4. The Evaluation Methodology

4.1. The Conceptual Framework

We begin with a simple utility maximization model, in which the calories of food consumed by the child must be purchased. Under standard assumptions, an Engel curve can be derived that traces out the optimal caloric intake with respect to income.[16] We draw the stylized Engel curve in Figure 1 suggesting that the curve will become quite flat, perhaps even at relatively low income levels. Quite simply, the flatness recognizes that there are limits to desired calories. To the extent that individuals are below the income level where caloric intake is appreciably flat, then the introduction of a school nutrition program will cause the caloric intake to increase. The mechanism for this beneficial effect is that school nutrition programs represent an in-kind income transfer.

To gauge the potential effects of the program, suppose we value the school breakfast at the USDA reimbursement rate of $1.12 for those families receiving free meals, which implies that the SBP represents a monthly transfer of about $25 for each child receiving free breakfasts. If this additional income were multiplied by a realistic marginal propensity to consume calories for the child, then we might expect a very modest income effect of the program.

Such a calculation could underestimate the impact of school nutrition programs for several reasons. First, to the extent that families participate in many other in-kind nutrition programs (Food Stamps, WIC, etc), then the poorest families might be spending very little of their own money on food. In such cases, a family might not have the opportunity to transfer their own food spending, implying that the entire school nutrition subsidy could purchase additional calories for the child.[17] Second, due to cooking habits or packaging constraints, households might not marginally change their food preparation behavior with the introduction of school nutrition programs, also implying that the entire school nutrition subsidy could purchase additional calories for the child.

Third, this simple model ignores the fact that not all calories are equal, but rather calories vary with respect to quality and price. For example, some calories are replete with vitamins and minerals, while other calories come with few nutrients and perhaps even negative attributes such as high saturated fats. Similarly, calories also vary tremendously in price, particularly when the purchase price and the time cost of preparation are considered. Such a complication can greatly change the relationship depicted in Figure 1. For example, many studies have found that the poor are more likely to be obese than the non-poor in the United States. This alternative relationship is often understood as high fat, empty calories being relatively inexpensive when compared to high quality, nutrient-rich calories.

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[16] See Deaton (1997) for a useful textbook treatment.

[17] Specifically, families might be at a corner solution regarding food expenditures in which the total in-kind food transfer that the family receives is greater than the level of food expenditures the family would choose if the in-kind transfers were paid in cash.

One implication of such concerns is that it can be useful to monitor many facets of a child's diet. For example, even if school nutrition programs have little effect on the quantity of calories that are consumed, the programs could still be substituting for relatively nutrient-poor calories at home. In such cases, the impact of the program would not be observed in measures of the quantity of food intake but rather in measures related to the quality of the diet. In fact, it is possible that an impact will be more easily observed in the quality of the diet if the underlying relationship with income is monotonic (as depicted in Figure 1) or if the income level at which the relationship becomes appreciably flat is higher.[18]

The second implication of such concerns is that the impact of the school nutrition program need not operate only through an income effect as described at the outset. Rather, positive impacts of the program would be available to all those who eat breakfast at school whenever the food eaten at school is of better quality than the food eaten at home. This impact will be observed regardless of whether the breakfasts are subsidized for a particular child and regardless of whether the school-provided meal is nutritiously good as measured by some objective dietary guideline. Given the conclusion in Bhattacharya and Currie (2001) that diets for children are often nutritiously poor, the scope for meal substitution effects may be large.

4.2. The Identification Strategy

We are interested in measuring the causal impact of NSLP and SBP on nutritional outcomes. Consider the SBP program.[19] As many previous researchers have noted, directly comparing students with SBP available to those without does not measure the true causal impact of SBP availability. Quite simply, those who have SBP available are likely to differ along many dimensions from those who do not. Differences in nutritional and other outcomes between the two groups will reflect both the causal impact of the program and the underlying differences between the two groups. For example, Table 2 shows that school breakfast is much more likely to be available to children in poor families and these children have systematically worse diets when compared to children from relatively high income families.

If we could observe everything that makes these two groups different, we could statistically adjust for these differences by estimating a regression model. However, such a method will always be subject to the criticism that we do not observe many of the important differences between the groups, and these remaining differences could confound regression results.

Our strategy to circumvent this problem rests with the simple observation that most school systems are not in session year around, and thus students do not receive the nutrition program year around. Therefore, we could imagine comparing students' diets while school is in session (and thus NSLP and/or SBP is available) to their diets while school is not in session. If the only thing that changes between these periods is the availability of school nutrition programs, then that difference would be the causal impact of the program.

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[18] In the appendix, we plot the relationship between various measures of nutritional outcomes and the poverty-to-income ratio for the children in our sample (ages 5 to 16) and adults age 18 to 34. The relationship between income and nutrition outcomes, particularly at lower incomes levels, varies across the various nutrition outcomes.

[19] Our discussion in this section focuses on SBP, but the reasoning about identification carries directly over to NSLP.

Such an identification strategy would only identify the causal impact of NSLP and SBP on outcomes that could reasonably change within a few months. For example, we would be able to identify the causal impact of the programs on dietary quality and vitamin deficiencies that depend on frequent consumption, but we could not identify the causal impact of school nutrition on longer-term outcomes such as school achievement and obesity. With respect to the outcomes we consider here, vitamin A, vitamin C, and folate are water soluble and are not stored long-term in the body. On the other hand, vitamin E is not water soluble and is stored longer in the body. Thus, it is more likely that we will be able to identify a causal impact on vitamin A, vitamin C, and folate with our identification strategy.

In practice, schools tend not to be in session during the summer months, and our identification strategy would assign all summer/non-summer differences in outcomes to be the causal impact of the program. However, it is conceivable that other things may vary by season. For example, if the opportunity cost of food is cheaper in the summer, either because food could be grown or food prices are lower, then dietary outcomes could be better during the summer regardless of real programmatic effects. Similarly, activity levels could vary by season, also affecting the clinical measures. Any such seasonal variation would confound our estimation procedure, leading us to underestimate the effect of the programs.

A good solution to this problem exists for evaluating the availability of the SBP. In particular, the SBP program is not as widely available as the NSLP program (see Table 2). The children for whom SBP is not available can provide important information regarding the variation that exists in various outcomes (for example, serum measures of vitamin deficiencies) between school being in session and not in session. Thus, we can use a difference-in-difference methodology in which we compare the outcomes for individuals across winter and summer to obtain direct estimates of the seasonal effects. By comparing the two differences, we obtain the causal impact of the nutrition program.

Table 3 demonstrates the basic identification strategy. We divide the sample into groups based on whether a SBP is available and whether school is in session. It is clear that the children with SBP available are relatively disadvantaged in that they have a lower income-to-poverty ratio and they are more likely to receive Food Stamps. Again, this finding implies that simply comparing the behavior of individuals for whom a SBP is available with those who do not would mislead us about what would happen if SBP were made available.

To illustrate the difference-in-difference strategy, consider the HEI score. For children with SBP available, they have a healthier diet when school is in session versus when school is not in session (63.0 vs. 60.9). This difference is consistent with SBP improving the diets of children. Interpreting this change directly is difficult, however, because it is unclear how diets change across seasons (which is coincident with school being in session). To gauge this underlying effect, we examine the variation among children for whom SBP is not available. The change among this group (63.6 vs. 64.7) goes in the opposite direction and is consistent with the notion that healthy food is relatively cheaper during the summer when school is not in session. A difference-in-difference strategy implies that impact of the SBP program on the HEI score is 3.2 [= (63.0 - 60.9) - (63.6 - 64.7)]. That is, the causal effect of SBP is to improve the dietary quality

of children by 3.2 HEI points. We present this estimate in the last column in Table 3, and statistical tests suggest that the difference-in-difference estimate is significant at the 0.05 level.

Turning to the other outcomes in Table 3, we find that the SBP improves the dietary outcomes for children, though not all of the improvements are statistically significant. The outcomes that are statistically significantly improved at the 0.1 level include the HEI score, the total calorie consumption from fat, the probability of a low serum level of vitamin C, and the probability of a low serum level of folate.

This identification strategy does not account for at least one seasonal confounding factor, the Summer Food Service Program (SFSP).[20] The Summer Food Service Program provides free nutritious meals and snacks to children in low-income areas during the summer months when school is not in session. The caseload of the SFSP is small relative to the NSLP or SBP. In the summer of 1999, the program served nearly 2.1 million children per day compared to 26.9 million children per day who participated in the NSLP and 7.8 million who participated in the SBP. Because the number of children participating in this program is relatively small, we do not believe that the existence of this program importantly affects our results. However, to the extent that it does, it will tend to bias our results toward not finding any impact because some children still receive a treatment (that is, a meal from the SFSP program) in the summer.

This identification strategy also limits us to examining the impact of SBP availability rather than SBP participation. Quite simply, our strategy allows us to take into account that SBP is more likely to be available to poor students (see Table 2), but it does not allow us to take into account who chooses to participate. To the extent that some students who have SBP available choose not to participate, the impact of SBP availability will be smaller than the impact of SBP participation. The impact of SBP availability is still of interest to policymakers because policymakers can only mandate that the program be made available, not mandate that students must participate.

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[20] Information on SFSP is available from the USDA/FNS website at http://www.fns.usda.gov/cnd/Summer/Default.htm.