
	(0.009)	(0.004)	(0.006)	(0.011)
Age 8	-0.034***	-0.011**	-0.014**	0.012
	(0.008)	(0.004)	(0.005)	(0.011)
Age 9	-0.017**	0.001	-0.004	0.013
	(0.009)	(0.003)	(0.005)	(0.011)
Age 10	-0.029***	-0.008**	-0.004	0.015
	(0.007)	(0.003)	(0.005)	(0.011)
Urban Locality	0.0568***	0.0117***	0.0057	0.008
	(0.005)	(0.003)	(0.005)	(0.009)
Siblings <5	-0.030***	-0.010***	-0.010	0.004
	(0.003)	(0.003)	(0.006)	(0.009)
Family size	-0.000	-0.000	0.000	-0.001
	(0.001)	(0.000)	(0.001)	(0.001)
Weekly Income	0.000	0.000***	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Hindu	-0.066***	-0.009	0.018	-0.001
	(0.010)	(0.006)	(0.017)	(0.005)
Muslim	-0.094***	-0.022**	0.014	-0.001
	(0.012)	(0.008)	(0.018)	(0.015)
Buddhist	0.008	-0.007	0.020	0.000
	(0.041)	(0.009)	(0.017)	(0.012)
Christian	-0.078***	-0.005	0.021	0.004
	(0.024)	(0.007)	(0.020)	(0.007)
Constant	0.806***	0.988***	0.964***	0.983***
Num. obs	45007	19978	8590	2312
R^2	0.174	0.040	0.027	0.031

Robust standard errors in parentheses

*** denotes p<0.01, ** denotes p<0.05, * denotes p<0.1

Table 7: Regression of School Enrollment on Mid-Day Meal, Stratified by Father's Education Level

(Dependent Variable: Enrollment)

Variable	Coefficient			
	< Primary School	**Primary School**	**Secondary School**	**Post Secondary School**
MDM Beneficiary	0.348***	0.098***	0.053***	0.035***
	(0.005)	(0.004)	(0.005)	(0.008)
Sex	0.069***	0.010**	0.008	0.002
	(0.007)	(0.005)	(0.005)	(0.007)
Age 6	-0.152***	-0.071***	-0.073***	-0.029*
	(0.012)	(0.009)	(0.012)	(0.016)
Age 7	-0.058***	-0.016**	-0.009	-0.007
	(0.011)	(0.007)	(0.007)	(0.015)
Age 8	-0.049***	0.002	-0.017**	0.013
	(0.011)	(0.006)	(0.008)	(0.009)
Age 9	-0.035***	0.002	0.003	0.006
	(0.012)	(0.007)	(0.006)	(0.011)
Age 10	-0.037***	-0.012*	-0.005	0.011
	(0.010)	(0.006)	(0.007)	(0.010)
Urban Locality	0.064***	0.025***	0.008	0.020***
	(0.007)	(0.004)	(0.007)	(0.007)
Siblings <5	-0.029***	-0.032***	-0.003	-0.003
	(0.004)	(0.004)	(0.004)	(0.005)
Family size	-0.006***	-0.002**	-0.001	-0.000
	(0.001)	(0.000)	(0.001)	(0.000)
Weekly Income	-0.000	0.000	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Hindu	-0.100***	-0.026***	-0.005	0.002
	(0.014)	(0.007)	(0.010)	(0.009)
Muslim	-0.097***	-0.038***	-0.034**	-0.012
	(0.016)	(0.009)	(0.014)	(0.020)
Buddhist	0.087***	-0.048	-0.000	0.017
	(0.032)	(0.057)	(0.011)	(0.011)
Christian	-0.098***	-0.013	-0.004	0.006
	(0.031)	(0.011)	(0.016)	(0.011)
Constant	0.818***	0.964***	0.969***	0.965***
Num. obs	27328	22728	13679	5582
R^2	0.218	0.083	0.051	0.039

Robust standard errors in parentheses

*** denotes p<0.01, ** denotes p<0.05, * denotes p<0.1

Table 8: Regression of School Enrollment on Mid-Day Meal, Stratified by Monthly Per Capita Expenditure Centile

(Dependent Variable: Enrollment)

Variable	Coefficient									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MDM Beneficiary	0.265***	0.230***	0.217***	0.179***	0.168***	0.155***	0.082***	0.265***	0.230***	0.217***
	(0.013)	(0.013)	(0.013)	(0.012)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.006)
Sex	0.045***	0.057***	0.038***	0.020***	0.052***	0.021***	0.030*	0.045***	0.057**	0.038***
	(0.016)	(0.015)	(0.015)	(0.014)	(0.012)	(0.013)	(0.012)	(0.011)	(0.010)	(0.008)
Age 6	-0.121***	-0.139***	-0.160***	-0.060***	-0.097***	-0.108***	-0.071***	-0.121***	-0.139***	-0.160***
	(0.028)	(0.027)	(0.026)	(0.025)	(0.021)	(0.024)	(0.021)	(0.022)	(0.019)	(0.014)
Age 7	-0.031	-0.057*	-0.064	-0.043	-0.036***	-0.035***	-0.026**	-0.031*	-0.057**	-0.064*
	(0.028)	(0.025)	(0.026)	(0.023)	(0.020)	(0.022)	(0.020)	(0.020)	(0.016)	(0.013)
Age 8	-0.033	-0.043	-0.031**	-0.010	-0.012**	-0.017	-0.010	-0.033	-0.043	-0.031
	(0.027)	(0.024)	(0.024)	(0.023)	(0.018)	(0.019)	(0.018)	(0.017)	(0.015)	(0.011)
Age 9	-0.031	-0.028	-0.042	0.010	0.012	-0.011*	-0.004	-0.031	-0.028	-0.042
	(0.028)	(0.029)	(0.028)	(0.024)	(0.020)	(0.022)	(0.018)	(0.019)	(0.016)	(0.012)
Age 10	-0.021*	-0.027	-0.030	-0.029	-0.001	-0.005*	-0.004*	-0.021	-0.027	-0.030
	(0.026)	(0.023)	(0.023)	(0.021)	(0.017)	(0.018)	(0.017)	(0.016)	(0.013)	(0.010)
Urban Locality	-0.003**	-0.016	0.004	0.001	0.024	0.019	0.015	-0.003**	-0.016***	0.004**
	(0.016)	(0.017)	(0.013)	(0.015)	(0.013)	(0.011)	(0.010)	(0.011)	(0.007)	(0.006)
Siblings <5	-0.013	-0.007	0.0062	-0.031	-0.021	-0.035	-0.008***	-0.013**	-0.007***	0.006
	(0.013)	(0.012)	(0.012)	(0.011)	(0.010)	(0.010)	(0.009)	(0.010)	(0.008)	(0.006)
Family size	-0.023***	-0.027***	-0.033***	-0.015***	-0.014***	-0.013***	-0.002***	-0.023***	-0.027***	-0.033
	(0.006)	(0.006)	(0.006)	(0.005)	(0.004)	(0.005)	(0.003)	(0.002)	(0.002)	(0.000)
Hindu	0.031	0.001*	-0.085***	-0.032	-0.084	-0.011***	-0.017*	0.031***	0.001	-0.085**
	(0.065)	(0.022)	(0.037)	(0.033)	(0.028)	(0.028)	(0.018)	(0.029)	(0.019)	(0.007)
Muslim	0.004	-0.047	-0.111***	-0.066	-0.123	-0.013***	-0.055***	0.004***	-0.047	-0.111***
	(0.070)	(0.029)	(0.041)	(0.037)	(0.032)	(0.032)	(0.023)	(0.033)	(0.022)	(0.013)
Buddhist	0.016	-0.015**	0.076	0.066	-0.054	0.023*	-0.023	0.016	-0.015	0.076
	(0.109)	(0.065)	(0.137)	(0.061)	(0.059)	(0.045)	(0.049)	(0.033)	(0.024)	(0.034)
Christian	0.041	-0.008	-0.104*	-0.129	-0.101	-0.011**	-0.042**	0.041***	-0.008	-0.104*
	(0.083)	(0.047)	(0.050)	(0.047)	(0.039)	(0.048)	(0.060)	(0.036)	(0.021)	(0.021)
(M) Primary School	0.080***	0.072***	0.034***	0.055***	0.056***	0.047**	0.052***	0.080***	0.072***	0.034***
	(0.016)	(0.014)	(0.015)	(0.013)	(0.009)	(0.013)	(0.010)	(0.010)	(0.007)	(0.007)
(M) Secondary School	0.057***	0.043	0.031	0.017**	0.046**	0.045**	0.052	0.057***	0.043***	0.031***
	(0.032)	(0.035)	(0.029)	(0.024)	(0.018)	(0.014)	(0.016)	(0.012)	(0.011)	(0.006)
(M) Post Secondary School	0.038	0.082	0.083	0.036	-0.044*	0.028	0.041	0.038	0.082	0.083***
	(0.138)	(0.050)	(0.044)	(0.040)	(0.048)	(0.065)	(0.027)	(0.037)	(0.018)	(0.008)
(F) Primary School	0.082***	0.090***	0.098***	0.079***	0.083***	0.075***	0.050***	0.082***	0.090***	0.098***
	(0.017)	(0.014)	(0.015)	(0.014)	(0.012)	(0.014)	(0.011)	(0.012)	(0.012)	(0.010)
(F) Secondary School	0.081***	0.077***	0.102***	0.093***	0.062***	0.082***	0.054***	0.081***	0.077***	0.102***
	(0.022)	(0.021)	(0.023)	(0.021)	(0.014)	(0.015)	(0.011)	(0.015)	(0.011)	(0.009)
(F) Post Secondary School	0.108*	0.172***	0.066**	0.087***	0.072***	0.069	0.043***	0.108***	0.172***	0.066***
	(0.052)	(0.046)	(0.031)	(0.025)	(0.031)	(0.031)	(0.017)	(0.017)	(0.012)	(0.010)
Constant	0.815***	0.907***	1.047***	0.938***	0.965***	0.941***	0.910***	0.814***	0.907***	1.047***
Num. obs	4252	4771	5144	5655	6076	6348	7614	8409	10550	17125
R^2	0.275	0.252	0.270	0.212	0.214	0.196	0.154	0.163	0.172	0.097

Robust standard errors in parentheses

*** denotes p<0.01, ** denotes p<0.05, * denotes p<0.1

Addressing Potential Biases

Before concluding the Analysis section, I would like to address potential confounding factors that could bias the results. First of all, conditional independence is an extremely strong assumption that may not necessarily hold in the case of unobserved heterogeneity in school-level corruption. Although household and child characteristics are controlled for, there is the potential for unobserved characteristics, correlated with the treatment, that affect outcome. For example, a corrupt school may siphon off funds that were intended for the Mid-Day Meal program, resulting in lower allocation of the meals, and potentially also lower enrollment levels due to reduced returns to schooling. On the contrary, schools that offer a mid-day meal may be schools that are more concerned with the well-being of their students, and are more likely to encourage high enrollment through efforts in other schooling areas. In this case, the coefficient on Mid-Day Meal would be biased upwards, overstating the effect of a mid-day meal on education by picking up the effect of low corruption and high accountability.

To address this potential omitted variable bias as a result of unobserved corruption levels, a randomized audit system could be implemented to measure the degree of local capture of funds, as in Reinikka & Svensson (2004). This measure would allow us to observe the currently unobserved effect of corruption, and strengthen the exogeneity assumption. Additionally, school numbers should be properly identified, to allow for cluster at the village level. Despite the potential for confounding factors, this estimation strategy provides interesting, and hopeful results regarding the effect of a school feeding program on educational outcome. With revised surveys, and additional research, the robustness of these estimates can be further quantified.

6 Policy Implications

The high gains in attendance achieved through the Mid-Day Meal program in India provide further validity to the evidence that school feeding programs are not only successful in improving health outcomes for children, but also contribute to significant educational gains. The differential gains for children from lower socio-economic backgrounds suggest high benefits from targeting this program towards poorer areas, in order to increase enrollment of children who would otherwise be unable to attend school.

An additional point in favor of this policy is the fact that the Mid-Day Meal program is relatively cheap, in comparison with other educational inputs. Providing a nutritious school lunch for children costs only $1.80 per child per day (Government of India), and given the high impacts on attendance rates and health, can contribute to long-run benefits in education and other development measures. An effective redistributive policy would be to target the Mid-Day Meal program towards under-resourced municipalities, in order to contribute to higher educational outcomes in the areas most in need.

Finally, greater transparency in the implementation process can reduce corruption levels that contribute to heterogeneous program allocation. By making funding information more publicly available, increasing checks on local schools, and establishing penalties for non-compliance, the program can be more readily available to all areas.

In order to evaluate the long-term educational, social, and labor market outcomes of school feeding programs for the children that were treated, it would be useful to conduct a follow-up survey. While it is clear that the program boosted attendance rates, this additional survey would provide conclusive evidence whether or not these high attendance rates led to better academic performance, overall educational attainment, and even social gains. It would then be

beneficial for the central government to continue allocating funds to the school feeding program in order to increase human capital accumulation, and overall measures of economic growth.

7 Conclusion

This paper examines a particular Mid-Day Meal program in India, evaluating its impact on both public and private school enrollment rates using a propensity score matching estimation method. Not only did the Mid-Day Meal program have a significant, positive effect on overall enrollment rates, but the effect was also more pronounced for those with the least educated parents and lowest economic status. In a world in which pre-determined household characteristics affect a child's educational access and success at birth, transfer programs such as the Mid-Day Meal program can have a large, positive effect. This impact is particularly salient for the lowest income groups, providing increased educational opportunity by making it affordable.

As usual, far more research must be conducted in this area. While these results are positive and significant in India, the external validity must be tested through evaluations of other school feeding programs in a wider range of regions. Additionally, follow-up surveys should be conducted to measure the long-term gains for program recipients, as exhibited by their overall educational attainment, adult income levels, and even the educational attainment of their future children.

Education plays an integral role in increasing economic growth in developing countries, while improving overall standard of living. Thus, policy initiatives that provide access to primary school education for children in the lowest socio-economic levels are crucial for economic success. While primary school education may not yet be universal by 2015, continued research will make progress towards this goal, paving the way for future generations to receive equal

educational opportunities and ultimately lift themselves out of an otherwise persistent poverty trap.

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Appendix: Variable List

Dependent Variable:
educ: 1 if child indicated attending school during the survey period, 0 otherwise

Treatment Variable:
MDM: 1 if child received a government-sponsored mid-day meal in the past year, 0 otherwise

Child Characteristics:
sex: 1 if male, 0 if female
Age 6: 1 if age 6, 0 otherwise
Age 7: 1 if age 7, 0 otherwise
Age 8: 1 if age 8, 0 otherwise
Age 9: 1 if age 9, 0 otherwise
Age 10: 1 if age 10, 0 otherwise
Age 11: 1 if age11, 0 otherwise (reference group)

Household Characteristics:
urban: 1 if urban locality, 0 if rural locality
siblings <5: number of children's siblings in the household that are under the age of 5
famsize: number of family members in the household
weekly income: weekly income of the household head, measured in rupees/ week
hindu: 1 if Hindu, 0 otherwise
muslim: 1 if Muslim, 0 otherwise
buddhist: 1 if Buddhist, 0 otherwise
christian: 1 if Christian, 0 otherwise
othr_relig: 1 if other religion, 0 otherwise (reference group)

Parent Characteristics:
mom_< primary: 1 if mother's educational attainment is less than primary school, 0 otherwise (reference group)
mom_primary: 1 if mother's highest educational attainment is primary school, 0 otherwise
mom_secondary: 1 if mother's highest educational attainment is secondary school, 0 otherwise
mom_postsecondary: 1 if mother's highest educational attainment is post-secondary school, 0 otherwise
pop_<primary: 1 if father's educational attainment is less than primary school, 0 otherwise (reference group)
pop_primary: 1 if father's highest educational attainment is primary school, 0 otherwise
pop_secondary: 1 if father's highest educational attainment is secondary school, 0 otherwise
pop_postsecondary: 1 if father's highest educational attainment is post-secondary school, 0 otherwise