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ARTICLE

Farm to school programming spillovers and households' fruits and vegetables purchases

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Abstract

The number of US school food authority's (SFA) implementing Farm to School Programming (FTSP) is growing. Little is known about potential spillover effects of school children's exposure to FTSP on household food purchases. We measure the relationship between school age children's exposure to FTSP and household-level Food-At-Home fruits and vegetables (FV) expenditures and expenditure shares. Combining Farm to School Census data on SFAs' FTSP participation with household-level scanner data, we estimate positive relationships between FV expenditures and different measures of children's exposure to FTSPs, especially for metro households. However, the magnitude of these relationships is likely too small to be meaningful.

KEYWORDS

farm to school activities, farm to school programming, fruits and vegetable expenditures, spillover effects

JEL CLASSIFICATION

D10, I12, Q18

1 | INTRODUCTION

During the period 2007–2010 the vast majority of the US population failed to consume the recommended intakes of fruits and vegetables (FV) (Moore & Frances, 2015; National Cancer Institute, 2014). Health institutions such as the Centers for Disease Control and Prevention (CDC), and the World Health Organization (WHO) provide guidance on strategies to increase FV consumption (Centers for Disease Control and Prevention, 2017; World Health Organization, 2002). Given the importance of promoting FV consumption at an early age (Thompson & Amoroso, 2011), several

nutrition programs in the US target school children with a variety of initiatives/interventions including setting nutritional standards for all foods served/sold in schools, providing subsidized meals that meet nutritional standards, increasing monitoring of school food authorities' maintenance of nutritional standards, and providing nutrition information to parents (The White House, 2010; USDA, 2013).

School initiatives and activities that include, among others, promoting the procurement of local foods to be served in school, establishing/tending to a school garden, and the integration of local farming/sourcing in the curriculum, are overall defined as farm to school (FTS) activities, or farm to school programming (FTSPs). The goals of FTS activities are: (1) improving children's health and education outcomes; (2) promoting equity in the food system; and (3) inspiring youth toward careers in agriculture (USDA FSN). Participation in FTSP has increased over time. Data from the 2015 and 2019 waves of the Farm to School Census (FTSC) Survey, show about 42% and 65% of school food authorities (SFAs) participating in FTS activities during school years 2013/14–2014/15 (2015 FTSC) and 2018/19 (2019 FTSC), respectively. Funding for FTSP, which can come from a multitude of sources, has also increased. Federal FTSP grants, authorized as part of the Healthy Hunger-Free Kids Act of 2010, amounted to about $5 million annually from 2013 to 2018 (Food and Nutrition Service, 2017), reaching $12.1 million in 2020 (National Farm to School Network, 2020).

The literature studying the effect of FTSP on school children has grown as well.[1] Existing studies find exposure to FTSPs increasing students' knowledge and acceptance of FV (Holland et al., 2015; Joshi et al., 2008; Moss et al., 2013). Further, FTSP can improve children's diets by facilitating multiple exposures to a variety of FVs and through activities such as taste tests, food coaches, and school orchards/gardens (Taylor & Johnson, 2013). Davis et al. (2015) review finds school garden interventions to be positively related to increased preference for vegetables, and to improved attitudes and willingness to choose vegetables during lunch. Further, in their systematic review Prescott et al. (2020) report that 9 out of the 10 multicomponent promotion activities studied reviewed, found improved nutrition knowledge, increased fruit preference and, in three cases, either improved consumption of fruit, vegetables, or both. Consistent with studies showing that multiple and repeated interventions foster children's long-term acceptance of FV (e.g., Blom-Hoffman et al., 2004; Lakkakula et al., 2010; Wardle et al., 2003), past exposure to FTSP appears associated with school children's higher willingness to try FV, more knowledge of agriculture/nutrition, and higher FV consumption among children with the lowest FV intake (Yoder et al., 2014).

In this study we assess whether households whose children are exposed to FTSP show higher FV expenditures than those that are not. We hypothesize school children exposure to FTSP to affect household Food-at-Home (FAH) FV expenditure (expenditure share) via two possible mechanisms: (1) School children repeated exposure to FTSP may reduce children's resistance to consuming FV at home, which, in turn, may lead households to purchase more FVs; and (2) As children are exposed to local and/or organic FV, they may become less resistant to consume produce with such features; thus, households may shift some of their purchases to include FV with these attributes, resulting in higher FV expenditures.

We use 2 years of the USDA FTSC, merged with Circana-Consumer Network Panel (CNP) household-level data on FV purchases for households with school-age children. Exposure to FTSP is measured as exposure duration and programming intensity. We further focus on subsamples of households residing in metro (where the majority of SFAs implementing FTSP are located—Bonanno & Mendis, 2021; Botkins & Roe, 2018) and nonmetro areas, and below and above 185 percent of the poverty

[1]Other research study SFAs' local food sourcing and spending, and the factors facilitating FTS participation. Research on SFAs' local food spending finds per-capita local food expenditures inversely related to SFAs procuring local foods directly from farmers (Christensen et al., 2019), while purchasing local foods from intermediaries makes school meal cost reduction less likely (Fitzsimmons & O'Hara, 2019). Higher SFA expenditures for local foods is associated with SFAs' decisions to buy from a wider local food-shed, reducing the benefits of FTS for nearby farmers (Plakias et al., 2020). With respect to factors facilitating FTSP adoption, (Wen & Connolly, 2022) found that neither state-funded FTS policies, nor the presence of food hubs affect SFA's FTSP. Other studies find state-level FTSP regulation to be associated with a higher likelihood of schools implementing FTSP, and a higher frequency of local foods served in school meals (McCarthy et al., 2017). Nicholson et al. (2014) find States with laws requiring/encouraging FTSPs, show higher FV availability in schools, relationship mediated by schools' adoption of FTSPs.

line. Additionally, we perform two falsification exercises where we assess the relationship between FTSP and (1) liquor expenditure of households with children and (2) FV expenditures of households without children.

Our study expands upon some of the early work on FTSP and household-level adoption of healthy diets (Joshi et al., 2008): in a Los Angeles case study, 90% of interviewed parents whose children engaged in FTSPs self-reported positive changes in grocery shopping patterns and at-home cooking (Joshi et al., 2006); in another case study in Burlington, VT, 32% of respondent parents believed their family diet had improved due to their children's participation in FTSP (Schmidt et al., 2006). The design of our study is similar to that of Brunello et al. (2014), who use scanner data and a difference-in-difference approach to compare sales of unhealthy snacks in supermarkets located in proximity of schools participating in an EU campaign providing FV to school children (treated) to those located outside that radius (control) in Rome. Differently from these authors, we consider household purchases instead of store sales, and focus on FV.

Further, we contribute to the literature investigating potential spillovers of publicly funded programs to support nutrition and food security among children. Bhattacharya et al. (2006) finds that children participating in the School Breakfast program improved their nutritional outcomes, but other household members experienced fewer positive effects. Ver Ploeg (2009) finds that children ages 5–17 living in WIC-participating families have higher Healthy Eating Index (HEI) than children in nonparticipating families. Kuhn (2018) reports that households where children receive school meals benefit from lower reduced consumption over the SNAP cycle, although there was no statistically significant effect on the adults in the household. Cleary et al. (2020), study the relationship between the number of meals consumed in schools and household-level HEI using data prior to the Healthy Hunger-Free Kids act, finding limited evidence of spillover effects.

Our findings indicate that, overall, FTSP exposure is associated with higher household FV expenditures and expenditure shares. This relationship is mostly driven by education/garden-based activities. These results, which are robust to different specifications of the FTSP variables, are mostly driven by metro households. Further, we fail to find clear patterns across households sub-sampled by poverty levels. Falsification exercises show that bias in the estimated relationship between children's exposure to FTSP activities and households FV expenditures may magnify some of our estimates.

This paper proceeds as follows: first, we describe the empirical model. Then we discuss the data used, our approach to match the FTSC data with the Consumer Network Panel, and the different metrics used to measure FTSP exposure intensity. A description of the empirical results comes next, followed by a discussion of their implications. Closing remarks and limitations conclude.

2 | EMPIRICAL METHODS

2.1 | The econometric model

The objective of this analysis is to assess whether a relationship exists between a household's FV purchases and the intensity of FTSP school-aged children in the household are exposed to. We treat FV expenditures and expenditure shares as latent variables. Let FV_i represent either household i's FV expenditure or its FV expenditure share. If $FV_i > 0$, it will take the value of the expenditures (expenditure shares) observed in the data or $FV_i = FV_i^\star$. For households showing no purchases of FV in the data, $FV_i \leq 0$, and $FV_i^\star = 0$.

We assume $FV_i^\star$ to be a function of a series of covariates:

$$\begin{aligned} FV_i &= f(FTSI_i, Dem_i, Market_i, Loc_i, Time_i|\beta) + \varepsilon_i \\ FV_i^\star &= FV_i \quad \text{if} \quad FV_i > 0 \\ FV_i^\star &= 0 \quad \text{if} \quad FV_i \leq 0 \end{aligned} \quad , \tag{1}$$

where, FTSI is a measure of FTSP exposure intensity; Dem are household-level demographic characteristics; Market are county-level market characteristics; Loc and Time represent, respectively,

time-invariant controls (urbanization/rurality and state fixed-effects) and month- and year- effects. For ease of exposition, these variables are collapsed in X; β is a vector of coefficients to be estimated, conformable with X. The unexplained variation in FV_i, ε_i is assumed to be $\sim N(0, \sigma^2)$. Equation 1 is estimated using a maximum likelihood Tobit estimator (Tobin, 1958) left-censored at zero.[2] Following McDonald and Moffitt (1980) we obtain three marginal effects characterizing the relationship between FTSP children exposure intensity and: (1) the probability of purchasing FV; (2) the overall (unconditional) FV expenditure (expenditure share); and (3) the conditional (on purchasing FV) FV expenditure (expenditure share):

$$\frac{\partial P(\mathrm{FV} > 0)}{\partial \mathrm{FTSI}} = f(z)\beta^{\mathrm{FTSI}}/\sigma, \tag{2}$$

$$\frac{\partial \mathrm{FV}}{\partial \mathrm{FTSI}} = F(z)\beta^{\mathrm{FTSI}}, \tag{3}$$

$$\frac{\partial \mathrm{FV}^{\star}}{\partial \mathrm{FTSI}} = \beta^{\mathrm{FTSI}}[1 - \mathrm{FTSIf}(z)/F(z) - f(z)^2/F(z)^2], \tag{4}$$

where FTSI is a measure of FTSP Intensity, β^{FTSI} is its estimated Tobit coefficient, $z = \beta' X/\sigma$, $f(z)$ is the standard normal probability density function (PDF) of z, and $F(z)$ is its cumulative distribution function (CDF).

2.2 | Model specifications and FTSP exposure intensity measures

We create different metrics of FTSI by relying on previous literature. A general consensus exists that repeated/multi-intervention programs influence school children's long-term acceptance of FV (e.g., Blom-Hoffman et al., 2004; Lakkakula et al., 2010; Wardle et al., 2003).[3] Thus, our first two measures of FTSI are: (1) the number of consecutive years an SFA implemented FTSP (i.e., the maximum number of years children are potentially exposed to FTSP) capturing repeated exposure ($\mathrm{NFTS}^{\mathrm{Years}}$), and (2) the number of activities implemented each year, as a proxy for multi-intervention programming ($\mathrm{NFTS}^{\mathrm{Act}}$). Specifications 1 and 2 are, respectively

$$\begin{aligned} \mathrm{FV}_i = \beta^{\mathrm{NFTS^{Years}}}\mathrm{NFTS}_i^{\mathrm{Years}} + \sum_{d=1}^{D}\beta_d^{\mathrm{Dem}}\mathrm{Dem}_{\mathrm{di}} + \sum_{m=1}^{M}\beta_m^{\mathrm{Market}}\mathrm{Market}_{\mathrm{mi}} \\ + \sum_{l=1}^{L}\beta_l^{\mathrm{Loc}}\mathrm{Loc}_{\mathrm{li}} + \sum_{t=1}^{T}\beta_t^{\mathrm{Time}}\mathrm{Time}_{\mathrm{ti}} + \varepsilon_i \end{aligned}, \tag{5}$$

$$\begin{aligned} \mathrm{FV}_i = \beta^{\mathrm{NFTS^{Act}}}\mathrm{NFTS}_i^{\mathrm{Act}} + \sum_{d=1}^{D}\beta_d^{\mathrm{Dem}}\mathrm{Dem}_{\mathrm{di}} + \sum_{m=1}^{M}\beta_m^{\mathrm{Market}}\mathrm{Market}_{\mathrm{mi}} \\ + \sum_{l=1}^{L}\beta_l^{\mathrm{Loc}}Loc_{\mathrm{li}} + \sum_{t=1}^{T}\beta_t^{\mathrm{Time}}\mathrm{Time}_{\mathrm{ti}} + \varepsilon_i \end{aligned}. \tag{6}$$

In Specification 3, we account for the simultaneous implementation of multiple FTSP activities. Following (Bonanno & Mendis, 2021) we use Principal Component Factor Analysis (PCFA) to identify activities showing common variation, isolating those with loadings >0.5 for each factor ($\mathrm{NPCF}_n^{\mathrm{Act}}$).

[2]Participation and continuation in the FTSP could reflect interest in/easier access to local food, which may lead to endogeneity and self-selection bias. Attempts to correct for endogeneity of FTSP participation and intensity/duration using the Endogenous Dose-Response Model (Baum & Cerulli, 2016; Cerulli, 2015; Filippetti & Cerulli, 2018) using excluded instruments as suggested in (Bonanno & Mendis, 2021) failed to provide believable and reliable results.

[3]The effects of training programs on employment and earnings exhibit similar patterns; for example, Flores et al. (2012); (Choe et al., 2015).

$$FV_i = \sum_{p=1}^{2} \beta_n^{NPCF^{Act}} NPCF_{ni}^{Act} + \sum_{d=1}^{D} \beta_d^{Dem} Dem_{di} + \sum_{m=1}^{M} \beta_m^{Market} Market_{mi} + \sum_{l=1}^{L} \beta_l^{Loc} Loc_{li} + \sum_{t=1}^{T} \beta_t^{Time} Time_{ti} + \varepsilon_i \quad (7)$$

Note that the equations presented above should have included two different time subscripts, one capturing the specific month where the FV expenditure is recorded, and another for the calendar year, omitted for simplicity. Also, note that FTSI variables and the household characteristics do not vary across months, but only across years.

2.3 | Falsification exercises

A positive relationship between FTSP and FV expenditures may be driven by changes in dietary quality over time, or other factors driving both higher FV expenditures and SFAs' incentives to adopt FTSP. To verify the extent to which our results may be an artifact of other forces at play, we conduct two falsification exercises.

In the first falsification exercise, we assess whether our results of interest may be driven by systematic difference in consumption habits across geographies and time periods resulting in higher than average FV expenditures in areas with more FTS activities. To detect the presence of such patterns, we estimate Specifications 2 and 3 using liquor expenditures and expenditure shares (out of total expenditures for food and liquor) by households with children as dependent variables. Intuitively, there should not be any relationship between children in the household being exposed to FTSP, and the decisions of the adults in the households to purchase liquors. Thus, we expect to find no relationship between exposure to FTSP activities and liquor expenditures (and expenditure shares). If instead FTSP adoption is positively correlated with unobserved factors affecting dietary habit, we will observe a negative and statistically significant relationship between FTSP intensity and liquor expenditures. Similarly, our estimates may suggest higher FV expenditures because overall expenditures across all categories may be higher in more affluent areas, also more likely to have an SFA implementing FTSP; if that is the case, we should observe a positive relationship between household liquor expenditures and FTSP exposure.

In the second falsification exercise, we estimate the relationship between FTSP exposure intensity and FV expenditure (expenditure shares) using a sample of households without children and Specifications 2 and 3. A positive and statistically significant association between the implementation of FTSP and household without children's FV expenditures and FV expenditure shares, would indicate that any estimated relationship between FTSP intensity and FV expenditures are likely to be biased upward due to spurious correlation. The magnitude of the relationship between FTSP and FV expenditures—measured by means of estimated average marginal effects—will inform on the magnitude of such bias.

3 | DATA

We primarily use two data sources: 2 years (2013 and 2015) of USDA's FTSC[4] and Circana Consumer Network Panel (CNP) for the years 2011–2014, accessed via a third-party agreement with the USDA ERS. The FTSC contains information on SFAs' participation in the FTSP, including the activities implemented and the characteristics of the SFAs. We follow the procedure used by Bonanno and Mendis (2021) to identify SFAs participating in both FTSC years (2013 and 2015). We

[4]The 2013 FTSC contains information about the 2011/12 school year and the 2015 FTSC contains information about the 2013/14 school year. In 2020, the USDA released another year of the FTSC. However, 2020 FTSC only contains data for the 2018/2019 school year. Because 2015–2017 FTSP information is not available, we cannot use FTSC 2020 in this study to investigate the effect of FTSP over time.

only retain SFAs appearing in both years of the FTSC located in a unique zip-code. Seven thousand and three hundred thirty SFAs are present in both the 2013 and 2015 FTSC. Of those, 94.7% show unique zip-codes, for a total of 6942 SFAs retained in the data.

The CNP provides data on daily household food purchases as well as households' demographic characteristics. To limit the number of nonpurchase observations, we aggregate total food expenditures and expenditures for FV at the monthly level (more details below), and only include the CNP "static panel" of households, which account for 70 to 80 percent of all purchases recorded in the CNP data (Muth et al., 2016). Given that only school-age children can be exposed to FTSP activities, we only retain households with at least one child aged 6 to 18 years.

We combine the CNP data with the FTSC matching households by their zip-code of residence with the corresponding SFA. Because of the majority of zip-codes in the United States belong to two or more school districts (and it is unclear which SFA they belong to), we limit our data to only include households with school-age children residing in the same zip-code of a SFA as reported in the FTSC.[5] Implicitly, we assume that children attend a school in the SFA located within the same zip-code where they reside. Thus, our sample of households with children residing within the same zip-code of an SFA implementing FTSP, will represent an "intent-to-treat" group rather than a "treated" group.

Exposure to FTSP is obtained combining the information from the FTSC on grades where FTSP activities were implemented with information on the age group children in the matched CNP households belong to. Households with at least one child in the 6–12 (13–17) age group were considered exposed to FTSP if the SFA in the zip-code they resided targeted Grades k-5 (Grades 6–8 and/or 9–12). Because we use the 2013 and 2015 FTSC which cover, respectively, 2011/12 and 2013/14 school years, we use monthly household purchase data from August 2011 to July 2012, and August 2013 to July 2014. Specifically, the data set used in the estimation consists of 5350 household-month observations for each month of the August to December 2011 period (26,750 observation total), 5263 for January to July 2012 (36,841 observations), 5422 for August to December 2013 (27,110 observations), and 5577 for January to July 2014 (39,039 observations) for a total of 129,740 observations.

3.1 | SFAs participation in FTSP and FTSP intensity variables

FTSP intensity variables are calculated using FTSC data. The 2013 (2015) FTSC contains information about SFAs' FTSP implemented during the 2011/12 (2013/14) school year. We calculated the three different measures of FTSP intensity discussed in Section 2.2, each capturing a different pathway through which FTSP can influence FV expenditures. For Specification 1, we calculate the number of years a school food authority implemented FTSP consecutively ($NFTS^{Years}$) varying from 0 to 3. The FTSP intensity measures for Specifications 2–4 are created based upon the activities SFAs implemented under FTSP. Specifically, in Specification 2, we include the total number of activities implemented in a school year ($NFTS^{Act}$), which varies from 0 to 14.

Since SFAs in FTSP may implement multiple activities during the same school year, Bonanno and Mendis (2021) suggest the possibility of multicollinearity between indicator variables representing each activity, as confirmed by the large tetrachoric correlation values reported in Supporting Information S1: Appendix Table A.1. Thus, following Bonanno and Mendis (2021), we combine different activities (listed in Table 1) using Principal Component Factor Analysis (PCFA) and a tetrachoric correlation matrix. We then sum the activities belonging to (i.e., showing loadings >0.5) each factor. The results of the PCFA (presented in the Supporting Information S1: Appendix)

[5]Using the 2013 National Center for Education Statistics data set "School District Geographic Relationship Files," we observed 33,000 zip-codes matched with 13,613 school districts. About 38% of the zip-codes belonged to one school district; 23% to two school districts, and the remaining 39% to three or more school districts.

TABLE 1 Descriptive statistics

Variable	Description	Mean	Standard deviation	Minimum	Maximum
FTSP activities					
Serve local	School food authority served locally produced foods in the cafeteria	0.438	0.496		
Taste demos	School food authority held taste testing/demos of locally produced foods	0.210	0.407		
Food coach	School food authority used cafeteria food coaches	0.112	0.316		
School garden	School food authority conducted edible school gardening or orchard activities	0.126	0.332		
Serve garden	Served products from school-based gardens or school-based farms	0.115	0.319		
Taste garden	Held taste testing/demos of school-based gardens/ farms products	0.099	0.298		
Field trip	Conducted student field trips to farms	0.139	0.346		
Farmer visit	Farmer(s) visit the cafeteria, classroom, or other school-related setting	0.980	0.297		
Themed promo	Promoted local efforts through themed or branded promotions	0.152	0.359		
Promote local	Promoted locally produced foods at school in general	0.237	0.426		
Media cover	Generated media coverage of local foods in schools	0.098	0.293		
Hosted events	Hosted community events	0.061	0.239		
F2S month	Farm to school month	0.117	0.321		
Curriculum	Integrated farm to school concepts into educational curriculum	0.072	0.259		
FTSP exposure intensity					
$NFTS^{Years}$	Number of years exposed to FTSP	0.944	1.137		
$NFTS^{Act}$	Number of activities implemented under FTSP	1.809	2.940		
N cafeteria/promo	Number of activities belonging to first factor	1.282	2.023		
N education/garden	Number of activities belonging to second factor	0.527	1.182		
Household-level control variables					
HHsize	Household size	4.198	1.195		
Income	Household income	73.970	48.356		
Hisp	Household head ethnicity: Hispanic	0.076	0.265	0	1
Black	Household head race: Black	0.085	0.278	0	1
Asian	Household head race: Asian	0.037	0.189	0	1
Others	Household head race: Other	0.054	0.226	0	1
White	Household head race: White	0.824	0.381	0	1
$Child_{0-6}$	At least one child age 0–6 present in the household	0.211	0.408	0	1

(Continues)

TABLE 1 (Continued)

Variable	Description	Mean	Standard deviation	Minimum	Maximum
$Child_{6-13}$	At least one child age 6–13 present in the household	0.581	0.493	0	1
$Child_{13-18}$	At least one child age 13–18 present in the household	0.645	0.478	0	1
Married	Household head marital status: Married	0.833	0.373	0	1
Widow	Household head marital status: Widower	0.018	0.131	0	1
Separated	Household head marital status: Separated	0.099	0.299	0	1
Single	Household head marital status: Single	0.050	0.217	0	1
Educ	Household head has bachelor degree or higher	0.805	0.396	0	1
Own	Home ownership tenure—Own	0.770	0.421	0	1
Rent	Home ownership tenure—Rent	0.210	0.407	0	1
OthOH	Home ownership tenure—Others	0.021	0.143	0	1
Local food supply chain control variables					
FarmInc	County-level average farm income (IDW)	0.256	0.183	0.019	1.190
Direct	County-level percentage of farms with direct-to-retail sales	3.523	2.848	0.215	19.849
Food hubs	Presence of a food hub in the county	0.039	0.193	0	1
PCFM	County-level number of farmer's markets per 10,000 people	0.135	0.234	0	4.089
Milk price	Ratio of county's milk price to the national average	0.955	0.136	0.722	1.217

Source: Author's elaborations on FTSC and Circana data.

show that activity indicators with the highest loadings on factor 1 either take place in the cafeteria (serving local foods, taste demonstrations, food coaches) or represent promotional activities (themed promotions, promotion of local foods, media coverage, hosted events, celebration of farm to school month, and farmer visits). Activity indicators with the highest loadings on factor 2 are mostly related to the presence of a school garden (presence of a school garden, served food from the school garden, taste test of products from the garden), or educational activities (field trip, hosted community events, and curriculum). The resulting variables, used in Specification 3 are *N*Cafeteria/Promo and *N*Education/Garden. Summary statistics for four FTSP exposure intensity variable are presented in the top panel of Table 1.

3.2 | Dependent variables

Households' monthly FV expenditures (FVExp) and expenditure shares (over the total food expenditure—FVExpSh) were calculated by aggregating household purchases of all fresh, frozen, canned, and dried FV which are included in the National School Lunch Program and School Breakfast Program. Of the 129,740 household-month observations in the data, approximately 22.13% (28,711 observations) report no FV expenditures. The average conditional (on purchasing) and unconditional monthly FV expenditure shares are 11.68%, and 9.09%, respectively, whereas

monthly FV expenditures are $30.25 and $23.55. Descriptive analyses of the variation in monthly FV expenditure, FV expenditure shares, and FTS intensity metrics can be found in the Supporting Information: Appendix.

3.3 | Control variables and identification

Because our data set is comprised of four "repeated" panels of household with children, we cannot rely on household-level fixed-effects to control for heterogeneity in households' FV expenditure (FV share). Therefore, we follow the existing literature on FV purchases (e.g., Kirkpatrick & Tarasuk, 2003) and that on SFAs' adoption of FTSP (Bonanno & Mendis, 2021; Botkins & Roe, 2018) to choose control variables that can help us reduce bias due to FTSP adoption being correlated to some drivers of FV expenditures. Botkins and Roe (2018) and Bonanno and Mendis (2021) analyses of, respectively, SFAs' participation and continuation in FTS, find the most important contributors to an SFA's decision to participate (and continuation [Bonanno & Mendis, 2021]) in FTSP are its size, the SFAs level of support to serving school meals (e.g., percentage of free and reduced meals, federal reimbursement per student), racial composition of the students in the SFA, demand-side (i.e., population, poverty rate), local food supply-side factors, rurality, and regional/state-level fixed effects.

The following household, or household-head characteristics are used as controls: household size (HHSize); household income (Income; in $ thousands) calculated as the mid-point of the income bracket a household belongs to, and four sets of indicator variables capturing: the presence of children in the household (younger than 6 years of age: $Child_{0-6}$; 6–13 years of age: $Child_{6-13}$, and 13–18 years $Child_{13-18}$); whether the household rents the home they live in (Rent) or if arrangements other than ownership or renting (OthOH) are in place (home ownership is the excluded category); the ethnic/race group the household head belongs to (Hispanic: Hisp; Black; Black; Asian: Asian; and "others": Others; excluded group is White); the marital status of the household head (Widowed: Widow; Separated: Separated; Single: Single; excluded group is married); and whether the household head has a college (or higher) degree (Educ).

Local food supply chain variables are included in the model following Botkins and Roe (2018) and Bonanno and Mendis (2021), to control for geographic factors that can facilitate SFA's procurement of local foods and the availability of locally produced FV for shoppers. As Bonanno and Mendis (2021) show, these variables can, in some cases be valid instruments for the challenges encountered by SFAs when trying to acquire food locally, an endogenous driver of FTSP participation. As a result, their inclusion in the model should not add bias to the estimated FTSP intensity parameters. However, as pointed out by an anonymous reviewer, they can still be correlated with unobserved factors affecting FV expenditure, and their estimated parameters are likely biased. The local food supply chain variables included in our model are: the average farm income of the county-FarmInc (in 2012) and the county-level percentage of farms with direct-to-retail sales-Direct (in 2012) to capture farm activity and farmers' propensity to sell through direct channels. FarmInc and Direct are calculated as inverse distance weighted (IDW) values, data which has been graciously shared by Botkins and Roe (2018); these authors constructed FarmInc and Direct considering local foods as produced within 400 miles radius (Food, Conservation and Energy Act of 2008). We also include the county-level number of farmer's markets per 10,000 people (PCFM) and a binary variable for the existence of food hubs in the county where the SFA is located (Foodhubs) as proxies for ease of access to local foods. Finally, we include the ratio of a county's milk price to the national average (Milkprice) as local milk is the most prominent "local food" served in many schools and milk price is highly correlated with that of nonproduce foods (Botkins & Roe, 2018). The USDA's Food Environment Atlas (USDA, 2015) provides data on farmers' markets in 2010 (used in place of 2011), 2012, and 2013; food hubs in 2011, 2012, and 2013; and milk prices in 2010.

Last, we include two set of indicator variables/fixed-effects. First, we use indicator variables based on the Rural–Urban Continuum Code (RUCC) classification of the county the zip-code belongs to. Counties with RUCCs 1–3, are considered "Metro", whereas RUCCs 5–9 are "Non-metro." Second, we control for state-level fixed effects to capture State-level policies that may affect implementing FTSP (Bonanno & Mendis, 2021; Lyson, 2016), as well as unobserved variation in dietary/purchasing patterns across geographic areas. Further, we control for time-dependent variation in FV expenditures, by including two sets of time effects: indicator variables for each month of the calendar year, capturing seasonal variation in FV purchase/consumption, and indicator variables for each year to capture possible intermediate/long-run trends in FV purchases.

Summary statistics of the main covariates included in the model are in the middle and bottom panels of Table 1.

4 | RESULTS AND DISCUSSION

This section focuses on the estimated associations between FTSP exposure intensity and households' with school aged children FV expenditures (and expenditure shares). Before discussing the main results of interest, we present a brief discussion of the estimated parameters for selected control variables.

4.1 | Control variables

Estimates for specifications 1 and 2 (Equations 5 and 6, respectively) are reported in Table 2 for both FV expenditures (FVExp) and FV expenditure shares (FVExpSh); estimates obtained using the other model specifications are similar to those reported in Table 2 and available in the Supporting Information: Appendix.

The sign and significance of the estimated parameters in Table 2 are consistent with previous literature and prior expectations. Larger households show higher (lower) FV expenditures (expenditure shares). Household income (Income) is associated with higher FVExp and FVExpSh. Ethnicity/race of the household head other than white (and non-Hispanic) shows a negative relationship with FVExp (although not statistically significant for OthersHH) and a positive and statistically significant relationship with FVExpSh for Asian and Others. The presence of children age 0–6 is negatively associated with both FVExp and FVExpSh; that of older children (age 6–13) is related to lower FVExp but higher FVExpSh, whereas the presence of high-school age (13–18) children is associated with lower FVExpSh and higher FVExp. HH head's marital statuses other than "Married" is associated with lower FV purchases. College educated household heads show larger expenditures in **FVExp** and FVExpSh. Housing arrangements other than home ownership are associated with lower FVExp and FVExpSh. Considering the local food supply chain control variables, Farm Income, presence of food hubs and farmers markets per 10,000 people, and the ratio of county milk price to the national average are negatively related to FVExpSh and FVExp, however, the association between FarmInc (Foodhubs, PCFM, or Milkprice) and FVExp is (FVExpSh are) not statistically significant. Direct is associated with higher FV expenditure in both absolute and relative terms.

4.2 | FTSP intensity and marginal effects

The estimated coefficients of the FTSP exposure intensity measures, and the average marginal effects are reported in Table 3. Continued exposure to FTSP ($NFTS_i^{Years}$, Specification 1) has a positive and statistically significant relationship with both FVExpSh and FVExp; similarly, the larger the number

TABLE 2 Selected estimated tobit coefficients of control variables for specifications 1 and 2—Dependent variables are monthly FV expenditure shares (FVExpSh) and FV expenditure (FVExp)

Control variable	Specification 1		Specification 2	
	FVExp	*FVExpSh*	*FVExp*	*FVExpSh*
Household-level control variables				
HHSize	0.785***	−0.357***	0.827***	−0.352***
	(0.109)	(0.035)	(0.106)	(0.034)
Income	0.061***	0.016***	0.062***	0.016***
	(0.003)	(0.001)	(0.002)	(0.001)
Hisp	−3.114***	−0.029	−3.284***	−0.044
	(0.452)	(0.144)	(0.439)	(0.140)
Black	−3.611***	0.065	−3.546***	0.135
	(0.407)	(0.129)	(0.392)	(0.125)
Asian	−2.940***	1.010***	−3.709***	0.959***
	(0.570)	(0.181)	(0.555)	(0.177)
Others	−0.424	0.149	−0.573	0.101
	(0.529)	(0.168)	(0.514)	(0.164)
$Child_{0-6}$	−2.651***	−0.278***	−2.900***	−0.334***
	(0.301)	(0.096)	(0.293)	(0.093)
$Child_{6-13}$	−1.175***	0.155	−1.007***	0.174*
	(0.299)	(0.095)	(0.290)	(0.093)
$Child_{13-18}$	0.256	−0.410***	0.305	−0.416***
	(0.318)	(0.101)	(0.308)	(0.098)
Widow	−2.693***	0.283	−3.159***	0.070
	(0.821)	(0.261)	(0.795)	(0.253)
Separated	−5.536***	−0.949***	−5.474***	−0.903***
	(0.390)	(0.124)	(0.376)	(0.119)
Single	−9.055***	−1.620***	−9.055***	−1.626***
	(0.529)	(0.167)	(0.509)	(0.161)
Educ	3.937***	1.388***	3.757***	1.322***
	(0.278)	(0.088)	(0.269)	202124 (0.086)
Rent	−4.859***	−1.497***	−5.113***	−1.573***
	(0.287)	(0.091)	(0.279)	(0.089)
OthHO	−3.093***	−0.913***	−3.611***	−0.984***
	(0.762)	(0.242)	(0.736)	(0.234)

(Continues)

TABLE 2 (Continued)

Control variable	Specification 1		Specification 2	
	FVExp	*FVExpSh*	*FVExp*	*FVExpSh*
Local food supply chain control variables				
FarmInc	−0.575	−0.371	0.093	−0.291
	(1.027)	(0.327)	(0.998)	(0.318)
Direct	0.703***	0.153***	0.890***	0.186***
	(0.109)	(0.035)	(0.105)	(0.033)
Food hubs	−0.762	−0.081	−0.631	−0.022
	(0.617)	(0.196)	(0.600)	(0.191)
PCFM	−0.543	0.263	−0.742	0.239
	(0.521)	(0.166)	(0.507)	202124 (0.161)
Milk price	−6.835***	−0.568	−5.962***	−0.411
	(1.784)	(0.568)	(1.721)	(0.548)
Constant	15.738***	6.567***	14.096***	6.402***
	(2.002)	(0.637)	(1.939)	(0.618)

Note: Standard errors in parentheses.

***, **, and * denote coefficients statistically significant at the 1%, 5%, and 10% probability level, respectively. Coefficients for RUCCs, month, year, and state-level fixed-effects are omitted for brevity.

of activities implemented by an SFA (Specification 2), the larger monthly FVExp and FVExpSh. The effect of 1 additional year of exposure to FTSP activities on the probability of a positive FVExp (FVExpSh) is about 0.27% (0.7%). The marginal effects of one additional year of children's FTSP exposure on conditional and unconditional monthly FVExp (FVExpSh) are $0.137 and $0.192 (0.13 and 0.18), respectively. The marginal effects of one additional activity on the probability of observing positive FVExp (0.29%) and FVExpSh (0.34%) are similar in magnitude. One additional activity is associated with an increase in 0.065 (unconditional) and 0.09 (conditional) FVExpSh and $0.15 and $0.21 monthly FVExp.

The results of Specification 3 suggest that children's higher exposure to both promotion and taste demonstrations activities, and education and school garden activities are associated with both higher FV expenditure shares, and monthly FV expenditure. One more cafeteria and promotion-based activities is related to a 60% smaller (one fourth) increase in FV expenditure (FV shares) compared to having one more education/garden related activity. One additional education/garden related activity is associated with $0.24 and $0.34 (0.077 and 0.107) higher unconditional and conditional FV expenditures (FV expenditure shares) whereas one additional cafeteria and promotion-based activity is associated with $0.1 and $0.14 (0.06 and 0.08) higher values of the outcome variables.

4.3 | Analysis by household subsamples

The average marginal effects of the FTSP intensity exposure for households with children segmented by metropolitan status of the county where they reside, are in the top panels of Table 4. The first panel includes the estimated marginal effects on FV expenditure; the second FVExpSh. Estimated marginal effects on FVExp of metro households show patterns resembling those of the full sample, and similar

TABLE 3 Estimated tobit coefficients and marginal effects: Changes in FTSP exposure intensity—Dependent variables: Monthly FV expenditure (FVExp) and FV expenditure share (FVExpSh).

		Estimated tobit coefficients		Marginal effects					
				FVExp			FVExpSh		
Spec	**FTSP exposure intensity**	***FVExp***	***FVExpSh***	**Pr(FV>0)**	**E(FV)**	**E(FV|FV>0)**	**Pr(FV>0)**	**E(FV)**	**E(FV|FV>0)**
Spec 1	N FTS years	0.275**	0.247***	0.0027**	0.1372**	0.1924**	0.0070***	0.1333***	0.1853***
		(0.111)	(0.035)	(0.001)	(0.055)	(0.078)	(0.001)	(0.019)	(0.027)
Spec 2	N FTS activities	0.300***	0.120***	0.0029***	0.1493***	0.2093***	0.0034***	0.0648***	0.0901***
		(0.037)	(0.012)	(0.000)	(0.019)	(0.026)	(0.000)	(0.006)	(0.009)
Spec 3	N cafeteria/promo activities	0.198***	0.108***	0.0019***	0.0986***	0.1383***	0.0031***	0.0583***	0.0811***
		(0.071)	(0.023)	(0.001)	(0.035)	(0.049)	(0.001)	(0.012)	(0.017)
	N education/garden activities	0.486***	0.142***	0.0048***	0.2422***	0.3395***	0.0040***	0.0767***	0.1067***
		(0.116)	(0.037)	(0.001)	(0.058)	(0.081)	(0.001)	(0.020)	(0.028)

Note: Standard errors in parentheses.

***, **, and * denote coefficients statistically significant at the 1%, 5%, and 10% probability level, respectively.

TABLE 4 Marginal effects: Changes in FTSP exposure intensity—Dependent variable: Household with children monthly FV expenditure (FVExp) and FV expenditure share (FVExpSh).

		Households in metro areas			Households in nonmetro areas		
Spec	**FTSP exposure intensity**	**Pr(FV>0)**	**E(FVExp)**	**E(FVExp|FVExp>0)**	**Pr(FVExp>0)**	**E(FVExp)**	**E(FVExp|FVExp>0)**
Spec 1	N FTS years	0.0027**	0.145**	0.204**	0.0004	0.018	0.026
		(0.001)	(0.067)	(0.093)	(0.002)	(0.100)	(0.139)
Spec 2	N FTS activities	0.0038***	0.201***	0.282***	−0.0025***	−0.107***	−0.149***
		(0.000)	(0.022)	(0.030)	(0.001)	(0.038)	(0.053)
Spec 3	N cafeteria/promo	0.0022***	0.118***	0.166***	−0.0011	−0.045	−0.064
		(0.001)	(0.041)	(0.057)	(0.002)	(0.072)	(0.101)
	N education/garden	0.0067***	0.354***	0.496***	−0.0051*	−0.219*	−0.307*
		(0.001)	(0.067)	(0.094)	(0.003)	(0.119)	(0.167)
		Households in metro areas			**Households in nonmetro areas**		
Spec	**FTSP exposure intensity**	**Pr(FVExpSh>0)**	**E(FVExpSh)**	**E(FVExpSh|FVExp>0)**	**Pr(FVExpSh>0)**	**E(FVExpSh)**	**E(FVExpSh|FVExp>0)**
Spec 1	N FTS years	0.0076***	0.150***	0.208***	0.0042*	0.070*	0.098*
		(0.001)	(0.023)	(0.031)	(0.002)	(0.037)	(0.052)
Spec 2	N FTS activities	0.0039***	0.077***	0.107***	0.0011	0.019	0.027
		(0.000)	(0.007)	(0.010)	(0.001)	(0.014)	(0.019)
Spec 3	N cafeteria/promo	0.0031***	0.062***	0.086***	0.0024	0.040	0.056
		(0.001)	(0.014)	(0.019)	(0.002)	(0.027)	(0.037)
	N education/garden	0.0053***	0.104***	0.144***	−0.0012	−0.020	−0.027
		(0.001)	(0.023)	(0.032)	(0.003)	(0.044)	(0.061)
		Households above 185% of poverty guideline			**Households below 185% of poverty guideline**		
Spec	**FTSP exposure intensity**	**E(FVExp)**	**E(FVExp|FVExp>0)**	**Pr(FVExp>0)**	**E(FVExp)**	**E(FVExp|FVExp>0)**	
Spec 1	N FTS years	0.0054***	0.300***	0.420***	−0.0035*	−0.141*	−0.198*
		(0.001)	(0.073)	(0.102)	(0.002)	(0.081)	(0.114)

TABLE 4 (Continued)

Spec	FTSP exposure intensity	Households above 185% of poverty guideline			Households below 185% of poverty guideline		
		E(FVExp)	E(FVExp|FVExp>0)	Pr(FVExp>0)	E(FVExp)	E(FVExp|FVExp>0)	
Spec 2	N FTS activities	0.0025***	0.137***	0.192***	0.0043***	0.172***	0.243***
		(0.000)	(0.024)	(0.034)	(0.001)	(0.028)	(0.040)
Spec 3	N cafeteria/promo	0.0030***	0.170***	0.238***	−0.0015	−0.059	−0.084
		(0.001)	(0.045)	(0.063)	(0.001)	(0.055)	(0.077)
	N education/garden	0.0014	0.077	0.107	0.0150***	0.597***	0.842***
		(0.001)	(0.074)	(0.103)	(0.002)	(0.091)	(0.127)

Spec	FTSP exposure intensity	Households above 185% of poverty guideline			Households below 185% of poverty guideline		
		Pr(FVExpSh>0)	E(FVExpSh)	E(FVExpSh|FVExp>0)	Pr(FVExpSh>0)	E(FVExpSh)	E(FVExpSh|FVExp>0)
Spec 1	N FTS years	0.0068***	0.142***	0.197***	0.0079***	0.126***	0.178***
		(0.001)	(0.024)	(0.034)	(0.002)	(0.031)	(0.043)
Spec 2	N FTS activities	0.0032***	0.067***	0.093***	0.0038***	0.060***	0.085***
		(0.000)	(0.008)	(0.011)	(0.001)	(0.011)	(0.015)
Spec 3	N cafeteria/promo	0.0035***	0.073***	0.100***	0.0014	0.023	0.032
		(0.001)	(0.015)	(0.021)	(0.001)	(0.021)	(0.030)
	N education/garden	0.0028**	0.057**	0.079**	0.0081***	0.129***	0.182***
		(0.001)	(0.025)	(0.034)	(0.002)	(0.035)	(0.049)

Note: Standard errors in parentheses. Metro ($N = 93,695$) vs. nonmetro ($N = 29,453$) subsamples and households with income above ($N = 87,800$) vs. below ($N = 41,940$) 185% of the poverty guidelines.
***, **, and * denote coefficients statistically significant at the 1%, 5%, and 10% probability level, respectively.

TABLE 5 Falsification exercises: Marginal effects of FTSP exposure intensity.

Households with children		Liquor expenditure (LEx)			Liquor expenditure share (LSh)		
		Pr(LEx>0)	E(LEx)	E(LEx|LEx>0)	Pr(LSh>0)	E(LSh)	E(LSh|LSh>0)
Spec 2	N FTS activities	0.0002	0.013	0.010	0.0001	0.003	0.002
		(0.000)	(0.022)	(0.018)	(0.000)	(0.007)	(0.006)
Spec 3	N cafeteria/promo	0.0004	0.024	0.019	0.0006	0.011	0.009
		(0.001)	(0.042)	(0.034)	(0.001)	(0.014)	(0.011)
	N education/garden	−0.0001	−0.008	−0.006	−0.0007	−0.013	−0.011
		(0.001)	(0.068)	(0.055)	(0.001)	(0.022)	(0.018)
Households without children		**FVExp**			**FVExpSh**		
		Pr(FV>0)	E(FV)	E(FV|FV>0)	Pr(FV>0)	E(FV)	E(FV|FV>0)
Spec 2	N FTS activities	0.0005***	0.029***	0.039***	0.001***	0.023***	0.030***
		(0.000)	(0.010)	(0.014)	(0.000)	(0.004)	(0.006)
Spec 3	N cafeteria/promo	0.0004	0.022	0.030	0.001***	0.027***	0.034***
		(0.000)	(0.019)	(0.026)	(0.000)	(0.008)	(0.010)
	N education/garden	0.0007	0.040	0.054	0.000	0.017	0.021
		(0.001)	(0.030)	(0.041)	(0.000)	(0.013)	(0.016)

Note: Standard errors in parenthesis. Top Panel: Household with children; dependent Variables: Liquor expenditure and expenditure share. Bottom panel: Households without children ($N = 320{,}537$); dependent variables: Monthly FV expenditure (FVExp) and FV expenditure share (FVExpSh).

***, **, and * denote coefficients statistically significant at the 1%, 5%, and 10% probability level, respectively.

($NFTS_i^{Years}$) or larger magnitudes (NEducation⁄garden, 46% larger in metro households compared to the full sample). For nonmetro households, the estimated marginal effects are either not statistically different from zero, or show negative and statistically significant association with FVExp; it is possible that, for nonmetro households, FTS programming may be seen as a way for school children to access more FV, resulting in lower at-home purchases of FVs. Similarly, the patterns of the estimated marginal effects on FVExpSh for metro households (Table 4, second panel) are similar to the full sample's, either showing the same or larger magnitudes (up to one-third for education/garden-based activities). For nonmetro households the relationship between FTS intensity exposures and FVExpSh is, across most FTSP intensity measures, not statistically different from zero.

The average marginal effects of FTSP exposure intensity on FVExp and FVExpSh on households with children above and below the 185% of the poverty guidelines are in the bottom panels of Table 4. One additional year of FTSP exposure is associated with higher FVExp for households above 185% poverty, and higher FVExpSh for both subsamples. For households above (below) 185% poverty, one additional year of FTSP exposure is associated with 0.2 (0.18) percentage points increase in conditional expenditure shares. Exposure to one additional FTSP activity is associated with higher FV expenditures and shares for both household groups; while the estimated marginal effect on conditional FVExp is 1.16 times larger for households below the 185% of poverty guideline, we find no difference in the estimated marginal effects for households above and below poverty, when it comes to FVExpSh. Specifications 3's results suggest that while cafeteria/promo activities have a positive and statistically significant relationship with both FVExp and FVExpSh for households above poverty, they show no relationships (or a negative one), for below poverty households. Education/garden activities have a much stronger relationship with FVExp and FVExpSh for households below 185% poverty than those above it.

4.4 | Falsification exercises

The average marginal effects of interest for the two falsification exercises are presented in Table 5. The results in the top panel show that we fail to find a statistically significant relationship between liquor expenditures (in level and shares) and FTSP exposure intensity. This result suggests the association between FTSP exposure intensity and FVExp/FVExpSh is likely driven by children's exposure to FTSP itself, than by other patterns related to the adoption of healthier diets OR higher spending across all categories. It should be mentioned that, unlike FV availability, the availability of liquors at grocery stores may be limited, also because of state-level restrictions, which may result in limited reported expenditures in our data. In fact, 83.2% of households with children in our data show zero liquor purchases.

The average marginal effects obtained for the second falsification exercise are presented in the bottom panel of Table 5. We find a positive association between $NFTS^{Act}$ and both FVExp and FVExpSh, and between NCafeteria/Promo and FVExpSh for households without children. The magnitudes of these marginal effects are smaller than those reported in Table 3. For instance, implementing one additional FTSP activity is associated with \$0.209 increase in conditional FVExp for households with children, and \$0.093 for households without children, suggesting a 44% upward bias. Thus, although upward bias is present, the association between FTSP exposure and FV expenditure among households with children is still in part driven by children's exposure to FTSP.

5 | DISCUSSION AND CONCLUSIONS

In this paper, we used FTS Census data matched with 3 years of households' monthly FV purchases to study the indirect relationship between children's exposure to FTSP activities and household expenditure/expenditure share of FV. Our results suggest a positive and statistically significant relationship exists between (most) FTSP exposure intensity measures and household with children's FV expenditures and FV expenditure shares. Overall, this relationship appears the strongest for education/garden-based activities, particularly among households residing in metro areas and households below the 185% poverty thresholds. Conversely, households above the 185% poverty thresholds benefit more by their children exposure to cafeteria-based and promotional activities. Even though our results do suggest beneficial spillovers of children FTSP exposure to the entire household, households benefiting the most are those residing in metro areas and those above the 185% poverty threshold, which may imply that FTSP may not be benefiting those who may need it the most. Some may find that the funding used for FTSP could be reallocated to programs that affect households in a more equitable manner.

From the standpoint of FTSP promoting healthier diets, our estimates appear too small to indicate an actual beneficial effect. Even the largest estimated effects are, in fact, rather small and unlikely to indicate any meaningful changes in purchasing behavior leading to healthier diets. Also, the presence of an upward bias in the estimates, confirmed by the falsification exercises, suggests that the estimated marginal effects represent upper bounds to the actual effects of FTSP intensity on FV expenditures. As we fail to account SFA's decision to participate in the FTSP, the estimated spillover may simply reflect the community's interest in/easier access to local food. Additionally, it is possible that households whose children are exposed to locally procured foods may decide to purchase local/organic/higher value produce, the estimated positive and statistically significant relationship between school children exposure to FTSP and their household's FV expenditures may capture households switching to "better" quality produce rather than consuming more FV.

However, given that we are unable to identify with certainty households whose children were exposed to FTSP, our results depict "intent-to-treat" and not actual treatment effects, and be a lower bound to the "true" effect of FTSP exposure on FV expenditure for treated households. Further, we do not observe where children in the CNP households attend school, and we exclude from our

analysis households residing in different zip-codes than those reported for the SFAs in the FTSC, while we may include households whose children do not attend a school implementing FTSP, whcih may bias our estimates downwards. Also, as discussed in Sweitzer et al. (2017), the Circana data used in this work report lower expenditures for the FV category than other datasets (i.e., the Consumer Expenditure Survey and USDA's National Household Food Acquisition and Purchase Survey). As a result, even though the falsification excercise suggest that our estimated relationships may be biased upwards, it is possible that, because of data limitation, we may actually be underestimating the relationship between FTSP and FV expenditures. Thus, further research, ideally using primary and/or experimental/quasi-experimental data, on this subject seems warranted.

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DATA AVAILABILITY STATEMENT

The Farm to School Program data that support the findings of this study are available in Farm to School Census website at https://farmtoschoolcensus.fns.usda.gov/. The consumer data are available from Circana, Inc. (formerly Information Resources, Inc.—IRI). Restrictions apply to the availability of these data, which were accessed in collaboration with USDA under a Third Party Agreement with Circana, Inc.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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