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The School Breakfast Program and Breakfast Consumption

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Abstract

This paper analyzes the effect of participation in the School Breakfast Program (SBP) on breakfast consumption using time-diary data from the Child Development Supplement of the Panel Study of Income Dynamics. Participation effects are identified by comparing differences in breakfast patterns between weekdays (when children are in school) and weekends (when they are not), for program participants versus nonparticipants. Results suggest that the SBP is associated with a significant *reduction* in the likelihood of eating breakfast. Additional analyses of the availability of the SBP in schools and adjustments for the quality of the time-diary data fail to alter this basic result. A plausible interpretation of this counter-intuitive result is that, contrary to parents' expectations, participating children may not actually be eating the breakfasts provided at school.

Keywords: School Breakfast Program, participation, low income

The School Breakfast Program and Breakfast Consumption

I. INTRODUCTION

A large body of evidence suggests that eating breakfast may improve educational and nutritional outcomes of school-aged children. Research also shows that breakfast skipping can result in overeating and increased snacking later in the day resulting in a significantly higher risk of obesity. Yet, data from the 1990s shows that one-quarter to one-third of children skip breakfast, with higher rates of skipping among adolescents (Siega-Riz et al., 1998). In 1966, the School Breakfast Program (SBP) was established to provide a nutritious breakfast to children who may otherwise not receive one. However, research on the SBP has been inconclusive regarding whether this program actually increases the likelihood of eating breakfast for participating children. Recently, there have been efforts to expand the school breakfast program to include all children, regardless of family income. Data on whether the SBP meets its basic goal of promoting breakfast consumption would be helpful in this context.

This paper examines the relationship between participation in the SBP and breakfast-eating patterns of school-aged children using data from the 2002 and 1997 rounds of the Child Development Supplement (CDS) of the ongoing Panel Study of Income Dynamics (PSID). The detailed information available in the CDS allows us to address concerns that unobserved differences between SBP participants and nonparticipants may be related to their food intake resulting in biased estimates of SBP effects on breakfast eating.

I examine breakfast outcomes of the SBP by using weekday and weekend time-diary data available for each CDS child to control for endogeneity in SBP participation. Specifically, I compare differences in breakfast patterns between weekdays (when children are in school) and weekends (when they are not), for program participants versus nonparticipants. The time-diary data in the CDS also provide details about the weekday morning routines of schoolchildren that may be useful for efforts to encourage use of the breakfast program.

Results suggest that, contrary to expectations, the SBP is associated with a significant *reduction* in the likelihood of eating breakfast. This finding persists after controlling for endogenous participation in the program. Additional analyses that employ data on the availability of the SBP in schools and adjust for the quality of time-diary data fail to alter this basic result.

Background

Approximately 8 million children participated in the School Breakfast Program during the 2002–2003 school year (FRAC, 2003). All public and private elementary and secondary schools are eligible to participate in the SBP. Participating schools must provide breakfast to all students in attendance. Children from families with incomes less than 130 percent of the federal poverty line receive free breakfasts at school, while reduced-price meals are available to those with incomes between 130 percent and 185 percent of the poverty line. During the 2002–2003 school year, only 21 percent of participating children paid full price for their breakfasts (FRAC, 2003).

The data is mixed on whether the SBP promotes breakfast eating among participants with results varying by the definition of breakfast. Data from the Student Nutrition Dietary Assessment–I shows that when breakfast is defined as any food or beverage consumption between wake up and 45 minutes after the start of school (or any consumption in this time that exceeds 50 calories), the availability of the SBP was not associated with any increase in the rate of breakfast eating (Devaney and Fraker, 1989; Gleason 1995). Only when breakfast was defined more strictly as food intake exceeding 10 percent of the recommended RDA was there a statistically significant difference between participating and nonparticipating schools in the rate of breakfast eating among low-income students (Devaney and Stuart, 1998; Gleason and Suitor, 2001). At the same time, studies on the nutritional impact of the program also suggest that provision of breakfasts in school has a positive impact on the nutritional quality of children's diets (e.g., Bhattacharya, Currie, and Haider, 2004), significantly improving scores on the Healthy Eating Index, reducing the percentage of calories from fat, and reducing the likelihood of vitamin deficiencies.

While it is reassuring that the School Breakfast Program may improve the quality of breakfast for participants who eat breakfast, the apparent lack of a program effect on its basic goal of providing breakfast for those who may otherwise not get one is disappointing, especially given the associations between breakfast eating and cognitive outcomes, short-term school performance, and even obesity (Pollitt and Mathews, 1998). The non-result may be driven by unobserved differences between program participants and nonparticipants that are also correlated with eating patterns. As Gleason and Suitor (2001) show, children below the poverty line who are most likely to be participants are also more likely to skip breakfast than higher income children. Rushed morning schedules, long bus or travel times, and other aspects of weekday morning routines that are not routinely captured in survey data, can adversely affect breakfast consumption and may disproportionately affect low-income children leading to a downward bias in cross-sectional estimates of the program's effect. On the other hand, parents who enroll in the breakfast program may be more health conscious and aware of the benefits of eating breakfast leading us to over-estimate the program's effects.

In an attempt to control for this self-selection into the program, Gordon, Devaney, and Burghardt (1995) use a two-stage estimation model in which meal prices and breakfast food service characteristics were used to predict SBP participation and identify causal effects of the program. Results once again showed that SBP participation was unrelated to the likelihood of eating breakfast. However, the identifying variables were not significant predictors of program participation, making their results inconclusive.

Recently, Bhattacharya et al. (2004) used cross-sectional data from the National Health and Nutrition Examination Survey to control for endogenous participation in the breakfast program by comparing participating and nonparticipating schools between the school year (when the SBP program was in effect) and the summer (when the program was not in effect). They find that availability of the program in schools improved the nutritional quality of children's diets but did not increase their likelihood of eating breakfast. However, these dietary improvements were concentrated among children from higher-income families with incomes over 185 percent of the federal poverty line (FPL) rather than

lower-income children who may have been expected to benefit more. The study authors interpret this odd result as indicating that higher-income parents are more able to take advantage of the nutritional benefits of the SBP than lower-income parents. Finally, their reliance on seasonal variation in the program availability is undercut by the widespread existence of summer feeding programs in schools across the country that are likely to depress estimated SBP effects on breakfast eating.

This paper approaches the endogeneity problem by using the unique CDS time diaries that record weekday and weekend time use for each child. The approach is similar to Bhattacharya et al. (2004); however, we focus on the breakfast consumption effects of both participation in the program and in-school availability of the SBP. The two days of time use data allow me to estimate fixed-effects models that control for unobserved differences between participants and nonparticipants that may also be correlated with breakfast eating/skipping.

II. METHODS

The relationship between SBP participation and the likelihood of breakfast eating is specified as follows:

$$Y_{id} = \alpha + \beta X_{id} + \gamma SBP_i + \lambda Weekday_{id} + \delta SBP_i \bullet Weekday_{id} + \theta_i + + \varepsilon_{id}$$

where Y_{id} represents the breakfast outcome under consideration for child i for day d. SBP_i represents child i's participation in the breakfast program, X_{id} represents a vector of child and family background characteristics, and λ represents differences in school day and non-school-day activities.

While the CDS data includes information on a rich set of characteristics, SBP participants may differ from nonparticipants in unobserved ways, θ_i, (e.g., dietary preferences) that may also be related to their propensity to eat breakfast, muddying a causal interpretation of the estimated coefficient on SBP in (1). Therefore, I estimate equation (1) using fixed-effects techniques and weekday and weekend data on breakfast patterns to difference out the unobserved child-specific factors that may be correlated with both program participation and breakfast consumption. The coefficient δ in the fixed-effects models identifies

the *within-person* weekday-weekend changes in breakfast eating that are associated with exogenous changes in participation due to children being in school on weekdays and out of school on weekends. Assuming that the weekday-weekend change in breakfast consumption would be similar between nonparticipants and participants in the absence of the breakfast program, δ measures the causal effect of the program on the likelihood of eating breakfast. Child-specific factors like age, race/ethnicity, and gender, which do not vary between weekdays and weekends, are differenced out of the model, thus we will not be able to identify their effects.

It is possible that SBP parents use the savings in food expenses due to the weekday program to augment food for their children on weekend days. In this case, the weekday-weekend difference between participants and nonparticipants will reflect more than just change in SBP availability. However, as Bhattacharya et al. (2004) discuss, the SBP represents a monthly transfer of $25 for students receiving free breakfasts. This small transfer is likely to result in only a modest increase in the value of food consumed ranging from approximately $4 to $12 per month, or $1 to $3 per weekend, presumably not enough to invalidate the identification strategy.

III. DATA

The CDS collected data in 1997 and again in 2002 on up to two randomly selected children of PSID respondents, aged 0 to 12 years in 1997. Data were collected both from primary caregivers (who were living with the child) and from the children themselves. The majority of primary caregivers in the survey were biological mothers. If biological mothers were not living with the child, then interviews were attempted with stepmothers or other female legal guardians (usually grandmothers) before fathers or other adult males (Institute for Social Research, 2006). Child interviews took place only during the school year. In 2002, the CDS collected information from 2,907 children aged 5 to 19 years.

Time Diaries in the CDS

The CDS collected a complete time diary for 88 percent of the surveyed children in 2002. The time diaries provide detailed accounting of activities for one randomly sampled weekday and one randomly sampled weekend day. For younger children (i.e., under 9 years), diaries were often completed by a parent alone or in cooperation with a child. Older children were expected to fill out the time diaries by themselves or with the assistance of the primary caregiver if needed. The time diaries were reviewed and edited by interviewers and codes were created for each recorded activity.

The time diary asked several questions about the child's flow of activities over a 24-hour period beginning at midnight of the designated day. For each activity reported, respondents were asked to provide information about the time the activity began and ended; where the child was during that activity; who was doing that activity with the child; who else was there but not directly involved in that activity; and what else the child was doing along with the primary activity—the secondary activity. Four-digit codes identify detailed activities such as brushing teeth, bathing, eating, and playing. The 1997 activity codes are at the 3-digit level, therefore less detailed than the 2002 codes. The time-diary data are presented at the activity level for each child and each diary day. Thus, in the 2002 data, there were 99,467 activities corresponding to an average of over 20 activities per diary day. Educational activities in the school day are not separately identified in the child's time diary (a 1997 teacher time diary focused on activities at school).

Substantial methodological work has established the validity and reliability of data collected in time-diary form for adults (Juster and Stafford, 1985). The open-ended format of the time diary avoids social desirability biases that may be prevalent in stylized time-use data (Hofferth, 1999), especially relevant in the case of an approved activity such as breakfast consumption. Confidence in the diary data is supported by Harris and Eccles (2005), who examine the relationship between sports participation and adolescent development using both the CDS time-diary data and stylized time-use estimates in the CDS.

They find similar results using both types of data. More recently, Mahoney, Harris, and Eccles (2006) use the CDS time-diary data to examine issues of youth development and participation in organized activities.

One potential problem with the use of time diaries stems from restriction of data collection to just two days in the week since time use can vary by season, day of the week, and typicality of the day. This type of measurement problem appears more likely for rare events than for a daily activity such as eating breakfast. Still, I use a CDS time-diary question assessing the typicality of the day to exclude cases that were rated "not at all typical." Only 7 percent of the diaries were rated this way.

Another problem with time diaries relates to the lack of detail about large blocks of time spent at work or at school (Stafford, 2006). While the CDS time diary requires meals eaten at school to be separately recorded from class time, weekday diaries may be wrongly recorded without making this distinction. Sensitivity analyses explore the extent to which this problem affects the basic results.

To examine breakfast outcomes using the time-diary data, I first define a "breakfast window." The window is defined differently for weekdays compared to weekends to allow for different routines on these two days. Thus, on weekdays, the breakfast window is defined as beginning at 5:00 a.m. and ending at 9:00 a.m. For weekends, the breakfast window is defined as starting at the wake-up time and ending two hours after wake up. I also use this breakfast window to identify the child's other morning routines on each of these two days.

Breakfast Outcomes

There are four activity codes in the 2002 time diary that record eating activities (meals at home; meals at another home; meals outside including at school, in a restaurant, etc.; snacks, irrespective of location).[1] Breakfast was defined as any food or drink (including snacks) consumed during the breakfast window. Since the weekend definition of the breakfast window is dependent on waking time, it is possible that a meal consumed on a weekend afternoon could be defined as breakfast. To prevent this, I

[1]The 1997 codes do not distinguish between snacking and meals.

also restricted the analysis to those who wake up between 5:00 a.m. and 10:00 a.m. Both primary and secondary activities were included in this breakfast definition. Thus, a child whose primary activity was traveling to school during the prescribed weekday window would also be defined as having eaten breakfast, if his/her secondary activity was eating while on the road.

Explanatory Variables

Program Participation (SBP)

Participation in the breakfast program was determined using primary caregiver response to the question "Does the child usually eat breakfast at (school/childcare center/ preschool/Head Start) under the Federal School Breakfast Program?" "Usually" was defined as approximately 3 days a week. Thus, "usual participation" need not correspond to the actual consumption of a school breakfast on the day of the weekday time diary.

Program Availability in Schools (SBA)

Information on breakfast availability in schools is available for the 1997 data from that year's questionnaire for elementary school administrators. Due to the low response rates from school administrators, availability data is only present for a small subgroup of 1997 CDS children with valid participation data and two days of diary information. Of approximately 374 children with administrator data, only 10 children had inconsistencies between primary caregiver reports of SBP participation and school administrator reports of program availability (i.e., were reported to be SBP participants by their primary caregivers while not having the program available in school). These data give us confidence that primary caregiver reports of SBP participation status are not inaccurate and can be used to infer availability in schools for those with missing administrator data. Specifically, we recoded SBA equal to

one for cases where the primary caregiver reported SBP participation but availability data was missing. In addition, we also recode 10 cases where administrators recorded SBA=0, but SBP=1. [2]

Weekday

The models also control for whether the observation came from a weekday (versus a weekend day). Studies show that there is a significant difference in dietary intake between weekends and weekdays, with a higher energy intake and consumption of alcohol and fat on weekends (Haines et al., 2003) though these differences were smaller than average for the age group under consideration in this study. I also control for whether the weekend diary was collected on a Sunday.

Morning Routines

In addition to breakfast eating, the time-diary data allow other morning routines in the breakfast window to be identified. The waking time and the time the child left the home were calculated and included as covariates in the fixed effects models. Missing data are reset to zero and flagged with dummy variables. Some models also controlled for other morning activities via dummy variables identifying time spent on personal care, household work, in formal or informal daycare, in organized activities (such as clubs, church, etc.), sporting activities, other active leisure, passive leisure, or in transit.

Final Sample

The 2002 analysis was restricted to children between 6 and 18 years of age who were enrolled in the first through twelfth grades and whose primary caregivers were their mothers (biological, step- or adoptive, foster) and where the family heads were also the parents. There were 2,030 children who met these criteria. These data were merged with the time-diary data for children whose reported waking time was between 5:00 a.m. and 10:00 a.m., who reported eating at least once during the diary day (either meal or snack), and who also reported being in school by 10:00 a.m. during the weekday diary day. There were

[2]The mean characteristics of program participants with this inferred SBA data are not significantly different from the characteristics of participants with SBA data provided by administrators.

1,521 cases that met our selection criteria and had weekday diary data, of which 1,134 had valid weekday and weekend data for the fixed effects models.

We also estimate the weekday-weekend difference in breakfast consumption between students in schools where the SBP is available versus unavailable using data from the 1997 CDS when the sample children were between 0 and 12 years of age. This formulation more closely mimics the approach of Bhattacharya et al. (2004) and is also interesting from a policy perspective since states can alter the availability of the SBP but cannot forcibly alter participation rates in the program. Models are estimated on the sample of children in school, aged 6 to 12 years. Using the same sample exclusions as in the 2002 analysis, the available 1997 sample size consists of 803 children with two days of valid diary data for participation models and 484 children for the analysis of availability of breakfasts in schools.

IV. RESULTS

Table 1 presents weighted means for the full 2002 sample of 1,521 cases with weekday data and by their SBP participation status. Approximately 28 percent of the sample reported usual participation in the SBP. The low level of participation reflects the fact that the SBP is not available in all schools and therefore to all students. In the 2002–2003 school year, only 78 percent of schools that offered the School Lunch Program also offered the SBP, and only 42 percent of students receiving subsidized school lunch also received a subsidized school breakfast (FRAC, 2003). When the 1997 sample is restricted to children who attend schools where the program is available, 63 percent of the children are reported to be usual program participants.

Almost one out of every two SBP participants in 2002 reports skipping breakfast on their typical weekday diary day, while one of every five nonparticipants skip breakfast. Overall, a quarter of children skip breakfast in the full 2002 sample of all participants and nonparticipants. Breakfast consumption was somewhat higher in the younger 1997 sample of children attending schools where the SBP was available, with 57 percent of program participants recording a weekday breakfast compared to 83 percent of nonparticipants. Still, the recorded rates of breakfast skipping in the CDS appear to be on the high side.

Table 1
Descriptive Statistics for Weekday Cases

Variable	Usual Participants	Nonparticipants
2002 Data, N=1,521	N=435	N=1,086
Family Recd. Food Stamps in 2002	0.33 (0.02)	0.06 (0.01)
# < 18 yrs in household	2.49 (0.06)	2.06 (0.03)
Children under 5 yrs	0.34 (0.02)	0.20 (0.01)
Single Parent	0.57 (0.02)	0.23 (0.01)
Region		
South	0.60 (0.02)	0.34 (0.01)
Primary Caregiver		
Employed	0.62 (0.02)	0.77 (0.01)
Years of Education	11.7 (0.12)	13.5 (0.07)
Eats Weekday Breakfast		
Full sample	0.51 (0.02)	0.79 (0.01)
1^{st}–5^{th} grade	0.52 (0.03)	0.91 (0.01)
6^{th}–8^{th} grade	0.52 (0.05)	0.79 (0.03)
9^{th}–12^{th} grade	0.48 (0.06)	0.62 (0.03)
1997 data, SBA=1 (N= 436)		
Eats Weekday Breakfast		
Full sample	0.57 (0.03)	0.83 (0.03)
1^{st}–5^{th} grade	0.59 (0.03)	0.87 (0.03)

For example, Siega-Riz et al. (1998) report that the rate of breakfast skipping in different populations varies from 7 percent to 34 percent depending on the age range and definitions of breakfast. Their analysis of trends in breakfast consumption from 1965 to 1991 shows that 25 percent of boys and 35 percent of girls skipped breakfast in 1991, with larger rates for older adolescents. While blacks and whites had similar rates of breakfast consumption in 1965, by 1989–1991, black adolescents were significantly less likely to consume breakfast compared to white youth.

It is possible that the high rate of breakfast skipping for SBP participants reflects socioeconomic differences in eating patterns as well as the downward trend in breakfast consumption over the years. SBP participants are more likely to be non-white, from poorer families, with less educated mothers than nonparticipants. Their families have more children under 18 years, and they are more likely than nonparticipants to have siblings under the age of 5 years, characteristics that have been linked to breakfast skipping in prior work (Devaney and Fraker, 1989). Notably, while nonparticipants are evenly distributed across the country, SBP participants appear to be concentrated in the South—fewer are from the Northeast or North Central regions. This regional distribution is consistent with the relative success of southern states in extending the SBP to students who also participate in the school lunch program (FRAC, 2003). It is also noteworthy that while non-SBP participants show a sharp decline in breakfast consumption as they progress into higher grades, the downward trajectory in breakfast consumption is significantly less pronounced among SBP participants in the 2002 CDS sample.

Table 2 presents the morning routines and activities by SBP participation and diary day for the sample of children with two days of valid diary data. Contrary to expectations, program participants have a higher rate of breakfast consumption on weekends compared to weekdays (when they attend school). Nonparticipants on the other hand have a lower rate of weekend breakfast consumption than weekday consumption. This weekday-weekend difference between participants and nonparticipants is statistically significant and may be driven by weekday-weekend differences in their routines. According to Table 2, SBP participants arise and leave home significantly earlier than nonparticipants on weekdays but not on weekends. Participants report starting classes ten minutes ahead of nonparticipants, a statistically

Table 2
Time Use in the Breakfast Period by Usual Participation[a,b]

	Participants		Nonparticipants	
Variable	Weekday	Weekend	Weekday	Weekend
Waking Time*	6:30 a.m. (0.03)	8:00 a.m. (0.05)	6:40 a.m. (0.02)	8:00 a.m. (0.03)
Leave Home	7:17 a.m. (0.03)	9:05 a.m. (0.10)	7:34 a.m. (0.02)	8:53 a.m. (0.05)
Start Classes*	7:50 a.m. (0.03)	-	8:00 a.m. (0.02)	-
Travels in morning (%)*	1.00	0.16 (0.02)*	0.97 (0.01)	0.25 (0.02)
Does household work (%)	0.07 (0.01)*	0.15 (0.02)	0.12 (0.01)	0.18 (0.01)
Active Leisure (%)	0.01 (0.01)*	0.20 (0.02)	0.06 (0.01)	0.28 (0.02)
Passive Leisure (%)	0.28 (0.02)	0.59 (0.03)	0.25 (0.02)	0.54 (0.02)
Eats Breakfast (%)*	0.51 (0.03)	0.67 (0.03)	0.84 (0.01)	0.68 (0.02)
Eats Breakfast (%)* (SBA=1)	0.59 (0.03)	0.68 (0.03)	0.84 (0.03)	0.68 (0.04)

Standard deviations are in brackets.
*-statistically significant weekday-weekend difference between participants and nonparticipants
[a]Based on calculation from the 2002 sample with 2 days of diary data. Breakfast rates for those with SBA=1 are drawn from the 1997 sample.
[b]Standard deviations of times are measured in hours.

significant difference. Participants are significantly less likely than nonparticipants to travel on weekend mornings. On weekday mornings, participants are significantly less likely to perform household work or engage in active leisure.

Fixed-Effects Models Using Weekday and Weekend Data

Table 3 presents the fixed-effects results from linear probability models for the full 2002 sample of 1,134 children with two days of available data.[3] Consistent with the descriptive statistics in Table 2, participation in the breakfast program is associated with a significant reduction in the likelihood of breakfast consumption, a result that persists when additional controls for differences in weekday and weekend morning routines are included in the model. Some children in the 2002 sample who are eligible for the SBP may be nonparticipants because their schools do not offer the program. In the absence of availability data in the 2002 sample, I estimate models excluding those cases that report subsidized receipt of school lunch but not usual participation in the SBP. In column (3) of Table 3, the negative results are unchanged once eligible nonparticipants are removed from the analysis. Since dietary intakes are reported to be lower in the spring months compared to winter or fall for 12- to 18-year-olds, I also control for seasonal variation in consumption and other time use by estimating models using only fall and winter diaries. There are no apparent seasonal differences in the relationship between SBP participation and breakfast consumption.

In column (5) we interact the weekday and program participation variables by four indicators for children from families with less than 135 percent of the federal poverty line; children from families with incomes between 135 percent and 185 percent of the poverty line; those with incomes greater than 185 percent of the poverty line; and those with missing income information. The federal subsidy for the breakfast program varies for children in these different income groups with the poorest receiving free

[3]The results from logit models are qualitatively similar and can be obtained upon request.

Table 3
Fixed-Effects Models of Breakfast Consumption Using 2002 CDS Data on Participation in the SBP
(Standard errors in parentheses)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Participation*Weekday	-0.32***	-0.31***	-0.31***	-0.31***	-0.30***		
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)		
Participation*Weekday *<135%FPL						-0.11	0.16
						(0.13)	(0.16)
Participation*Weekday *135–185%FPL						-0.18*	-0.35***
						(0.09)	(0.12)
Participation*Weekday *>185%FPL						-0.35***	-0.33***
						(0.06)	(0.07)
Weekday	0.20***	0.25***	0.15***	0.26***	0.26***		
	(0.03)	(0.05)	(0.04)	(0.04)	(0.04)		
Sunday	0.08**	0.07**	0.06*	0.07*	0.08**	0.07**	0.06
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)
Log(Waking Time)		0.24	0.02		0.17	0.25	0.38*
		(0.16)	(0.16)		(0.16)	(0.16)	(0.21)
Log(Leaving Time)		0.15	0.36*		0.26	0.13	0.34
		(0.20)	(0.20)		(0.20)	(0.20)	(0.25)
	All	All	All—with routines	Excludes eligible but SBP=0	Fall/Winter	All	Elementary grades
# children	1134		1134	976	1060	1134	632

meals, and the highest income groups receiving the smallest subsidies. We expect the poorest program participants to receive the greatest benefit from the SBP.

Results show that the negative relationship between program participation and breakfast consumption is concentrated among students from families with over 135 percent of the federal poverty level. For the poorest children who receive free breakfasts under the program, participation is associated with an insignificant reduction in the likelihood of breakfast consumption. Prior research shows that breakfast consumption tapers off among older students in middle and high school, as does participation in the SBP. When the sample is restricted to elementary grade children, program participation is associated with an insignificant increase in breakfast consumption for the poorest children (p=0.28). However, a significant negative relationship persists for children from families with income over 135 percent of the poverty line, a group that includes needy children receiving subsidized meals.

The Impact of SBP Availability

Table 4 re-focuses the analysis on the 1997 CDS sample which includes information on both student program participation and *school program availability* (SBA).Column (1) reproduces the 2002 results from Table 3, while column (2) presents the analogous estimates using the younger 1997 sample. Results for the SBA models in columns (4) and (5) correspond most closely to those in Bhattacharya et al. (2004), which uses cross-sectional data on breakfast consumption during the school year and in the summer. As stated earlier, that study may be vulnerable to downward bias due to the presence of alternate summer feeding programs. By contrast, the longitudinal data containing weekday and weekend diary data on each student, allows me to factor out the stable heterogeneity across students while also avoiding such bias problems.

Table 4 shows that the negative relationships from the participation models persist in the availability models.[4] Our results imply that children from schools where the breakfast program is

[4]Results are similar in Appendix Table A1 that relies only on administrators' data with no imputations.

Table 4
Fixed-Effects Models of Breakfast Consumption Using CDS Data on SBP Availability and Participation
(Standard errors in parentheses)

	2002	1997				
Variable	(1)	(2)	(3)	(4)	(5)	(6)
SBP*Weekday	-0.31***	-0.23***				
	(0.04)	(0.04)				
SBP*Weekday *<135%FPL			0.20			
			(0.17)			
SBP*Weekday *135–185%FPL			-0.42***			
			(0.15)			
SBP*Weekday *>185%FPL			-0.17**			
			(0.08)			
SBA*Weekday				-0.15**		-0.03
				(0.07)		(0.08)
SBA*Weekday *<135%FPL					-0.05	
					(0.27)	
SBA*Weekday *135–185%FPL					-0.25	
					(0.20)	
SBA*Weekday *>185%FPL					-0.08	
					(0.08)	
SBA*SBP* Weekday						-0.21***
						(0.06)
	All	All	in Elem. schl	w/ SBA data	w/ SBA data	w/ SBA data
# children	1134	803	613	485	485	484

available have a lower likelihood of eating breakfast—once again a counterintuitive result. As in the participation models, column (5) allows the estimated relationship between program availability and breakfast consumption to vary by income category. Results show that availability of the program in schools has a negative association with breakfast consumption across all income groups, with the largest association among poor children eligible for reduced-price meals (incomes between 135 percent and 185 percent of the poverty line). However, the relationships are statistically insignificant due to the small number of poor children in non-breakfast-program schools. In column (6) of Table 4, the coefficient on the three-way interaction between participation, availability, and weekday in the fixed-effects model estimates the weekday-weekend difference in breakfast consumption for participants compared to nonparticipants *in schools where the program is available*. Our essential result remains unchanged—SBP participants are significantly less likely to eat breakfast than nonparticipants in schools where the program is available.

Sensitivity Analyses

Interpreting the negative coefficient on SBP participation as measuring program effects relies on the assumption that the weekday-weekend differences in breakfast consumption would be similar between nonparticipants and participants in the absence of the breakfast program. Instead, if there are other unobserved weekday-weekend differences in breakfast consumption between program participants and nonparticipants, our identification strategy is inappropriate for estimating causal effects of the program. To address this possibility, Table 5 presents results when the sample is restricted to children from lower-income families with less than 200 percent of the FPL, a more homogenous group of children. Program participation continues to be linked to a significant reduction in the likelihood of breakfast consumption in both 1997 and 2002 data. Column (5) restricts the 1997 sample to the sub-group of 375 children who are reported to have the program available in their schools. There is no change in results. In (6), we allow the relationship between participation and breakfast to vary across income groups for these children in participating schools. Results indicate that the negative relationship between participation and breakfast

Table 5
Check on Identification Strategy
(Standard errors in parentheses)

	2002		1997			
Variable	(1)	(2)	(3)	(4)	(5)	(6)
SBP*Weekday	-0.31*** (0.04)	--0.27*** (0.06)	-0.23*** (0.04)	-0.18** (0.07)	-0.21*** (0.07)	
SBP*Weekday *<135%FPL						-0.04 (0.26)
SBP*Weekday *135–185%FPL						-0.39* (0.20)
SBP*Weekday *>185%FPL						-0.11 (0.09)
	All	Income < 200% FPL	All	Income < 200% FPL	SBA=1	SBA=1
#children	1134	393	803	274	375	375

consumption is concentrated in children from poor families with incomes between 135 percent and 185 percent of the poverty line, eligible for reduced price meals.

A comparison of the full- and restricted-sample results suggests that our identification assumptions are not inappropriate.

Data Quality

As stated earlier, time-diary data may not capture detailed activities within large blocks of undifferentiated time spent at school or at work (Stafford, 2006). Thus, it is possible that SBP participants (or their parents) fail to separately record breakfasts at school as they should, instead wrongly recording the activity under the "school" code. More generally, parents or children may have simply omitted a detailed record of their daily activities resulting in under-reporting of breakfast consumption. Since breakfast is more likely to be eaten at school for SBP participants compared to nonparticipants, the under-reporting of school food could bias our estimates of program effects on breakfast consumption downward.

An analysis of CDS data shows that such under-reporting of eating while in school is widespread. Only 19 percent of children in the 1997 sample and 15 percent of the 2002 sample record eating activities during school hours between 10 a.m. and 3 p.m. on the weekday. This failure to record school food occurs at similar rates for SBP participants (84 percent in 1997; 86 percent in 2002) and nonparticipants (80 percent in 1997; 85 percent in 2002). However, the reported rate of breakfast consumption in 1997 is not significantly different for those SBP children who also record school eating versus those who do not (59 percent). In 2002, the rate of breakfast consumption is 14 percent higher for SBP children who also recorded eating activities during the non-breakfast school hours, compared to those who did not (57 percent versus 50 percent).

To examine the extent to which our results showing a negative relationship between SBP participation and breakfast consumption may be driven by the non-reporting of school eating in the time diaries, we flag diaries that do not record any school eating activity including lunch between the non-breakfast weekday hours from 10 a.m. to 3 p.m. Models were re-estimated after interacting explanatory

variables with the diary flags to allow the estimated relationship between SBP participation and breakfast consumption to vary across those with different quality diary data.

Results in Table 6 show that the basic results remain unchanged. Participation in the school breakfast program is once again associated with a reduction in the likelihood of breakfast consumption for children, with statistically significant effects for those who correctly recorded eating during school hours in columns (3) and (5), and effects just short of statistical significance in (1). SBP participation also has a negative effect on breakfast consumption in columns (2), (4), and (6), which report results for samples restricted to children from families with incomes less than 200 percent of the FPL.5 For this more restricted sample, the coefficients for those flagged for more reliable diary data are similar to those in the unrestricted sample, but are estimated with greater error because of the very small number of observations. For example, in the combined 1997–2002 sample in (6), participation effects for those whose diaries also record eating during non-breakfast school hours are identified using data on 102 low-income children with two days of diary data. In spite of this small sample, negative SBP effects fall just short of statistical significance (p-value = 0.11). For all models, tests of the difference between the estimated SBP coefficient for the two types of diaries show that the differences are not statistically significant. Thus, our results do not appear to be driven by time-diary problems in recording eating activities during school hours.6

V. SUMMARY

The results of this study suggest that SBP participants are significantly less likely to eat breakfast than nonparticipants. This result is obtained from fixed-effects models that factor out stable unobserved

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[5]Analysis of the 1997 children with data on program availability shows that 87 percent of children in this income category report availability of the program in their schools.

[6]To check for a more general recording problem where parents or children simply do not provide a detailed record of daily activities, main models were re-estimated after excluding children whose diaries omitted personal care activities like dressing and brushing teeth on weekdays when the children were also reported to have attended school. The basic results are unchanged and may be obtained upon request.

Table 6
Adjustments for Time Diary Data Quality
(Standard errors in parentheses)

	2002		1997		Combined 1997 & 2002	
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Cases reporting eating during school hours						
SBP*Weekday	-0.16 (0.10)	-0.19 (0.15)	-0.26** (0.11)	-0.26 (0.20)	-0.18*** (0.07)	-0.19 (0.12)
Cases with no reported eating during school hours						
SBP*Weekday	-0.34*** (0.04)	--0.27*** (0.07)	-0.22*** (0.05)	-0.16** (0.08)	-0.27*** (0.03)	-0.21*** (0.05)
Test for differences between SBP effects	P=0.10	P=0.66	P=0.71	P=0.66	P=0.22	P=0.86
Sample	All	Income < 200% FPL	All	Income < 200% FPL	All	Income < 200% FPL
#children	1134	393	803	274	1695	606

heterogeneity between program participants and nonparticipants. The results are robust to alternative definitions of "breakfast," different definitions of program availability in schools, and checks for the quality of the time-diary data.[7]

Taken at face value, our results appear to indicate that, strangely, participation in the school breakfast program causes children to increase their rate of breakfast skipping. A more reasonable interpretation of this counter-intuitive result is that while parents of SBP participants may delegate the job of providing breakfast to schools on weekdays, students may not actually eat the breakfast provided at school. This interpretation is consistent with observational studies of SBP participants. Guinn et al. (2002) compared parents' reports of SBP participation with actual eating at school by their children and found a significant difference between parent reports and actual breakfast consumption. Only two-thirds of the children whom parents reported as participants actually entered the breakfast line at school according to this study. Similarly, a descriptive study of breakfast eating habits of inner-city high school students found that despite the free, hot breakfast program in their schools, 48 percent of breakfast-eaters ate at home, compared to only 14 percent who ate at school (Sweeney and Horishita, 2005). Over half of students skipped breakfast citing timing difficulties and schedules.

A recent study of 23 urban school districts listed several barriers to eating school breakfasts, including the lack of sufficient time to eat, tight bus schedules that add to the timing problems, the lack of personnel to supervise breakfast, student preference for play rather than eating, and stigma (FRAC, 2007). School districts that addressed these problems via alternate methods such as classroom provision or grab-and-go breakfasts had higher participation levels among low-income students than school districts that did not. The results of this current study provide additional evidence that the current delivery of school breakfasts needs improvement, supporting the case for innovations in breakfast provision to promote school breakfast consumption among program participants.

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[7] "Breakfast" was also defined as any eating within two hours of waking on the weekends and until 10 a.m. on weekdays. Another definition extended the breakfast window to 10 a.m. on both weekdays and weekends.

Table A1
Models of Breakfast Consumption Using 1997 CDS and Alternate Breakfast Definitions
(Standard errors in parentheses)

	SBA*Weekday	SBP*Weekday	SBP*Weekday	SBP*Weekday	SBA*SBP*Weekday
Variable	(1)	(2)	(3)	(4)	(5)
Main Definition [a]	-0.15**	-0.22***	-0.18**	-0.21***	-0.21***
	(0.07)	(0.04)	(0.07)	(0.07)	(0.06)
Alternate 1 [b]					
Alternate 2 [c]	-0.21***	-0.25***	-0.25***	-0.20***	-0.21***
	(0.06)	(0.04)	(0.07)	(0.06)	(0.06)
	All	All	Income < 200% FPL	SBA=1	All

[a]Breakfast defined as any eating from wakeup till 9 a.m. on weekdays and till hours after wakeup on weekends.
[b]Breakfast defined as any eating from wakeup till 10 a.m. on weekdays and till hours after wakeup on weekends.
[c]Breakfast defined as any eating from wakeup till 10 a.m. on both weekdays and weekends.

Table A2
Fixed-Effects Models of Breakfast Consumption Using Unimputed Program Availability
(Standard errors in parentheses)

	2002	1997					
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SBP*Weekday	-0.31*** (0.04)	-0.22*** (0.04)				-0.23*** (0.08)	
SBP*Weekday *<135%FPL							0.03 (0.31)
SBP*Weekday *135–185%FPL							-0.41* (0.25)
SBP*Weekday *>185%FPL							-0.23* (0.13)
SBA*Weekday			-0.08 (0.07)		0.005 (0.07)		
SBA*Weekday *<135%FPL				-0.04 (0.27)			
SBA*Weekday *135–185%FPL				-0.14 (0.21)			
SBA*Weekday *>185%FPL				-0.05 (0.08)			
SBA*SBP*Weekday					-0.23*** (0.08)		
	All	All	w/ SBA data	w/ SBA data	w/ SBA data	SBA=1	SBA=1
# children	1134	804	336	336	336	222	222

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