Estimating the Effects of Universal Free School Meal Enrollment on Child Health: Evidence from the Community Eligibility Provision in Georgia Schools*

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Abstract

We estimate the effect of providing universal free school meals through the Community Eligibility Provision (CEP) on the percentage of healthy weight students attending a school and average Body Mass Index (BMI) score among the population of K-12 schools in the state of Georgia. Different specifications of school CEP eligibility are used as instruments for CEP participation in our analysis. We find that CEP participation leads to an increase in the percentage of healthy weight students attending a school and a decrease in average student BMI. Furthermore, we find no statistically significant evidence to support a deleterious effect from CEP participation on our aggregate measures of child weight. Subsample analyses suggest that the effect of CEP participation varies by school grade and location type, with smaller overall effects for schools serving older students and schools in suburbs/towns. We also show that our results are generally robust to different modeling specifications and key variable assumptions. Overall, the beneficial aggregate weight effects caused by CEP participation indicate that providing universal free meals in low-income schools may be a valuable tool in the fight against increasing rates of childhood overweight and obesity.

Keywords: Child Health, Obesity, School Meals, Community Eligibility Provision
JEL Codes: I12, I21, I38, H75, H53

1 Introduction

During each academic year, children in the United States recieve between one-third and one-half of their daily calories from meals eaten in school (Schanzenbach 2009, Briefel et al. 2009). The majority of these meals come from subsidized school meal programs like the National School Lunch Program (NSLP) and School Breakfast Program (SBP). The NSLP alone is the nation's second largest nutrition assistance program and provides school lunch in 95 percent of public schools at an annual cost of $13.6 billion dollars (FRAC 2017). Both the NSLP and SBP also offer school meals at a free or reduced-price to students from low-income households. Of the 44.6 million children who participated in school meals during 2016, roughly 75 percent received meals either for free or at a reduced price (USDA 2017a, USDA 2017b). These school meals represent a critical source of nutritious and consistently available food for many of the nation's disadvantaged children. For the most at-risk students, school meals may make the difference between going hungry and having the food necessary for successful learning and development (NKH 2017).

While federally subsidized school meals have been available to students for several decades, the Healthy Hunger Free Kids Act's (HHFKA's) Community Eligibility Provision (CEP) led to a considerable change in how America's low-income schools provide meals to their students. Unlike the traditional system where individual families submit applications for their child to receive free or reduced-price school meals, the CEP gives eligible schools serving a high proportion of low-income children the opportunity to provide free lunch and breakfast universally to *all students*, no exceptions. The CEP makes free school meals available to students in a way that is independent from the previous application and take-up decisions of their families. During the 2015-2016 school year, more than 18,000 schools (half of all CEP eligible schools) in nearly 3,000 school districts adopted the CEP, reaching around 8.5 million children nationwide (USDA 2016).

In this study, we estimate the CEP's effect on school-level aggregate measures of child weight among the population of K-12 schools in the state of Georgia. More specifically, we estimate models of school-level student weight outcomes using different specifications of CEP eligibility as instruments for CEP participation. Our approach allows us to estimate plausibly causal effects of providing universal free meals to students in public schools on aggregate weight measures. We provide separate estimates for the full sample of K-12 schools, elementary schools, middle schools, and high schools. We also estimate our results separately for schools in urban areas, rural areas, and suburbs/towns. To our knowledge, this is the first study to directly evaluate the CEP's effect on child health.

Our results suggest that CEP participation increases the percentage of students who fall within the healthy weight range and reduces average Body Mass Index (BMI) scores for K-12 schools in the state of Georgia. While some existing studies find that free and reduced-price school meals provided under the traditional system lead to worsened weight outcomes, we find no statistically significant evidence of similar changes following CEP participation. We find that CEP participation is expected to increase the number of healthy weight students attending a school by 13 for the full sample and decrease average BMI by approximately 1 percentage point. Looking at our results by grade type, we do not find statistically significant effects on the aggregate weight outcomes of high schools, implying that CEP participation leads to smaller changes in the average weight outcomes of schools serving older children.

We also find that CEP participation leads to statistically significant increases in the percentage of healthy weight students attending urban and rural schools, but we do not find significant impacts on the healthy weight percentage of schools located in suburbs and towns. Furthermore, while rural schools are located in Georgia's poorest counties and provide the fewest free and reduced-price meals during the pre-CEP period, urban schools are far more likely to participate in the CEP conditional on eligibility. This stands in contrast to the CEP's primary goal of targeting schools where students were inadequately covered by the existing free and reduced-price meal system. Given the potentially beneficial weight effects of CEP participation found in our results, differences in take-up by location type may create or worsen area-level child health disparities if the CEP cannot be made effective, feasible, and attractive to all schools.

2 Literature Review

A growing literature explores the various ways in which school meals impact child health. Historically, there have been two channels on which research has focused. The first is food insecurity. Existing evidence suggests that food insecurity leads to worsened child health outcomes including parent-assessed child health (Cook et al. 2006, Kirkpatrick, McIntyre, and Potestio 2010), mental health (Melchior et al. 2012, Whitaker, Phillips, and Orzol 2006), malnutrition (Eicher-Miller et al. 2009), and child weight (Kuku, Garasky, and Gundersen 2012, Gundersen and Kreider 2009). Since children from low-income households are more likely to experience food insecurity, providing them with free and reduced-price school meals is one potential way to diminish their food insecurity risk (Huang and Barnidge 2016, Arteaga and Heflin 2014, Almada and McCarthy 2017).

The second primary channel through which school meals may affect child health is diet quality. The effect of school meals on overall diet quality depends on the their quality relative to what a child would consume were they to bring meals from home. Among low-income households, the change in quality caused by switching to school meals is likely positive if low quality processed foods are the more affordable and readily available alternative. Smith 2017 examines the effect of school meal participation on the diets of children across the distribution of initial diet quality. The author finds that school meals improve the diets of nutritionally disadvantaged children, but the effect varies considerably across the initial distribution and leads to a decrease in diet quality for children towards the distribution's upper end.

Abstracting from potential channels, studies that estimate the direct effects of school meal participation on child health have found mixed results. Some studies find that participation in the NSLP leads to increases in child BMI and the likelihood of being obese (Schanzenbach 2009; Millimet, Tchernis, and Husain 2010). Capogrossi and You 2017 show that NSLP participation increases a child's probability of being overweight with more prominent effects in the South, Northeast, and rural areas of the country. Alternatively, Millimet, Tchernis, and Husain 2010 find that SBP participation reduces child BMI, implying that the provision of free breakfasts in schools may partially offset the weight differential among children from low- and high-income families. Gundersen, Kreider, and Pepper 2012 use a bounding model and show that participation in school lunch significantly reduces rates of food insecurity, poor health, and obesity. Furthermore, there is limited evidence that school meals produce no long run effect on an individual's weight into adulthood (Hinrichs 2010)

Alternatives to the traditional school meal provision system which has been studied significantly less in the literature are universal meal programs through which schools provide lunch, breakfast, or a combination of both to all students free of charge. Schanzenbach and Zaki 2014 examine short run effects of the Universal Free Breakfast and Breakfast in the Classroom programs and find little to no impact of either program on BMI, other health outcomes, or a child's score on the Bad Behavior Index. In the most similar study to our own, Schwartz and Rothbart 2017 exploit variation in school lunch participation caused by the switch to universal free lunch in New York City where breakfast had been universally free for some time prior. The authors find little evidence that universal free lunch increases BMI and some evidence that lunch participation improves weight outcomes for non-poor children who began receiving free meals through the universal program.

Aside from health effects there are a handfull of existing studies exploring the impact of CEP participation on other child outcomes. Gordanier et al. 2018 show that CEP participation increases math test scores for elementary school students in South Carolina, with more substantial effects for students in poorer and more rural areas, and among students who were previously eligible for free and reduced-price lunch. The study also finds a decline in absences for students attending urban schools. Likewise, Ruffini 2018 uses variation in CEP timing across states to show that universal access to free school meals improved math test performance. Gordon and Ruffini 2018 find that CEP adoption leads to modest reductions in suspension rates among elementary and middle school students, with reductions concentrated in areas with higher levels of child food insecurity.

Our study represents a significant contribution to the literature on school meals and child weight by providing the first causally interpretable estimates using the CEP. Furthermore, our study adds to the small but growing literature on the effects of universal school meal programs. Our estimates also provide information on the health effects of school meals after the HHFKA's sweeping changes to minimum school nutrition standards which are not reflected in studies conducted before the act's implementation. Taken together, our results suggest that providing universal free school meals leads to improved aggregate weight outcomes for children attending low-income schools in Georgia, implying that programs like the CEP may be effective policy tools in the fight against childhood obesity and overweight.

3 The Community Eligibility Provision

While 2010's Healthy Hunger-Free Kids Act (HHFKA) affected almost every aspect of school nutrition, one of its most noteworthy components was the Community Eligibility Provision (CEP) which was implemented nationally in 2014.[1] The provision gives schools serving low-income student with an Identified Student Percentage (ISP) of 40% or more the opportunity to provide free lunch and breakfast to all students in their school regardless of each child's family income or other traditional qualification criteria. Each school's ISP is the percentage of their student body who are considered "identified" as eligible for free school meals independently of family income level. More specifically, identified students are children from households that automatically qualify for free school meals through participation in other government assistance programs including the Supplemental Nutrition Assistance Program, Head Start, and Medicaid, or by meeting other special criteria (e.g. migrant or homeless child).[2] Individual children are identified through either direct certification which relies on data matching between school, state, and federal databases, or by an appropriate official who determines eligibility for homeless, migrant, foster care, and Head Start services. The CEP participation decision for each CEP eligible school is then made by the school's district. Districts also have the option to enroll district-wide if the average ISP of their schools falls at or above the 40% level. During the post-CEP period, roughly 23.7% of all districts have at least one school participating in the CEP. About 59.3% of these districts choose to enroll district-wide, implying that all schools in the district provide free lunch and breakfast to their students.

While the 40% ISP cutoff is a discontinuity in eligibility, schools with ISPs just above the threshold are far less likely to participate in the program. The most likely reason for this low participation rate among barely eligible schools is the USDA's meal reimbursement scheme. As was the case for all schools prior to the CEP, CEP ineligible and CEP eligible non-participating schools receive a set amount of reimbursement from the USDA for each lunch and breakfast they serve. The amount reimbursed is meant to cover a portion of the meal's preparation costs and depends on

[1]Prior to 2014, the CEP was piloted in earlier periods for schools in 11 states. Illinois, Kentucky, and Michigan were the first states to pilot the provision during 2011; the District of Columbia, New York, Ohio, and West Virginia were added in 2012; and Florida, Georgia, Maryland, and Massachusetts were added in 2013.

[2]Comprehensively, students are considered "identified" if (i) their families are enrolled in the Supplemental Nutrition Assistance Program (SNAP), Temporary Assistance for Needy Families (TANF), or the Food Distribution Program on Indian Reservations (FDPIR), (ii) the student is a Head Start or Early Head Start participant, (iii) the student is a migrant, runaway, homeless, or foster child, or (iv) the student is on Medicaid.

whether the meal was purchased by the student at the normal price, reduced-price, or provided for free. Free meals earn the highest level of reimbursement and normal priced "paid" meals earn the lowest. For example, the reimbursement rates for paid, reduced-price, and free lunches during the 2017-2018 school year were $0.39, $3.00, and $3.40, respectively (USDA 2017b).

Unlike non-CEP schools, the reimbursement scheme for CEP participating schools varies by ISP even though all meals are provided to students for free. More specifically, a share of $1.6 \times ISP$ of all meals are reimbursed at the free rate and the remaining portion of meals are reimbursed at the much lower paid rate. For a school with an ISP of 40%, this translates into 64% of meals being reimbursed at the free rate and 36% at the paid rate. Alternatively, once a school's ISP is at or above 62.5% all meals are reimbursed at the free rate. The difference in average meal reimbursement amount for a school with an ISP of 40% relative to a school with an ISP at or above the 62.5% level is considerable, with the 40% school receiving roughly $1.08 less per lunch and $0.52 less per breakfast in reimbursements.

To further illustrate how CEP participation changes with ISP, Figure 1 shows the CEP participation rate of all CEP eligible K-12 schools in Georgia by bins of ISP. With a participation rate of 0.079, very few barely eligible schools with ISPs between 40 and 45 percent choose to adopt the CEP. CEP participation is strictly increasing in ISP up to the level where all school meals are reimbursed at the free rate, at which point the participation rate fluctuates between about 0.85 and 1. Naturally, schools with higher ISPs are also likely to be more disadvantaged, implying that they may take-up the CEP at a higher rate for reasons other than their reimbursement amount. While covariates other than program cost likely drive some part of the CEP participation decision, it seems unlikely that the point where enrollment stops monotonically increasing with respect to ISP would be at exactly the level where all meals are reimbursed at the free rate if the relationship between ISP and reimbursements was not a primary factor.

It is also important to note that a school's ISP differs from their initial Free and Reduced-price Lunch Percent (FRL%) as identified students are only a subset of those who participate in free or reduced-price meals (Levin and Neuberger 2013). This discrepancy is by design, however, as the CEP's primary purpose is to provide free meals to at-need children who were inadequately reached by the existing system. More specifically, the CEP was created to increase the low free and reduced-price meal participation rate among certain groups of students from eligible families.

Participation in free and reduced-price meals may have been below desired levels for such groups due to several reasons. One potential cause was inadequate information or application support for families. Children who are eligible to apply for free and reduced-price school meals come from disadvantaged families who may be unaware of the options available to them. Without adequate information, parents may be unsure about their eligibility status or unable/unwilling to complete the application process. While school counselors and other designated staff help to identify and enroll eligible students, many eligible children who would benefit from school meals remain unreached.

Another potential reason for low rates of free and reduced-price school meal utilization is stigma (Askelson et al. 2017). The CEP is meant to address the stigma associated with receiving free school meals since no child can be singled out as low-income by their peers in the cafeteria if all students recieve their school meals for free (USDA 2016). In the past, New York City and several other large urban school districts have made combinations of school lunch and breakfast universally free to students. Results from these studies suggest that such universal free meal provisions increase breakfast participation (Ribar and Haldeman 2013, Leos-Urbel et al. 2013). Since its introduction, early evidence associates the CEP with significantly higher levels of school meal participation (Logan et al. 2014). These results imply that the CEP significantly impacts the number of students consuming school meals and ensures that every child has at least two healthy meals available to them each day. In addition to providing free meals to students, CEP participating schools are no longer required to collect and process free and reduced-price meal applications from students, thereby removing the associated costs and administrative burden. Non-eligible and non-participating schools continue operating under the existing system, however, and determine student eligibility through the usual free and reduced-price meal applications.

With regards to the relationship between the CEP and child weight, we expect universal free school meal availability to affect weight outcomes at several margins. The first is children who were ineligible for free and reduced-price meals during the pre-CEP period. If these children were bringing meals from home rather than purchasing meals from school, making school meals free could adequately incentivize a switch to the now cheaper free meal option. This switch leads to a change in the student's diet, the impact of which may be beneficial or harmful depending on the schools meal's quality relative to the forgone home option. The second margin is students who were already eligible for free or reduced-price meals but did not participate. Depending on why families choose not to enroll their children, we may expect different changes following CEP participation. For example, if certain low-income families were unaware of their eligibility status, we would expect them to begin taking advantage of free school meals following adoption of the CEP. Alternatively, if eligible children did not participate because they prefer meals brought from home, we would expect no change in their behavior. The third margin is children who were eligible for reduced-price, but not free, school meals during the pre-CEP period. While the average cost of a reduced-price meal may seem negligible, it is possible that offering free meals will be enough to induce a switch to school meals. Fourth, the CEP may affect child health through an income effect for all families with children not already participating in free meals. If a family uses the money saved on school meals in ways that improve health, we would expect to see a positive relationship between universal free school meals and child health. Alternatively, if the resulting income effect leads to an increase in detrimental inputs or behaviors, we would expect to see a negative relationship between CEP participation and health.

Aside from the traditional margins discussed above, a potentially worrying possibility is that students who were bringing meals from home during the pre-CEP period continue to do so after CEP enrollment while also eating some or all of their free school meals. Some students who continue bringing meals from home may opt out of their free school meal option entirely. Alternatively, some students may eat some or all of both meals each day, leading to a potentially significant increase in total calories consumed. Even if the total number of calories consumed in school does not go up, students who eat only one of the two meals or choose to eat their favorite items while discarding the remainder may produce increased levels of overall food waste.[3]

4 Data

Our study utilizes several sources of data from K-12 schools in Georgia over the 2011 to 2016 school years.[4] The data set contains variables related to school-level average child weight outcomes, Identified Student Percentage (ISP), CEP participation and eligibility, and student sociodemographics. Data on weight outcomes come from the FitnessGram. Each year, physical education instructors in Georgia public schools are required to administer the FitnessGram; a collection of tests which measure the physical fitness, height, and weight of students attending each school. FitnessGram data aggregated at the school-level are publicly available for our sample period through the Georgia Department of Education (GaDOE).[5] Our primary outcomes of interest from the FitnessGram relate to child body composition, namely average child Body Mass Index (BMI) score and the percentage of children who are of a healthy weight.

For the most part, changes in BMI at the school-level are difficult to interpret and compare across schools serving children of different ages. One contributing reason is that only observing a change in the mean provides no information as to where in the weight distribution the change is taking place. For example, obese or underweight children losing weight can cause an identical decrease in mean BMI with obviously different implications for overall student health. The second issue is that child BMI score interpretations vary by age and gender.

To remove some of this ambiguity, we primarily focus on another FitnessGram variable show-

[3]Conversation with the nutrition department director of a large urban school district in Georgia informed us that many students who were bringing meals from home during the pre-CEP period continued to do so after CEP enrollment. The director believed that most students brought meals from home so that they would have an alternative option if they did not like the school meal being offered on a given day. It was not clear, however, if these students were consuming some or all of both meals each day.

[4]Throughout the remainder of the study, we reference each school year by the year when students return to school, e.g. 2011-2012 is referred to as simply 2011, 2012-2013 as 2012, etc.

[5]Data can be found on the GaDOE website for the 2011-2014 school years: http://www.gadoe.org/Pages/Home.aspx. Data for the 2015 and 2016 school years were obtained through an open data request.

ing the percentage of children at each school who fall "In the Healthy Fitness Zone" (InHFZ%) for BMI. A child is considered in the BMI healthy fitness zone if their score falls within the 5th and 85th percentile range for their age and gender as determined by the Centers for Disease Control and Prevention (CDC).[6] Therefore, InHFZ% is equivalent to the percentage of healthy weight children attending a school. Unlike mean BMI, changes to InHFZ% have direct implications for child health. An increase (decrease) in InHFZ% relates to an improvement (worsening) of school-level health regardless of where in the weight distribution the change occurs. Going one step further, the combination of changes to mean BMI and InHFZ% suggests additional information. If mean BMI decreases and InHFZ% increases, then the dominant change in weight likely comes from overweight or obese children losing weight and moving into the healthy weight range. This interpretation does not rule out the possibility of concurrent weight changes elsewhere in the BMI distribution, but it does allow us to identify the probable location of a change.

We collect CEP data for the 2014-2016 school years from the Center on Budget and Policy Priorities (CBPP) who gathers and provides the data in a joint effort with the Food Research and Action Center (FRAC).[7] The USDA began requiring that each state submit a list containing the CEP eligibility, participation status, and ISP of all applicable schools and districts in 2014. Unfortunately, even though Georgia was a CEP pilot state during 2013, information is only available for the 2014 school year onward. To account for this limitation, the 2013 school year is excluded from our primary analysis. We test the sensitivity of our results to this assumption in Section 7.

Data used to identify each school's location type come from the National Center for Education Statistics' (NCES') Common Core of Data (CCD).[8] Schools are separated by location type as either urban, rural, or suburb/town. We also collect school-level revenue, expenditure, and student sociodemographic data for the entire analysis period through the Governor's Office of Student Achievement (GOSA).[9] Finally, county-level data on poverty percentages by age range and median household income for each year come from the Census Bureau's Small Area Income and Poverty

[6] *See* Plowman and Meredith 2013.

[7] Data are available through the CBPP's website: https://www.cbpp.org.

[8] Data are available directly through the CCD website: https://nces.ed.gov/ccd/pubschuniv.asp.

[9] Data are available directly from the GOSA website: https://gosa.georgia.gov/downloadable-data.

Estimates (SAIPE) program.

Summary statistics for the dependent variables of interest, independent variables of interest, and control variables are presented in Table 1. As Table 1 shows, the mean BMI for schools in our sample is approximately 20.35. Unlike adult BMI which has a consistent interpretation across age and gender, a child BMI score of 20.35 falls within the obese weight range for a six-year-old boy and the healthy weight range for a 14-year-old boy. As an alternative view of child weight, our InHFZ% variable shows that roughly 58.88% of Georgia students fall within the healthy weight range during the sample period, implying that 41.12% of children are some combination of underweight, overweight, and obese. Our "Ever CEP Eligible" variable shows that roughly 47% of Georgia's K-12 schools were eligible for the CEP at some point during the 2014-2016 period. Our "Ever CEP Participating" variable indicates that approximately 26.87% of all schools participated in the CEP at some point during the same period, giving us a CEP take-up rate of roughly 57% among eligible schools. Our "ISP if CEP Eligible" variable shows that the average ISP of CEP eligible schools is roughly 55.96%. Alternatively, our "ISP if CEP Participant" variable shows that the average ISP for schools that participate in the CEP is roughly 60%, further suggesting a positive correlation between ISP and the CEP participation rate. The final set of control variables used in our analyses include: Percent Black Students, Percent White Students, Percent Migrant Students, Percent Special Education Students, Percent English as a Second Language (ESL) Students, and Percent Gifted Students.

Figures 2 and 3 provide graphical illustrations of the across-year change in InHFZ% and mean BMI for the group of ever CEP eligible and never eligible schools. Figure 2 shows that there is a considerable difference between the average InHFZ% of never CEP eligible and ever CEP eligible schools, with the never eligible group having a higher average percentage of healthy weight students in all years. We also see that the InHFZ% of both groups increased non-trivially beginning in the 2015 school year. The bulk of this increase is due to a widening of the CDC's healthy weight thresholds in 2015 which lead to a greater number of children falling within the 5th-85th percentile range. Since this change to InHFZ% affects all students and schools simultaneously, any impact of the measurement change on our results should be removed through the use of year fixed effects.[10]

Finally, Figure 3 shows us that the average BMI of ever CEP eligible schools is higher than that of never eligible schools during both the 2011 and 2012 school years. The average BMI of both groups saw comparable decreases from 2011 to 2012, suggesting that both sets of schools had similar pre-trends in child weight during our two pre-CEP periods. The reason for this decrease is most likely improvements in school meal minimum nutrition standards caused by the HHFKA directly before and during the pre-CEP period. Interestingly, the average BMI level of CEP eligible schools begins to fall below that of never eligible schools starting in 2013, the same school year that Georgia implemented the provision as a pilot state prior to the national roll-out in 2014. The average BMI of both school types continues to decrease during 2014 and 2015, but increases in 2016 to roughly their 2014 levels.

5 Methodology

To eliminate potential biases caused by the self-selection of schools into the CEP, we use two different specifications of CEP eligibility as instrumental variables for CEP participation in a two-stage linear regression model.[11] We begin with a model using a binary CEP eligibility variable as an instrument for CEP participation. The first stage of our model under the binary eligibility

[10] One case where the healthy weight threshold change would bias our analyses is if either the CEP eligible or CEP ineligible group of schools had a disproportionate number of students with BMIs just outside the pre-2015 healthy weight range, implying that more students would fall within the new threshold relative to the other group of schools. To test this, we estimate our primary results for InHFZ% excluding the 2015 and 2016 school years. Aside from some changes in statistical significance due to the reduced sample size and time horizon, the exclusion does not fundamentally alter our findings.

[11] Since CEP eligibility is technically determined by a discontinuity in ISP at 40%, a regression discontinuity (RD) design would seem like a natural approach for our analyses. Unfortunately, using an RD model is not well suited for our purposes. As spoken to in Section 3, few schools with ISPs just at or above the 40% level participate in the CEP due to USDA's meal reimbursement rates. This variation in reimbursements combined with our limited sample size gives us too few CEP participating schools just above the threshold to precisely estimate an RD with data from only one state. Furthermore, variation in our weight outcomes at the eligibility threshold is driven by the underlying CEP participation rate. Since the set of barely eligible schools for which the the barriers to participation do not prevent enrolling in the provision are likely different from the average school just below the eligibility threshold, this may lead to improper estimates of the treatment effect.

specification for school i in year t is given as:

$$CEP_{it} = Z_{it}\gamma + \phi ELIG_{it} + \alpha_i^1 + \lambda_t^1 + v_{it} \tag{1}$$

where CEP_{it} is equal to 1 if school i participates in the CEP during year t and 0 otherwise, Z_{it} is a vector of time-variant control variables, $ELIG_{it}$ is a binary variable equal to 1 if school i is eligible to participate in the CEP during year t and 0 otherwise, α_i^1 captures school-level sources of time-invariant unobserved heterogeneity, λ_t^1 captures year-level sources of unobserved heterogeneity, and v_{it} is the model's normally distributed idiosyncratic error term. The primary effect of interest in equation (1) is ϕ which gives us the effect of being CEP eligible on a school's probability of participating in the CEP during the same year, all else unchanged.

While the binary eligibility specification above predicts CEP participation using plausibly exogenous variation in program timing and eligibility rather than other unobserved factors affecting self-selection, our binary specification only considers the extensive margin of eligibility. The assumption that CEP participation in a certain year depends solely on a school's eligibility status abstracts from the non-linear relationship between CEP participation and ISP discussed in Section 3. In order to allow CEP participation to vary non-linearly with CEP eligibility and ISP, we also use an alternative specification in our model's first stage such that for school i in year t:

$$CEP_{it} = Z_{it}\gamma + \phi(100 - ISP_{it}) * ELIG_{it} + \eta((100 - ISP_{it}) * ELIG_{it})^2 + \alpha_i^1 + \lambda_t^1 + v_{it} \tag{2}$$

where ISP_{it} is the Identified Student Percentage (ISP) of school i in year t and all other terms hold the same definition they are assigned in equation (1). In addition to isolating the variance in CEP participation caused by eligibility, the specification given by equation (2) captures two features present in the relationship between ISP and CEP participation. First, the effect of CEP eligibility on participation is allowed to vary linearly with its running variable, ISP. Second, our ISP interaction specification allows for a non-linear effect of CEP eligibility interacted with ISP on CEP participation. With this feature, increases in ISP among CEP eligible schools may raise or lower the probability of participation depending on a school's initial identified student percentage.

In our model's second stage, we utilize the variation in CEP participation caused by CEP eligibility and ISP under one of the two specifications above to construct instrumental variable estimates of CEP participation's effect on school-level weight such that for school i in year t:

$$Y_{it} = Z_{it}\beta + \delta CEP_{it} + \alpha_i^2 + \lambda_t^2 + e_{it} \tag{3}$$

where Y_{it} is either InHFZ% or average BMI, CEP_{it} is CEP participation, and all other variables hold the same interpretation given in (1) and (2). Estimation of (3) involves replacing CEP participation with its predicted value from our first stage regression using either the binary eligibility or ISP interaction specification given by equations (1) and (2), respectively.

The primary coefficient of interest in (3) is δ which represents the average difference in InHFZ% and average BMI among CEP participating schools and non-participating schools conditional on the model's other covariates. Consistent estimation of δ faces two primary challenges. The first is the potential for bias caused by self-selection into the CEP based on unobservable factors related to student health. More succinctly, if CEP eligible schools participate in the provision because of unobserved factors that also affect the weight of their students, then our estimates of δ will be inconsistent. We address this concern by instrumenting for CEP participation using our specifications of CEP eligibility. This approach allows us to estimate our effect of interest in our model's second stage using variation in CEP participation caused by eligibility for the provision rather than the set of unobservables determining self-selection.

The second challenge to consistent identification of δ is that CEP eligibility is determined by ISP, implying that CEP eligible schools necessarily serve a greater number of disadvantaged students who are enrolled in government assistance programs. Since our outcome of interest is at the school-level, we are able to make two reasonable assumptions to control for the effect of these programs on weight using school and year fixed effects. Our first assumption is that the proportion of students participating in government assistance programs changes only trivially for each school over our sample period. Under this assumption, we are able to isolate the effect of CEP participation on our aggregate weight outcomes net of time-invariant differences in student government assistance program participation using school fixed effects. Furthermore, we use year fixed effects to control for potential variation in government assistance program participation rates caused by any national or state level changes which simultaneously affect all schools in our sample.

6 Results

We use two different instrumental variable (IV) specifications in our model's first stage to produce our primary results.[12] First, we use a binary indicator of CEP eligibility during each post-CEP school year as an instrument for CEP participation. Panel A of Table 2 shows the estimated effect of this binary eligibility instrument on CEP participation from our model's first stage for the full sample of schools along with separate estimates for elementary schools, middle schools, and high schools. We find that CEP eligibility is highly predictive of CEP participation with coefficients that are statistically significant below the 1% level for the full sample of schools and all grade types. Being eligible for the CEP during the post-CEP period increases the likelihood of participation by roughly 46.7 percentage points for the full sample of schools conditional on our set of control variables, school fixed effects, and year fixed effects. Looking at the results of our first specification by grade type, we find that CEP eligibility has the smallest effect on CEP participation among elementary schools at 41.7 percentage points compared to 52.5 and 60.5 percentage points for middle and high schools, respectively.

In the second specification of our model's first stage, we instrument for CEP participation using (100-ISP) interacted with the binary CEP eligibility indicator from our first specification. We also include the square of the same term to account for nonlinear effects. Specifically, this specification allows us to capture nonlinearities in the effect of CEP eligibility and its running variable, ISP, on

[12]Since our analyses are at the school-level, we weight all regressions by school student population in 2014. Estimates produced using student population in 2015 or 2016 as regression weights does not fundamentally change our results.

CEP participation which we discuss in Section 3. Panel B of Table 2 shows our first stage estimates under the ISP interaction specification for the full sample of schools along with separate estimates for elementary, middle, and high schools. For the full sample of schools, the positive coefficient on our ISP interaction combined with the negative coefficient on the squared interaction term imply that the probability of CEP participation is initially increasing in ISP, but at a point the effect becomes negative. The turnaround point for our full sample occurs at a (100-ISP) of 29 which corresponds to an ISP of roughly 71%. At an average ISP of 56% for CEP eligible schools, a 1 percentage point increase in ISP would lead to a 3.13 percentage point increase in the probability of CEP participation. Similar to the case with our binary CEP eligibility specification, we find that the effect of our ISP interaction instruments on CEP participation is smaller for elementary schools relative to both middle and high schools.

We use the specifications above to estimate the impact of CEP participation on two outcomes of interest: the percent of students attending a school who are of a healthy weight (InHFZ%) and average school-level BMI. Beginning with our binary CEP eligibility specification, Table 3 shows the estimated effects of CEP participation on InHFZ% and average BMI for the full sample of schools as well as separately for elementary schools, middle schools, and high schools. Beginning with the full sample of schools in Panel A of Table 3, we find that CEP participation leads to a statistically significant increase in the percentage of healthy weight children attending a school of roughly 1.8 percentage points relative to non-participating schools. At the average student population of 719 and average InHFZ% of 58.8% among the set of CEP eligible schools, our binary specification results suggest that participation in the CEP is expected to increase the number of healthy weight students attending a school by 13. Looking at our binary specification results by grade type, we see that CEP participation leads to positive effects on the InHFZ% of elementary, middle, and high schools. However, the coefficients are statistically insignificant for each of the three grade types. The lack of statistical significance for our results by grade type is potentially caused by the reduction in sample size, but it may also be the case that CEP participation only leads to more healthy weight children at the aggregate K-12 level.

Panel B of Table 3 shows the estimated effect of CEP participation on average BMI using our binary CEP specification. We find that CEP participation leads to a statistically significant decrease of 0.197 points in school average BMI for the full sample of K-12 schools. Looking at our results by grade type, we find that CEP participation leads to lower average BMI scores for elementary, middle, and high schools, but the effect is only statistically significant for elementary schools.

Moving now to the primary results of the model using our ISP interaction terms as instruments for CEP participation, Table 4 shows the estimated effect of CEP participation on InHFZ% and average BMI for the full sample of schools as well as by school grade type. Beginning with Panel A of Table 4, we find that CEP participation leads to a statistically significant increase in a school's expected percentage of healthy weight students of around 1.3 percentage points for the full sample of schools. While smaller than the effect we find under the binary eligibility specification, our results indicate that CEP participation is expected to increase the number of healthy weight students attending an average CEP eligible school by 9. Examining our results by school grade type, we find that CEP participation leads to a statistically significant 2.29 percentage point increase in the InHFZ% of middle schools. The average middle school size and InHFZ% among CEP eligible schools is 796.4 and 53.66% respectively, implying that participating in the CEP is expected to increase the number of healthy weight students attending an average CEP eligible middle school by roughly 18 students. While positive, the effect of CEP participation on InHFZ% is statistically insignificant for elementary schools under our ISP interaction specification. Alternatively, the effect for high schools is found to be negative under our ISP interaction specification, but the effect is close to zero and highly insignificant.

Looking at Panel B of Table 4, we find that CEP participation is expected to reduce a school's average BMI by roughly 0.1 points for the full sample of schools under our ISP specification. While statistically significant and positive, using our ISP interaction terms as instruments for CEP participation gives us an estimate nearly half the size of our results using binary CEP eligibility. Looking to our results by school grade type, we find that CEP participation leads to decreases in school-level average BMI for elementary, middle, and high schools, but the effect is only statistically significant for middle schools and marginally so.

Taken together, the results of Tables 3 and 4 for our full sample of schools suggest that the expected change in InHFZ% and average BMI following CEP participation are most likely driven by overweight and obese children losing weight and falling into the healthy weight range. If it is the case that changes in the percent of healthy weight students are driven by underweight students gaining weight and moving into the healthy range, then we would not expect to see negative effects of CEP participation on BMI. Alternatively, if the estimated decrease in average BMI is driven by healthy weight or underweight children losing weight, it would not likely be accompanied by an increase in InHFZ%. While it is entirely possible that participating in the CEP leads to variation elsewhere in the distribution of child weight, we believe that weight loss among overweight and obese children following adoption of the CEP is the most plausible explanation of our findings.

In addition to potential heterogeneity in the effect of CEP participation on child weight by school grade type, we also expect that CEP participation may have differential impacts among schools in different location types. To test for this location specific heterogeneity, we estimate our primary results separately for schools in urban areas, rural areas, and suburbs/towns. The primary reasons why we would expect the relationship between school meals and child health to differ for schools in different areas *a priori* relate to area specific trends in food insecurity and institutional beliefs and practices. For example, children attending a low-income urban school may be more likely to live in a food desert, implying that the nutritional quality of meals may be the most crucial factor rather then their caloric content. Alternatively, families in rural areas may be less likely to enroll their child in a nutrition assistance program due to stigma or personal beliefs regarding government assistance programs.

Table 5 shows the results of our first stage estimates separated by school location type under the binary CEP eligibility specification and the ISP interaction specification. Beginning with Panel A of Table 5, we find that CEP eligibility leads to positive and statistically significant increases in the probability of participation for schools in all location types. Urban schools see a substantially larger effect at 73.1 percentage points compared to 48.5 percentage points and 37.8 percentage points for rural schools and schools in suburbs/towns, respectively. This difference is likely the result of urban schools having higher ISPs on average relative to rural schools and schools in suburbs/towns, thus making them more likely to participate in the CEP. Less clear is why the estimated change in the probability of CEP participation caused by CEP eligibility is 22% higher for rural schools relative to schools in suburbs/towns given that both sets of schools have roughly the same average ISP among eligible schools at 53.6% and 54.1%, respectively. Looking at Panel B of Table 5, we find that rural schools are more reactive to changes in ISP relative to schools in suburbs/towns with respect to CEP participation. This differential may explain why CEP eligible rural schools are found more likely to participate in the provision under our binary CEP eligibility specification relative to schools in suburbs/towns.

Table 6 shows our primary results under the binary CEP eligibility specification separated by school location type. In Panel A of Table 6, we find that CEP participation leads to positive effects on the percentage of healthy weight students attending urban schools, rural schools, and schools in suburbs/towns. The effect is only found to be statistically significant at the 10% level for urban and rural schools, but statistically insignificant for schools in suburbs/towns. We find the largest effect among urban schools where CEP participation is estimated to increase the percentage of healthy weight students attending a school by 2.54 percentage points relative to the 1.94 percentage point increase for rural schools. Given the average number of students and InHFZ% of urban and rural CEP eligible schools, CEP participation is expected to cause roughly 16 more children to fall into the healthy weight range for urban schools and 13 students in rural schools. While statistically insignificant, the effect for schools in suburbs/towns indicates that roughly 13 additional students will fall into the healthy weight range following CEP participation. While the implied number of students is the same for rural schools and schools in suburbs/towns, the overall percent change is smaller for suburbs/towns since they are larger on average relative to their rural counterparts.

Panel B of Table 6 shows the primary results for average BMI under the binary eligibility specification separated by school location type. We find that CEP participation leads to an expected decrease in average BMI for schools in all location types. Surprisingly, the effect is statistically insignificant for urban schools and only significant at the 10% level for rural schools but statistically significant below the 1% level for schools in suburbs/towns. We also find that the effect for schools in suburbs/towns is significantly larger in magnitude compared to our estimates for urban and rural schools.

Table 7 shows our primary results for InHFZ% under the ISP interaction specification separated by school location type. Beginning with Panel A of Table 7, we again find that the CEP participation leads to increases in the expected percentage of healthy weight students attending a school for schools in all location types. We find the effect of CEP participation on InHFZ% to be statistically significant below the 1% and 5% levels for urban and rural schools, respectively, and statistically insignificant for schools in suburbs/towns. Compared to our results using the binary CEP eligibility specification, we see a substantial increase in the statistical significance of our estimates under the ISP interaction specification for urban and rural schools. Furthermore, we find a meaningful increase in the effect's magnitude for urban schools and a decrease in the effect size for rural schools. While we expect urban schools to see roughly 16 more healthy weight students following adoption of the CEP under our binary eligibility specification, we estimate that an additional 23 students will be within the healthy weight range using our ISP interaction specification. Alternatively, the same increase for rural schools goes from 13 additional students under the binary specification to 10 using our ISP interactions as instruments for CEP participation.

Finally, Panel B of Table 7 shows the results of our model for average BMI under the ISP interaction specification separated by school location type. While the effect of CEP participation on average BMI is negative for schools in all location types, the effects are statistically insignificant. These results stand in contrast to those of our binary eligibility specification in Panel B of Table 6. Compared to our ISP interaction specification estimates, we find larger effects of CEP participation on BMI for rural schools and schools in suburbs/towns. While we find no statistically significant effect using our ISP interaction instruments, we find the effect of CEP participation on average BMI to be statistically significant for rural schools and schools in suburbs/towns using our binary specification at the 10% and 1% levels, respectively.

7 Sensitivity Analysis

We now turn to tests of the validity of our estimation strategy and the sensitivity of our results. First, we perform a placebo test using data from the pre-CEP period. In placebo testing, the primary analysis is replicated using a pseudo outcome that is expected *not* to be affected by the treatment (Athey and Imbens 2017). In other words, the true value of the point estimate for the pseudo outcome should be zero. Rejecting the null hypothesis in this case would bring the credibility of our original analysis into question. While various pseudo outcomes can be tested, we use variables related to future CEP eligiblity and participation as independent variables of interest in models of pre-CEP period outcomes.

Our falsification test involves designating the group of schools that were eligible to participate in the CEP at some point during the 2014-2016 period and indicating a false post-treatment period of 2012. We then perform the placebo test with a difference-in-differences (DID) model of our aggregate weight outcomes using data from the 2011 and 2012 school years. Our approach can be likened to comparing the pre-CEP period trends of InHFZ% and mean BMI for the groups of ever and never CEP eligible schools. Finding an effect from future CEP eligibility during the pre-CEP period would suggest that trends in the aggregate weight outcomes of interest differed by CEP eligibility prior to the provision's introduction, implying that our estimates may not represent valid treatment effects.

Table 8 shows the results of our placebo test for the full sample of schools and by school grade type using future CEP eligibility status as a false treatment indicator during the pre-CEP period. We find no statistically significant effect from future CEP eligibility on either InHFZ% or average BMI during the pre-CEP period. The results of our placebo test suggest that the trends in our aggregate weight outcomes were not statistically different between the set of CEP eligible and ineligible schools prior to the provision's introduction. Furthermore, since the estimated effect of future CEP eligibility on InHFZ% is negative during the pre-CEP period, the positive effect of CEP participation we find in our primary results are likely conservative. We similarly find positive coefficients on future CEP eligibility in our placebo test, implying that the negative effects of CEP participation on average BMI we observe in our primary results are likely to be conservative as well.

Moving now to the sensitivity of our results to alternative specifications, one potential concern with our study is that the average treatment effects we estimate may largely be driven by the set of schools with the highest ISPs. We test the sensitivity of our results to the exclusion of these high ISP outliers by omitting 195 schools with ISPs above the 90th percentile of 66%. For both our binary CEP eligibility and ISP interaction specifications, we find that excluding these high ISP schools has no impact on our first stage results for the full sample of schools, our results by school grade type, or our results by school location type.

With regards to the impact of CEP participation on InHFZ% after excluding the set of high ISP schools, the only noteworthy changes we find are the change from 1.27 percentage points to 1.36 percentage points for the full sample of schools and a slight change in our estimate magnitudes for suburbs/towns. Our results for average school level BMI also change only trivially after omitting schools with the highest ISPs. We find no significant change in our BMI estimates under the binary eligibility specification. The estimates for our ISP interaction specification also remain robust for the entire sample after omitting the subset of high ISP schools. The most notable change in our results by school grade type is in the effect for middle schools which changes from marginally significant to statistically insignificant when we exclude high ISP schools, but the effect magnitudes are nearly identical to one another.

We omit the 2013 school year from our primary analyses since we are unable to identify which schools were eligible and/or participating in the CEP during Georgia's pilot year. Alternatively, we can make the assumption that schools have the same ISP, CEP eligibility, and CEP participation status in 2013 that we observe in 2014. While this assumption affords us an additional year of data and likely holds true in most cases, imputing our CEP variables and including data from 2013 introduces additional noise into our estimations.

To see how including 2013 changes our results, Tables 9 and 10 show our first stage results by school grade and location type, respectively. As the table's show, our results remain generally robust to the inclusion of 2013 under both the binary CEP eligibility and ISP interaction specifications. We find slightly smaller effects of CEP eligibility on CEP participation on average after including 2013, a change we would expect to see if CEP eligible schools were generally less likely to participate in the program during the provision's pilot year.

Tables 11, 12, 13, and 14 show the results of our model's second stage under the same specifications used to create our primary results after including the 2013 school year. The most common changes in our estimates after including 2013 are decreased effect magnitudes and levels of statistical significance. Given that the CEP was being piloted in Georgia during 2013, we expect that many schools were considerably less likely to participate in the CEP during 2013 relative to later years. If this is the case, then we would expect to see smaller effects from CEP participation on student weight outcomes relative to our primary results because many schools will be mislabeled as having participated in 2013 when they did not truly adopt the CEP until 2014. Regardless, we find that including 2013 into our analysis does not fundamentally change our overall results or their implications.

8 Conclusion

In this study, we estimate the Community Eligibility Provision's (CEP's) effect on school-level measures of child weight for the population of public K-12 schools in the state of Georgia. We use two specifications of CEP eligibility as instruments for CEP participation in regressions separated by school grade type and school location type in addition to regressions using the full sample of schools. Our primary outcomes of interest are the percentage of students attending a school who are in the healthy weight range and school average body mass index (BMI) score.

Our results suggest that CEP participation simultaneously increases the percentage of healthy weight students attending a school and decreases school-level average BMI. Our estimates are largely consistent across specifications and we find no statistically significant evidence to support a harmful effect from CEP participation on school-level child weight. We find that CEP participation produces the largest changes in healthy weight percentage for middle schools, urban schools, and rural schools. We also find that elementary and middle schools see the most significant decreases in average BMI following CEP adoption.

Our results stand in contrast to seminal studies looking at the effect of school lunch on child weight. While Schanzenbach (2009) and Millimet et al. (2010) find that school lunch participation increases child weight, we do not find evidence to support the assumption that universal free school meals worsen child health. One possible cause of this discrepancy is that the CEP makes both lunch and breakfast free to all students. Given that some existing studies have found participation in school lunch, rather than breakfast, leads to worsened health outcomes (Millimet et al. 2010), it may be the case that the beneficial effects of CEP participation are driven by breakfast rather than lunch. Alternatively, Schwartz and Rothbart (2017) find some evidence of a positive effect from providing universal free school lunch on child weight among non-poor eighth graders in New York City even though universal free breakfast had been in place for years prior.

The effects of CEP participation we observe may also differ from the results of previous studies on school meal participation due to changes in meal quality during the pre-CEP period. In addition to creating the CEP, 2010's Healthy Hunger Free Kids Act(HHFKA) changed the nation's minimum nutrition standards for school meals. Prior to the HHFKA's revised minimum nutrition standards, meals served in school may have been more likely to be lower quality relative to meals brought from home, implying that we would expect to see fewer students with improved weight outcomes following the switch to school meals. If so, increased meal participation could lead to the detrimental health effects observed by early studies. In light of these nutrition standard changes, it is especially important that we revisit the relationship between school meals and child health.

Finally, the variations in free school meal enrollment following participation in the CEP also occurs at different margins than changes to factors like family income eligibility or categorical eligibility laws. Most notably, the CEP affects children who were already eligible for free meals but were not participating *and* children living in families with incomes above the existing free or reduced-price eligibility range. CEP participation removes child-level self-selection into free school meal programs entirely, implying that the negative health effects found in previous studies may be due to adverse selection into school meals under the traditional system; a theory supported by Millimet et al. (2010). Furthermore, it is possible that the beneficial effects we observe are driven by mechanisms other than changes to meal consumption. For example, it may be the case that removing the stigma surrounding free lunch participation in CEP schools produces weight improvements among students who were already eating school meal in the pre-CEP period. Unfortunately, we are not able to evaluate this possibility more thoroughly using our current data.

Given that our results suggest participation in the CEP leads to improved school-level child weight outcomes, an important question becomes - what factors determine a school's participation? While not explicitly presented here, results from a simple model of CEP participation gives some insight into possible determinants. First, schools with more students enrolled in free or reduced-price lunch during the pre-CEP period are less likely to sign up for the provision. The cause of this relationship may be schools with the majority of their students already receiving free or reduced-price meals deciding that the small increase in uptake caused by the CEP is not worth the effort. This possibility stands in contrast to the assumption that schools with high numbers of students enrolled in free and reduced-price meals are still adequately incentivized to participate in the CEP by the reduction in costs caused by removing meal applications.

We also find CEP eligible schools with identified student percentages below 62.5% are less likely to participate since CEP schools with ISPs between 40% and 62.5% only have a portion of their meals reimbursed at the free rate by the USDA. This further supports that program costs play a role in each school's likelihood of participation. Furthermore, we find that schools within the 40% to 62.5% range are more likely to participate as their ISPs increase. If barely eligible schools are dissuaded from participating in the CEP because of reimbursement rates, our results suggest that the USDA may be able to significantly improve child health by changing the CEP's current reimbursement scheme to raise CEP enrollment among low-ISP eligible schools.

County-level poverty also seems to play a complex role in the CEP participation decision. For example, we find that the overall percentage of a school's county living in poverty is negatively correlated with CEP participation, indicating that schools in counties that are poorer overall are less likely to adopt the provision. While this relationship may again be due to differences in pre-CEP free and reduced/price meal enrollment rates. We find that the poorest counties in Georgia do not have more children enrolled in free school meals on average. Alternatively, schools in counties with higher levels of child poverty are more likely to adopt the CEP, implying that the age-poverty distribution within a county affects the participation decision.

In relation to poverty, we find that eligible schools in urban areas are more likely to participate in the program than schools in suburbs/towns while rural schools are not. Rural schools in Georgia have the lowest number of students enrolled in free and reduced/price meals during the pre-CEP period even though they serve children in the state's poorest counties. Therefore, the low uptake rate among rural schools diverges from the CEP's primary goal of providing free school meals to children who were not adequately reached by the existing system. If disadvantaged schools in different areas continue to participate at different rates, the CEP may unintendedly perpetuate location specific disparities in child health.

While the results of our study provide important evidence regarding the CEP's effect on school-level measures of child health, future research is needed to understand the effects of universal free school meals at the child-level. As spoken to throughout our study, school-level measures of health identify specific moments of an underlying child-level distribution, making it impossible to determine where changes stem from. A promising avenue for future research will be to estimate the effects of school meal programs on child-level health for children from different sociodemographic and economic groups. Furthermore, our study ignores other mechanisms through which free school meal provisions could either improve or harm the lives of children and their families. One such mechanism is the CEP's removal of child-level stigma surrounding the receipt of free meals in school.

We are also limited by the use of data from schools in only one state. While this provides us with some advantage in that all schools share the same state-level environment, we are unable to examine the effects of CEP participation on school-level weight in other states. This limitation is especially important given the degree of variation in pre- and post-CEP school environments and CEP participation rates across state lines. For example, while 92.2% of CEP eligible schools chose to participate in Ohio during the 2016-2017 school year, only 15.1% of eligible California schools participated in the CEP during the same year. It is most likely the case that differences across states affect the school meal environment of low-income schools as well as how the provision of universal free meals impacts child health.

Finally, additional work is needed to better understand the possible interactions, decisions, and outcomes schools face when choosing whether or not to participate in the CEP. Aside from the observable determinants of participation, one possible factor which we have not seen considered in the literature is school-level stigma. If schools choose not to adopt the CEP because they feel that it will negatively effect their public perception, our results indicate that the choice of non-participation may come at the expense of forgone improvements to the health of their students.

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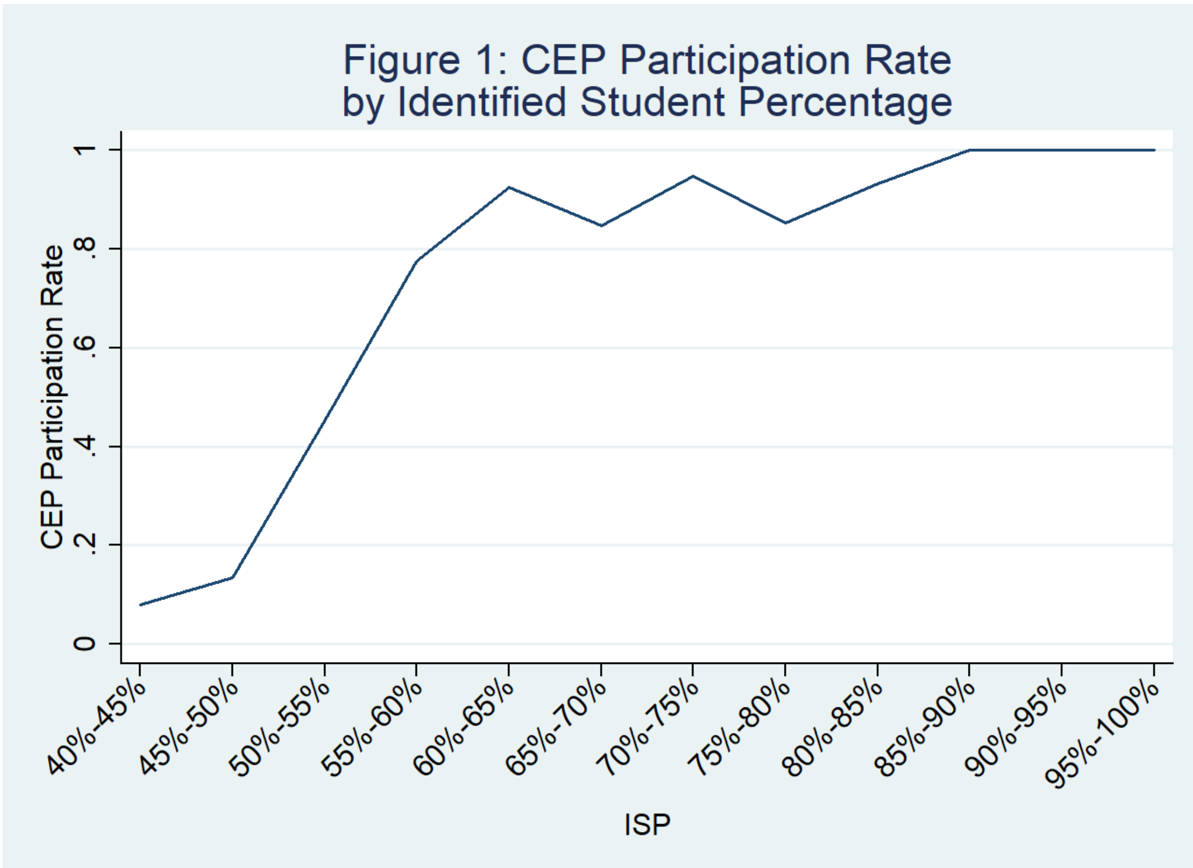
Tables and Figures



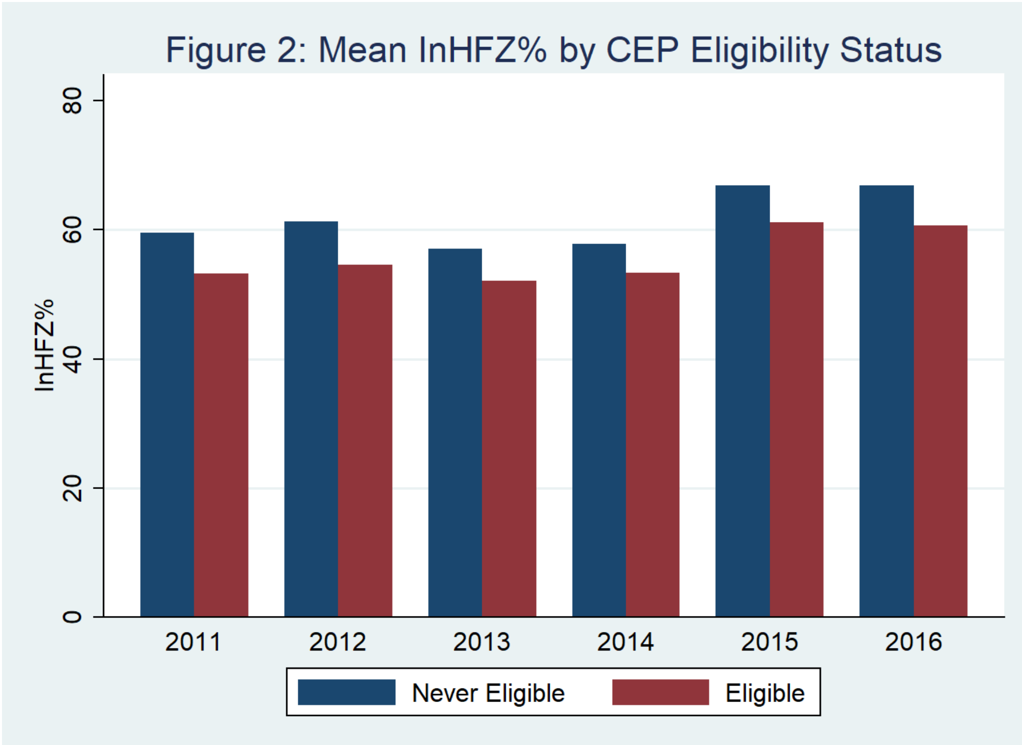


Figure 2: Mean lnHFZ% by CEP Eligibility Status
lnHFZ%
0
20
40
60
80
2011
2012
2013
2014
2015
2016
Never Eligible
Eligible

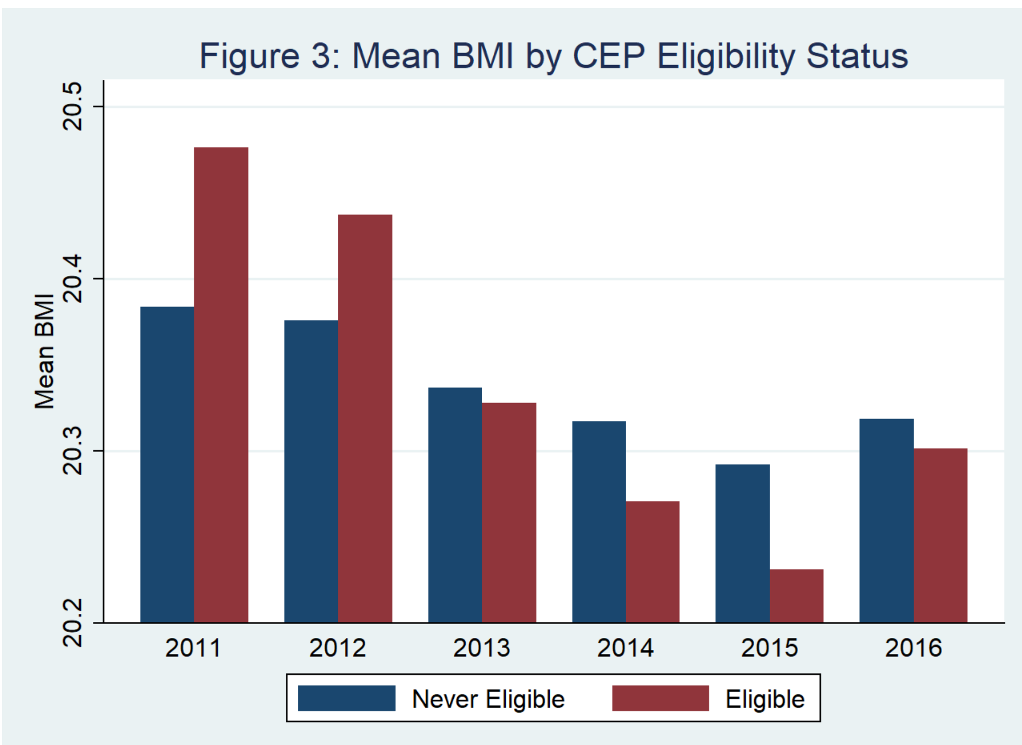


Figure 3: Mean BMI by CEP Eligibility Status
Mean BMI
20.2
20.3
20.4
20.5
2011
2012
2013
2014
2015
2016
Never Eligible
Eligible

Table 1: Variable Summary Statistics 2011-2016

	Mean	StD	Min	Max	Count
Percent Students In Healthy Fitness Zone	58.88	10.51	1.47	92.08	8797
Mean Body Mass Index Score	20.35	2.27	14.97	27.25	8797
Percent Free and Reduced Price Lunches	63.02	26.27	5	100	8797
Ever CEP Eligible	.472	.4992	0	1	8797
Ever CEP Participating	.2687	.4433	0	1	8797
Number of Students	866.08	476.37	75	4192	8797
Percent Black Students	33.37	27.90	0	100	8797
Percent White Students	46.44	28.47	0	99	8797
Percent Migrant Students	.3066	1.325	0	24	8797
Percent Special Education Students	10.95	3.4	0	30	8797
Percent ESL Students	5.63	9.70	0	79	8797
Percent Gifted Students	10.71	8.41	.1	74.3	8797

Table 2: First Stage Estimates by School Grade Type

Panel A: First Stage Regression of CEP Participation on binary CEP Eligibility

	All Schools	Elementary Schools	Middle Schools	High Schools
CEP Eligible	0.466^{***}	0.417^{***}	0.525^{***}	0.605^{***}
	(0.0128)	(0.0141)	(0.0293)	(0.0459)
F-stat	1,327.90	869.49	322.34	173.72
N	7430	4716	1533	1167

Panel B: First Stage Regression of CEP Participation on ISP Interaction Instruments

	All Schools	Elementary Schools	Middle Schools	High Schools
$($100-ISP$) *$ CEP Eligible	0.0602^{***}	0.0579^{***}	0.0670^{***}	0.0647^{***}
	(0.0015)	(0.0019)	(0.003)	(0.0028)
$($100-ISP$) *$ CEP Eligible ^{2}	-0.001^{***}	-0.001^{***}	-0.0011^{***}	-0.0011^{***}
	(0.0000)	(0.0000)	(0.0001)	(0.0001)
F-stat	1,783.29	1,078.1	514.13	385.55
N	7406	4711	1533	1162

Clustered robust standard errors in parentheses. CEP Eligible is an indicator of CEP eligibility for a given school in a given year. ISP represents a school's identified student percentage in a given year. Control variables include percent black students, percent white students, percent migrant students, percent special education students, percent ESL students, and percent gifted students. All regressions include year and school fixed effects. Regressions are weighted by student population in 2014.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Second Stage Binary CEP Eligibility IV Estimates of CEP Participation Effects on Weight Outcomes by School Grade Type

Panel A: IV Estimated Effects of CEP Participation on Percentage of Healthy Weight Students				
	All Schools	Elementary Schools	Middle Schools	High Schools
CEP Participation	0.0181***	0.0098	0.0225	0.0014
	(0.0066)	(0.0072)	(0.016)	(0.0142)
N	7416	4716	1533	1167
Panel B: IV Estimated Effects of CEP Participation on average BMI				
	All Schools	Elementary Schools	Middle Schools	High Schools
CEP Participation	−0.197***	−0.201**	−0.0424	−0.147
	(0.0562)	(0.0816)	(0.0896)	(0.118)
N	7416	4730	1533	1168

Clustered robust standard errors in parentheses. CEP participation is an indicator of enrollment in the CEP for a given school in a given year instrumented for using binary CEP eligibility. Control variables include percent black students, percent white students, percent migrant students, percent special education students, percent ESL students, and percent gifted students. All regressions include year and school fixed effects. Regressions are weighted by student population in 2014.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Second Stage Identified Student Percentage Interaction IV Estimates of CEP Participation Effects on Weight Outcomes by School Grade Type

Panel A: IV Estimated Effects of CEP Participation on Percentage of Healthy Weight Students				
	All Schools	Elementary Schools	Middle Schools	High Schools
CEP Participation	0.0127^{***}	0.0047	0.0229^{**}	-0.0049
	(0.0048)	(0.0052)	(0.0109)	(0.0123)
N	7406	4711	1533	1162
Panel B: IV Estimated Effects of CEP Participation on average BMI				
	All Schools	Elementary Schools	Middle Schools	High Schools
CEP Participation	-0.0997^{**}	-0.0551	-0.13^{*}	-0.0195
	(0.0443)	(0.0598)	(0.0759)	(0.102)
N	7406	4711	1533	1162

Clustered robust standard errors in parentheses. CEP participation is an indicator of enrollment in the CEP for a given school in a given year instrumented for using ISP interaction terms. Control variables include percent black students, percent white students, percent migrant students, percent special education students, percent ESL students, and percent gifted students. All regressions include year and school fixed effects. Regressions are weighted by student population in 2014.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: First Stage Estimates by School Location Type

Panel A: First Stage Regression of CEP Participation on binary CEP Eligibility

	Urban	Rural	Suburbs/Towns
CEP Eligible	0.731^{***}	0.485^{***}	0.378^{***}
	(0.0467)	(0.0324)	(0.0277)
F-stat	421.7	508.07	470.43
N	851	3145	3434

Panel B: First Stage Regression of CEP Participation on ISP Interaction Instruments

	Urban	Rural	Suburbs/Towns
$(\text{100-ISP}) * \text{CEP Eligible}$	0.0649^{***}	0.0625^{***}	0.056^{***}
	(0.003)	(0.0025)	(0.0024)
$(\text{100-ISP}) * \text{CEP Eligible}^2$	-0.0011^{***}	-0.0011^{***}	-0.001^{***}
	(0.0001)	(0.0000)	(0.0000)
F-stat	728.16	738.64	567.88
N	834	3141	3431

Clustered robust standard errors in parentheses. CEP Eligible is an indicator of CEP eligibility for a given school in a given year. ISP represents a school's identified student percentage in a given year. Control variables include percent black students, percent white students, percent migrant students, percent special education students, percent ESL students, and percent gifted students. All regressions include year and school fixed effects. Regressions are weighted by student population in 2014.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Second Stage Binary CEP Eligibility IV Estimates of CEP Participation Effects on Weight Outcomes by School Location Type

Panel A: IV Estimated Effects of CEP Participation on Percentage of Healthy Weight Students			
	Urban	Rural	Suburbs/Towns
CEP Participation	0.0254^{*}	0.0194^{*}	0.0156
	(0.0134)	(0.0099)	(0.012)
N	840	3142	3434
Panel B: IV Estimated Effects of CEP Participation on average BMI			
	Urban	Rural	Suburbs/Towns
CEP Participation	-0.0106	-0.164^{*}	-0.28^{***}
	(0.114)	(0.085)	(0.101)
N	840	3142	3434

Clustered robust standard errors in parentheses. CEP participation is an indicator of enrollment in the CEP for a given school in a given year instrumented for using binary CEP eligibility. Control variables include percent black students, percent white students, percent migrant students, percent special education students, percent ESL students, and percent gifted students. All regressions include year and school fixed effects. Regressions are weighted by student population in 2014.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Second Stage Identified Student Percentage Interaction IV Estimates of CEP Participation Effects on Weight Outcomes by School Location Type

Panel A: IV Estimated Effects of CEP Participation on Percentage of Healthy Weight Students

	Urban	Rural	Suburbs/Towns
CEP Participation	0.0364^{***}	0.0159^{**}	0.0037
	(0.0116)	(0.0066)	(0.0084)
N	834	3141	3431

Panel B: IV Estimated Effects of CEP Participation on average BMI

	Urban	Rural	Suburbs/Towns
CEP Participation	-0.0256	-0.0859	-0.11
	(0.102)	(0.0613)	(0.0731)
N	834	3141	3431

Clustered robust standard errors in parentheses. CEP participation is an indicator of enrollment in the CEP for a given school in a given year instrumented for using ISP interaction terms. Control variables include percent black students, percent white students, percent migrant students, percent special education students, percent ESL students, and percent gifted students. All regressions include year and school fixed effects. Regressions are weighted by student population in 2014.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Pre-CEP Period Falsification Test by School Grade Type

Panel A: Regression of Percentage of Healthy Weight Students on False CEP eligibility in 2012

	All Schools	Elementary Schools	Middle Schools	High Schools
False CEP Eligibility	-0.0025	-0.0049	-0.0047	-0.0027
	(0.0026)	(0.0039)	(0.0043)	(0.0046)
N	2936	1869	608	459

Panel B: Regression of Average BMI on False CEP Eligibility in 2012

	All Schools	Elementary Schools	Middle Schools	High Schools
False CEP Eligibility	-0.023	0.0626	0.0313	0.0406
	(0.0365)	(0.0484)	(0.0629)	(0.0636)
N	2936	1869	608	459

Clustered robust standard errors in parentheses. False CEP eligibility status is an indicator assigned to schools in 2012 which are CEP eligible after the program's implementation. Control variables include percent black students, percent white students, percent migrant students, percent special education students, percent ESL students, and percent gifted students. All regressions include year and school fixed effects. Regressions are weighted by student population in 2014.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: First Stage Estimates by School Grade Type with 2013

Panel A: First Stage Regression of CEP Participation on binary CEP Eligibility

	All Schools	Elementary Schools	Middle Schools	High Schools
CEP Eligible	0.427^{***}	0.387^{***}	0.464^{***}	0.542^{***}
	(0.0197)	(0.0223)	(0.0442)	(0.0635)
F-stat	1,340.83	836.57	343.23	198.24
N	8804	5608	1824	1372

Panel B: First Stage Regression of CEP Participation on ISP Interaction Instruments

	All Schools	Elementary Schools	Middle Schools	High Schools
$($100-ISP$) *$ CEP Eligible	0.0595^{***}	0.057^{***}	0.0655^{***}	0.0657^{***}
	(0.0016)	(0.0019)	(0.0035)	(0.0029)
$($100-ISP$) *$ CEP Eligible ^{2}	-0.001^{***}	-0.001^{***}	-0.0011^{***}	-0.0011^{***}
	(0.0000)	(0.0000)	(0.0001)	(0.0001)
F-stat	1,771.02	1,046.03	525.14	406.86
N	8794	5603	1824	1367

Clustered robust standard errors in parentheses. CEP Eligible is an indicator of CEP eligibility for a given school in a given year. ISP represents a school's identified student percentage in a given year. Schools are assigned the same CEP eligibility status, ISP, and CEP participation status in 2013 as 2014. Control variables include percent black students, percent white students, percent migrant students, percent special education students, percent ESL students, and percent gifted students. All regressions include year and school fixed effects. Regressions are weighted by student population in 2014.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: First Stage Estimates by School Location Type with 2013

Panel A: First Stage Regression of CEP Participation on binary CEP Eligibility			
	Urban	Rural	Suburbs/Towns
CEP Eligible	0.697^{***}	0.445^{***}	0.343^{***}
	(0.0536)	(0.0325)	(0.0271)
F-stat	421.7	508.07	470.43
N	983	3735	4086
Panel B: First Stage Regression of CEP Participation on ISP Interaction Instruments			
	Urban	Rural	Suburbs/Towns
$(100\text{-ISP}) * \text{CEP Eligible}$	0.0666^{***}	0.0623^{***}	0.0547^{***}
	(0.0031)	(0.0025)	(0.0026)
$(100\text{-ISP}) * \text{CEP Eligible}^{2}$	-0.0012^{***}	-0.0011^{***}	-0.001^{***}
	(0.0001)	(0.0000)	(0.0000)
F-stat	713.86	755.17	564.16
N	977	3734	4083

Clustered robust standard errors in parentheses. CEP Eligible is an indicator of CEP eligibility for a given school in a given year. ISP represents a school's identified student percentage in a given year. Schools are assigned the same CEP eligibility status, ISP, and CEP participation status in 2013 as 2014. Control variables include percent black students, percent white students, percent migrant students, percent special education students, percent ESL students, and percent gifted students. All regressions include year and school fixed effects. Regressions are weighted by student population in 2014.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Second Stage Binary CEP Eligibility IV Estimates of CEP Participation Effects on Weight Outcomes by School Grade Type with 2013

Panel A: IV Estimated Effects of CEP Participation on Percentage of Healthy Weight Students

	All Schools	Elementary Schools	Middle Schools	High Schools
CEP Participation	0.0149^{**}	0.0071	0.0157	0.0023
	(0.0074)	(0.0074)	(0.018)	(0.0141)
N	8791	5596	1824	1371

Panel B: IV Estimated Effects of CEP Participation on average BMI

	All Schools	Elementary Schools	Middle Schools	High Schools
CEP Participation	-0.176^{***}	-0.184^{**}	-0.0126	-0.177
	(0.0562)	(0.0811)	(0.0898)	(0.116)
N	8804	5608	1824	1372

Clustered robust standard errors in parentheses. CEP participation is an indicator of enrollment in the CEP for a given school in a given year instrumented for using binary CEP eligibility. Schools are assigned the same CEP eligibility status and CEP participation status in 2013 as 2014. Control variables include percent black students, percent white students, percent migrant students, percent special education students, percent ESL students, and percent gifted students. All regressions include year and school fixed effects. Regressions are weighted by student population in 2014.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Second Stage Binary CEP Eligibility IV Estimates of CEP Participation Effects on Weight Outcomes by School Location Type with 2013

Panel A: IV Estimated Effects of CEP Participation on Percentage of Healthy Weight Students

	Urban	Rural	Suburbs/Towns
CEP Participation	0.0301^{**}	0.024^{**}	0.0031
	(0.015)	(0.0106)	(0.0131)
N	983	3735	4086

Panel B: IV Estimated Effects of CEP Participation on average BMI

	Urban	Rural	Suburbs/Towns
CEP Participation	-0.003	-0.173^{**}	-0.223^{**}
	(0.114)	(0.086)	(0.101)
N	973	3732	4086

Clustered robust standard errors in parentheses. CEP participation is an indicator of enrollment in the CEP for a given school in a given year instrumented for using binary CEP eligibility. Schools are assigned the same CEP eligibility status and CEP participation status in 2013 as 2014. Control variables include percent black students, percent white students, percent migrant students, percent special education students, percent ESL students, and percent gifted students. All regressions include year and school fixed effects. Regressions are weighted by student population in 2014.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Second Stage Identified Student Percentage Interaction IV Estimates of CEP Participation Effects on Weight Outcomes by School Grade Type with 2013

Panel A: IV Estimated Effects of CEP Participation on Percentage of Healthy Weight Students

	All Schools	Elementary Schools	Middle Schools	High Schools
CEP Participation	0.0109^{**}	0.0024	0.0128	-0.001
	(0.0049)	(0.0051)	(0.0117)	(0.0115)
N	8794	5603	1824	1367

Panel B: IV Estimated Effects of CEP Participation on average BMI

	All Schools	Elementary Schools	Middle Schools	High Schools
CEP Participation	-0.0767^{*}	-0.0352	-0.104	-0.0109
	(0.0418)	(0.0567)	(0.0733)	(0.0926)
N	8781	5591	1824	1366

Clustered robust standard errors in parentheses. CEP participation is an indicator of enrollment in the CEP for a given school in a given year instrumented for using ISP interaction terms. Schools are assigned the same CEP eligibility status and CEP participation status in 2013 as 2014. Control variables include percent black students, percent white students, percent migrant students, percent special education students, percent ESL students, and percent gifted students. All regressions include year and school fixed effects. Regressions are weighted by student population in 2014.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14: Second Stage Identified Student Percentage Interaction IV Estimates of CEP Participation Effects on Weight Outcomes by School Location Type with 2013

Panel A: IV Estimated Effects of CEP Participation on Percentage of Healthy Weight Students			
	Urban	Rural	Suburbs/Towns
CEP Participation	0.0425^{***}	0.0187^{***}	-0.0021
	(0.0124)	(0.0066)	(0.0084)
N	977	3734	4083
Panel B: IV Estimated Effects of CEP Participation on average BMI			
	Urban	Rural	Suburbs/Towns
CEP Participation	-0.023	-0.0487	-0.0916
	(0.0954)	(0.0578)	(0.0703)
N	967	3731	4083

Clustered robust standard errors in parentheses. CEP participation is an indicator of enrollment in the CEP for a given school in a given year instrumented for using ISP interaction terms. Schools are assigned the same CEP eligibility status and CEP participation status in 2013 as 2014. Control variables include percent black students, percent white students, percent migrant students, percent special education students, percent ESL students, and percent gifted students. All regressions include year and school fixed effects. Regressions are weighted by student population in 2014.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$