

# Impacts of Introducing a Farm to School Program on National School Lunch Program Participation and Selection of Salads

Benjamin Y. Avuwadah

Food and Resource Economics Department,

University of Florida

Contact email: [bavuwadah@ufl.edu](mailto:bavuwadah@ufl.edu)

Jaclyn D. Kropp

Food and Resource Economics Department,

University of Florida

Contact email: [jkropp@ufl.edu](mailto:jkropp@ufl.edu)

*Selected Paper prepared for presentation at the 2019 Agricultural Applied Economics  
Association Annual Meeting, Atlanta, GA, July 21 – July 23*

*Copyright 2019 by Benjamin Y. Avuwadah and Jaclyn D. Kropp. All rights reserved. Readers  
may make verbatim copies of this document for non-commercial purposes by any means, provided  
that this copyright notice appears on all such copies.*

# Impacts of Introducing a Farm to School Program on National School Lunch Program Participation and Selection of Salads \*

Benjamin Y. Avuwadah <sup>†</sup>

Jaclyn D. Kropp <sup>‡</sup>

## Abstract

Farm to school (FTS) programs complement the National School Lunch Program (NSLP) by ensuring schools use locally sourced products in the preparation of school meals. This paper analyzes the impacts of introducing a new FTS program. Specifically, we analyze the impacts of offering NSLP salad meals prepared with locally sourced products on NSLP participation and NSLP participants' selection of salads. Using school-level point of sale (POS) data and product procurement records for the 2015/2016 school year, we find introduction of the FTS program did not increase NSLP participation; however, more NSLP meals and more salads are served on days when locally sourced products are used in the preparation of NSLP salad offerings. The findings suggest that procuring local foods served as part of the NSLP positively affects program participation and promotes the selection of healthier meals by program.

---

\*Selected Paper prepared for presentation at the 2019 Agricultural Applied Economics Association Annual Meeting, Atlanta, GA, July 21 – July 23

<sup>†</sup>Doctoral Student; Food and Resource Economics Department, University of Florida.

<sup>‡</sup>Associate Professor; Food and Resource Economics Department, University of Florida.

# 1 Introduction

Motivated by high rates of childhood overweight and obesity, the federal government passed the Healthy, Hunger-Free Kids Act (HHFKA) of 2010 which set new nutrition standards for school meals. The Act requires schools participating in the National School Lunch Program (NSLP) to offer more healthy items such as whole-grain foods and fresh fruits and vegetables(USDA, 2012). In line with the goal of offering more fresh foods in school cafeterias, the HHFKA also officially established the Farm to School (FTS) program under the United States Department of Agriculture (USDA). Local procurement of products served in school cafeterias is the principal aspect of most FTS programs; however, many FTS programs also encompass practical learning activities such as school gardens and integrated nutrition education (Kloppenburger et al., 2008). Following the implementation of the HHFKA, policymakers and practitioners alike have been concerned about declining NSLP participation rates (Ralston and Newman, 2015).

The NSLP is the second largest food assistance program in the United States serving approximately 4.9 billion lunches during the 2017-18 school year (USDA, 2018). Yet, participation has declined steadily since the introduction of the HHFKA (USDA, 2019). While the implementation of the new nutritional requirements outlined in the HHFKA is a potential cause of the decline in participation, price increases for paid meals that began in 2011 and slow recovery from the Great Recession are also likely contributing factors (Ralston and Newman, 2015).

At the same time that NSLP participation declined, more school districts began offering FTS programs. The most recent USDA FTS Census for the 2013/2014 school year indicated 42% of districts participate in FTS programs; hence, FTS programs are in more than 42,000 schools in over 5,200 school districts reaching more than 23.6 million children (USDA, 2016). The USDA FTS Census for the 2013/2014 school year also indicated that schools spent approximately 790 million on local foods served as part of school meals; this represented a 105% increase over expenditures in the 2011/2012 school year when the first FTS Census was conducted.6 Furthermore, approximately 46% of school districts surveyed in the most recent Census expressed the desire to buy more local foods in the future (USDA, 2016).

Although FTS programs are prevalent throughout the country and there is some anecdotal evidence of their success, such as school food service professionals noting reduced plate waste, improved acceptance of the healthier school meals, increased participation in school meals programs,

and lower school meal program costs (USDA, 2015), few prior academic studies investigate the effects of FTS programs on NSLP participation and the selection of meals prepared with locally sourced products. Joshi et al. (2008) reviewed 15 prior studies on the effects of FTS programs and found 7 of them reported increases in NSLP participation attributed to FTS programs. However, only one of the studies reviewed by Joshi et al. (2008) was peer-reviewed; the vast majority of the reviewed studies were progress or evaluation reports to funding agencies. Furthermore, none of the reviewed studies were conducted after the implementation of the HHFKA.

Since the implementation of the HHFKA, peer-reviewed studies on the effects to FTS programs have primarily focused on the programs ability to influence behavior changes pertaining to selection and consumption of fruits and vegetables using plate waste methodologies (Yoder et al., 2014, 2015; Jones et al., 2015; Kropp et al., 2018). Yoder et al. (2014) observed students at various schools with FTS programs over the course of a year to compare the effect of years of FTS programming on fruit and vegetable consumption. They found an increase in student meals containing fruits and vegetables from baseline to post for all schools. The authors also found that consumption rates were higher at schools with more years of FTS programming. Jones et al. (2015) found no significant difference in the consumption of vegetables between students in schools with FTS programs and students at the control schools after controlling for school.

While plate waste studies have the benefit of using observed student-level selection and consumption data, these studies tend to draw inferences from relatively short periods of observation, which might explain their mix findings. Therefore, empirical research that uses data collected over a longer period is needed to provide a more comprehensive investigation of how serving locally sourced products affect students' behaviors.

Given the mixed results of prior studies and declining participation in the NSLP following the implementation of the HHFKA, this study seeks to investigate the impacts of a new FTS program on NSLP participation and food selection behaviors using point of sale data (POS). Specifically, this study uses daily school-level POS data and procurement records of locally sourced products for the Alachua County Public Schools (ACPS) system in Florida. These data span the entire 2015/2016 academic year and include observations both before and after the implementation of the FTS program. t-tests and ordinary least squares (OLS) regression analysis are used to test the hypotheses that the introduction of the FTS program positively impacted NSLP participation (total number of meals served) and that the use of locally sourced products in the preparation

of NSLP meals positively affects both NSLP participation and the selection of meals containing these products (salads). The study focuses on salad offerings because locally sourced products consisted mainly of vegetables and were only used in the preparation of NSLP salad offerings during the study period. Although the recently passed Agricultural Improvement Act of 2018 contains language for continued support of local food systems, it did not expand mandatory funding for the USDA Farm to School Grant Program. Consequently, this study contributes to the FTS literature as well as the on-going policy debate pertaining to the importance of FTS programs.

We find that the number of NSLP meals served is higher on days when NSLP meals are prepared using FTS and FFF products. In addition, more NSLP salad meals are served on days when FTS and FFF products are used in the preparation of salad offerings. These findings suggest that locally sourcing products increases NSLP participation and positively influences the selection of healthier items in school cafeterias.

In the next section, we describe characteristics of the study setting. This is followed by a discussion of the data and empirical models used to test the hypothesis that the use of FTS and FFF products in the preparation of NSLP meals positively affects both NSLP participation and the selection of meals containing these products. The results are then presented, and the final sections discuss the policy implications and limitations of the study.

## 2 Methods

### 2.1 Study setting

The ACPS system is a suburban/rural district that first implemented the local procurement aspect of its district-wide FTS program in Title I elementary schools in late October of 2015. Analogous to other FTS programs in the US, the district has a flexible definition of products that qualify as FTS products. The district first seeks to procure products from Alachua County and adjacent counties, then from farms within 150 miles of the district’s FTS hub (which includes producers in southern Georgia), and then from farms throughout the state of Florida (Fresh from Florida products). To better understand the effects of these two different types of local products, we analyze FTS (products sourced from within 150 miles of the food hub) and FFF products

separately.

At the study schools, each day students are offered a variety of meal (meat/meat alternative) options with one of the options being a salad offering. The menu is set at the district-level and follows a three-week menu cycle; these menus meet federal and state nutritional guidelines. All elementary schools within the district have the same menu on a given day. Parents/caregivers and students can obtain information pertaining to the nutritional information of the various lunch offerings and the source of the products used to prepare the offerings each day from the study schools' websites. Hence, parents/caregivers can use this information when deciding to pack their child a lunch or have their child purchase the school lunch. Furthermore, there is signage both outside of the school cafeteria and on the lunch-line indicating which offerings contain FTS or FFF products; students can use this information when selecting a lunch from the various offerings.

## **2.2 Data**

A school-level panel dataset was constructed from school-level point of sale (POS) data, school-level FTS and FFF product procurement records, and school-level demographic data. Since these data were school-level records, Institutional Review Board review was not required. School-level POS data were obtained from the district chef; the data contained the total number of NSLP meals served by meat/meat alternative meal option for each school day by school. The data spanned from August 2015 to June 2016; and hence the dataset included observations before and after the implementation of FTS program in elementary schools in the district. The analyses were limited to elementary schools because, at the time of the study, the FTS program had only been implemented in elementary schools in the ACPS system. School-level FTS and FFF product procurement records were obtained from the district's FTS program coordinator. The procurement records contained information on the various locally sourced farm products and the dates these products were delivered to each school. Delivery dates ranged from late October of 2015 through May of 2016. Using the product information and the recipes of the various menu offerings, a dataset of when salads containing FTS and FFF products were offered at each school in the district was constructed. As previously stated, FTS and FFF were only used in the preparation of salad offerings during the study period. From the directives of the district FTS

coordinator, it was assumed that schools used products from broad-line retailers/wholesalers or governmental sources (hereafter referred to as conventionally sourced products) to prepare meals when they did not receive supplies of locally sourced FTS or FFF products. FTS and FFF supplies delivered to schools usually lasted for a week. School-day observations when fruit salad meals were offered were excluded from the analysis because FTS or FFF products were not used in the preparation of fruit salad meals.

The following analyses used data from 13 schools within the district that offered meals made with FTS or FFF products on at least 15 school-days during the 2015/2016 academic year. Although the choice of excluding schools with less than 15 days of FTS/FFF products may seem arbitrary, Table A1 in the supplementary materials shows that there is a clear distinction between schools that had fewer than 15 school-days of FTS/FFF offerings and schools with more than 15 school-days of FTS/FFF offerings. While the district’s FTS coordinator indicated that 15 schools were formally participating in the FTS program at the time of the study, other schools occasionally received FTS products when the district purchased surplus products.

Data on the demographic characteristics of the students enrolled in the various elementary schools, specifically the race/ethnicity of the students, were obtained from the Florida Department of Education (FDE) for the 2015/2016 academic year ([FDE, 2019](#)).

### **2.3 Empirical model**

Analysis were preformed using Stata 12. Means and frequencies were used to describe the number of days NSLP meals containing FTS, FFF, and conventionally sourced products were offered and the mean number of meals served when offered. T-tests were used to assess differences between the average number of meals served by source of product. In addition, ordinary least squares (OLS) regression analysis were preformed. Panel-corrected standard errors were constructed following the methods of [Beck and Katz \(1995\)](#). As an robustness check, standard errors constructed following the methods of [Driscoll and Kraay \(1998\)](#) were also constructed and are reported in tables A.3 and A.4 of the supplementary materials.

### 2.3.1 NSLP participation

We empirically test the hypothesis that FTS and FFF products have a positive impact on students' participation in the NSLP by modeling the total number of NSLP meal served as a function of the source of products used in preparing the school lunch offerings, menu offerings, and the demographic characteristics of the enrolled students. More specifically, we estimate

$$Y_{zt}^{Meals} = \gamma_0 + \gamma_1 FTS_{zt} + \gamma_2 FFF_{zt} + X'\Theta + \varepsilon_{zt} \quad (1)$$

where  $Y_{zt}^{Meals}$  is the number of NSLP meals served at elementary school  $z$  on school day  $t$ .  $FTS_{zt}$  and  $FFF_{zt}$  are indicator variables that take the value of 1 when true and 0 otherwise; they indicate a FTS or FFF product was used in the preparation of one of the school salad meal offerings on school day  $t$  in elementary school  $z$ , respectively. The base group is conventionally sourced items and is excluded from the regression estimations. The coefficients on the source of the products indicator variables,  $\gamma_1$  and  $\gamma_2$ , are the key parameters of interest as they depict the effects of products procured from FTS and FFF sources on the number of NSLP meal served per school, respectively. Additional covariates are contained in  $X$ . These include covariates controlling for the type of salads offered, other menu offerings, and school characteristics.

### 2.3.2 Selection of salads

To analyze the impacts of FTS products and FFF products on student's selection of NSLP salad offerings, we model the number of salads served per day by school as a function of the source of products used in the preparation of the salad offering, types of salad and non-salad meals offered, and school-level demographic characteristics of students. Specifically, we estimate

$$Y_{zt}^{salads} = \delta_0 + \delta_1 FTS_{zt} + \delta_2 FFF_{zt} + X'\beta + \mathcal{E}_{zt} \quad (2)$$

where  $Y_{zt}^{salads}$  is the number of salad meals served at elementary school  $z$  on school day  $t$ . Since some schools offered more than one salad option, the number of salad meals served was constructed by summing across the various salad options for school day  $t$  in elementary school  $z$ . Frequently, the second salad option consisted of leftover salads from the previous day. Similar to the previous regression model, the coefficients of interest are the coefficients on  $FTS_{zt}$  and



$FFF_{zt}$  as they indicate how the number of salads served is impacted by salad offerings containing FTS and FFF products, respectively.

## 2.4 Covariates

Since the introduction of the FTS program may have led to a permanent change in behavior (i.e., a permanent increase in NSLP participation or permanent increase in the selection of salads following the introduction of the FTS program), an indicator variable *FTSstarted* was included as a covariate in the regression models to assess the impact of introducing the FTS program on the outcome variables. *FTSstarted* took the value of 1 on school-day observations following the introduction of the FTS program at the school and 0 on school-day observations before the introduction of the program.

Additional covariates to control for the types of NSLP meals offered were included. These covariates controlled for the type of salad offered as well as the types of non-salad school meal offerings. Following [Peckham et al. \(2017\)](#) the district’s non-salad meal offerings were categorized into seven taste profile categories. School-level demographic (race/ethnicity) variables were also included as covariates. Since the study schools provided free lunch to all enrolled students under the Community Eligibility Provision (CEP), it was not necessary to control for reduced and free-lunch eligibility.

The analyses on the two outcome variables were preformed using the school-level demographic (race/ethnicity) variables as controls and then repeated using school-level fixed effects in place of the demographic variables. School-level fixed effects controlled for school-level demographic and socio-economic characteristics of the enrolled students, as well as other time invariant unobservable school-level factors that could impact NSLP participation such as school gardens, Smarter Lunchroom Strategies, etc. that might have varied across schools. As an additional robustness check, all models were estimated with *FTSstarted* included as a covariate, and then again using only data from the start of the FTS program (*FTSstarted*=1).

## 3 Results

Of the 22 elementary schools in the district, 13 of them offered NSLP salad meals made with FTS or FFF products on at least 15 school-days during the 2015/2016 school year. Collectively, these

13 schools offered both salad and non-salads NSLP offerings on 1,880 school-days. As shown in Table 1, a total of 730,020 NSLP meals were served in the study schools on days when both salad and non-salads NSLP meals were offered. Of these meals, 506,198 (about 69.3%) were served on days when schools used only conventionally sourced products to prepare school meals, 201,379 of the NSLP meals (approximately 27.6%) were served on days when schools used FTS produce to prepare salad meals, and 22,443 of the NSLP meals (about 3.1%) were served on days when schools used FFF products in the preparation of salad meals. Table 1 indicates that study schools used FTS product on 496 school days (approximately 26.4% of all school-day observations), FFF product on 53 school days (about 2.8% of all school-day observations), and only conventionally sourced products on the remaining 70.8% of the school-day observations. Table 1 also shows that, on average, 388.3 NSLP meals were served per school each day. Specifically, 380.3, 406.0, and 423.5 NSLP meals were served, on average, per school each school-day when conventionally sourced products, FTS products, and FFF products were used to prepare school salad meals, respectively. T-tests indicated statistically significant more NSLP meals were served on days when FTS and FFF products were used in the preparation of the meals than on days when only conventionally sourced products were used.

Table 1 shows that 32,949 salad meals (about 4.5% of total meals) were served across the study schools during the 2015/2016 academic year. On average, students selected 17.4, 22.7, and 17.4 salad meals per school on days when schools prepared these meals with FTS produce, FFF produce, and conventionally sourced products, respectively. More salads were served on days when they were prepared with FFF products than with conventionally sourced products. Sixty times (3.2% of the school-day observations) schools offered salad NSLP meals but no salads were selected by students.

### **3.1 Effects of the FTS program on NSLP participation**

The OLS regression results in Table 2 indicate that the introduction of the FTS program did not lead to a significant change in NSLP participation; however, significantly more NSLP meals were served on days when meals were prepared using either FTS or FFF products than when only conventionally sourced products were used. More specifically, the regression results for the analyses that include school-level demographic variables as covariates (results presented in

columns (1) and (2)) indicate that, on average, schools served approximately 12 more NSLP meals per day (approximately 3.2% more meals) on days when FTS products were used in the preparation of NSLP salad meals relative to when only conventionally sourced products were used. The analyses with school-level fixed effects instead of the school-level demographic controls (columns (3) and (4)) show that schools served approximately 7 more NSLP meals (approximately 1.8% more meals), on average, on days when meals were prepared with FTS products compared to when only conventionally sourced products were used. The regression results for the analyses that include school-level demographic variables as covariates (columns (1) and (2)) also indicate that, on average, schools served about 37 more NSLP meals (approximately 9.7% more meals) on days when FFF products were used to prepare salads relative to when conventionally sourced products were used. However, the effect of FFF is not significant in the models where the school-level demographic variables are replaced with school-level fixed effects.

### 3.2 Effects of the FTS Program on selection of salads

Table 3 indicates that the introduction of the FTS program led to a significant decline in the average number of salads selected each day by NSLP participants. The results also indicate that offering salads prepared with FFF products had a positive statistically significant effect on the number of salads served; however, the effect of offering salads prepared with FTS products did not significantly impact the number of salads served. More specifically, approximately 31.8% - 50.1% more salads were served on days when salads were prepared using FFF products.

As a robustness check, the more conservative [Driscoll and Kraay \(1998\)](#) standard errors are presented in Tables A2 and A3 of the supplementary materials. The results are similar to those of the [Beck and Katz \(1995\)](#) standard errors discussed above.

## 4 Discussion

This study examines the impacts of offering NSLP meals, specifically salad offerings, prepared with locally sourced products on NSLP participation (the number of NSLP meals served) and selection of salad offerings by NSLP participants. Using school-level POS data and local procurement records, our findings indicate that NSLP participation is significantly higher (1.8% - 9.7% depending on the model) on days when schools use locally sourced (FTS and FFF) prod-

ucts to prepare NSLP salad offerings than on days when schools use only conventionally sourced products. While preparing meals with either FTS or FFF products impacts NSLP participation, the effects of offering FFF products, products procured from anywhere in the state of Florida, is larger than the effect of offering FTS products, products procured from farmers less than 150 miles from the district in the regression models that included demographic controls. Furthermore, when FFF products are used in the preparation of the salad offerings, schools serve more salads (approximately 31.8% - 50.1% more depending on the model). Perhaps the larger impact of FFF is due to students being more familiar with FFF products as they can also be found at local grocery stores. Collectively, the results provide evidence that products procured from local sources have a positive impact on students' participation in the NSLP and students' selection of NSLP salad meals. That is, during the 2015/2016 school year study schools, on average, served more NSLP meals and more NSLP salad offerings when locally sourced products were used to prepare school lunches. However, the findings also suggest that the introduction of FTS program in itself did not significantly impact NSLP participation and actually negatively impacted the selection of salads.

The results of this study support the findings of several past studies. These prior studies found that the FTS programs increased NSLP participation and increased the selection and consumption of healthier school meal offerings, particularly fruit and vegetables (Joshi et al., 2008; Kloppenburg et al., 2008; Colasanti et al., 2012; Kropp et al., 2018). Furthermore, our study improves upon prior studies by using POS transaction data from all schools participating in the FTS program within the district for an entire school year with these data including a period of observation prior to the implementation of the FTS program and after implementation. By using both pre-intervention and intervention data and controlling for the offering of locally sourced products on specific days, we were able to separate the effects associated with the introduction of the program from the effects of preparing meals with local products. Thus, this study contributes to the understanding of how FTS programs impact participation and item selection.

## 5 Implications for research and practice

Following the implementation of the HHFKA of 2010, policymakers and program administrators have been concerned about declining NSLP participation rates.<sup>3</sup> The HHFKA required schools

to offer more healthy foods such as whole-grain foods and a wider variety of fresh fruits and vegetables. As a result of serving unfamiliar and less popular foods, participation rates declined particularly amongst participants paying full price for their lunches.<sup>3</sup> The findings presented here suggest that serving meals prepared with local products can help combat the decline in NSLP participation rates. These timely findings are particularly relevant given that the recently passed Agricultural Improvement Act of 2018 did not expand mandatory funding for FTS programs under the USDA FTS Grant Program.

Although this study provides a better understanding of the impacts of the local procurement aspect of a FTS program on students' participation in the NSLP and selection of healthier meal offerings, there are several limitations. First, this study uses school-level aggregated POS data as a proxy for student choices. The researchers would have preferred to use student-level data instead of school-level data. Unfortunately, student-level POS data was not readily available from the study district because CEP schools within the study district do not record individual student-level transaction data. Future research should determine if similar results are obtained when individual-level student data are used. In addition, more research is needed to determine if the observed increases in selection of salads translates to increased salad consumption.

Furthermore, FTS programs typically incorporate other activities such as school gardening and nutrition education, which, together with procurement, yield the targeted results of the FTS program. At the time of the study, none of the schools in the district offered formal nutrition education programs during the regular school day. However, several of the study schools had school gardens that were operational prior to the introduction of the local procurement aspect of the FTS program. While we do not control for the presence of school gardens directly, the effect of these gardens is contained within the school-level fixed effects. More research is needed to evaluate the impacts of FTS programs within the larger context of the combined impacts of procurement, school gardens, and nutrition interventions.

In addition, since the analyses carried out in this study focused on elementary schools that had offered meals prepared with FTS or FFF more than 15 school days during the school year, further research is needed to determine whether the findings would be different if the elementary schools received a substantially higher supply of locally sourced products and offered meals prepared with these products more frequently. The number of school days within the 2015/2016 school year that schools received FTS or FFF supplies was relatively low (about 26.4% of total

school-day observations). Furthermore, additional research is needed to determine if the results are similar in other districts offering other FTS products.

Finally, this study does not investigate what is driving students' selection behaviors. The observed students' selection behaviors and preferences for lunches made with locally sourced produce could possibly be due to the freshness and quality of the FTS products, or the presence of signs in the school cafeterias promoting the products. Further research is needed to determine if students' selection behavior is driven by the relative freshness and palatability of the locally sourced produce or other factors such as promotion/advertising in school cafeterias. It is curious that FTS products impacts the overall number of NSLP meals served, but the effect of FTS products on the selection of salads is not statistically significant. A possible justification is that parents/caregivers use information on the schools' websites regarding the offering of FTS and FFF products when they are deciding whether to pack their child a lunch. However, once the child is confronted with the actual choice of selecting a particular lunch in the lunchroom, he or she is no longer influenced by his or her parent's/caregiver's desire for her to select the FTS/FFF offering and thus choose a non-salad option not containing a locally sourced item. More research is needed to understand the dynamics of parents/caregivers and their children's decision-making process pertaining to meal selection.

Table 1: Summary Statistics for NSLP Meals and Salads Served

Source of Product	Number of School-Day Offered	NSLP Meals					Salads				
		Total Meals Served	Mean Number of Meals Served	Standard Deviation	Minimum	Maximum	Total Meals Served	Mean Number of Meals Served/ Offering	Standard Deviation	Minimum	Maximum
All	1,880	730,020	388.3	126.7	60	700	32,949	17.5	21	0	169
Conventional	1,331	506,198	380.3	124.8	60	700	23,105	17.4	21.2	0	165
FTS	496	201,379	406	129.5	92	674	8,639	17.4	20.4	0	169
FFF	53	22,443	423.5	127.5	165	660	1,205	22.7	20.4	0	112
FTS and FFF	549	223,822	407.7	129.3	92	674	9,844	17.9	20.4	0	169

Note: School-day observations represents school days when schools offered both salad and non-salad NSLP meals.

Table 2: Regression Results for Number of NSLP Meals Served

	(1)	(2)	(3)	(4)
<i>FTSstarted</i>	8.851* (5.365)		-1.231 (3.016)	
Product source:				
FTS	12.26** (4.913)	12.606** (4.969)	6.587** (2.732)	7.425** (3.091)
FFF	36.519*** (13.677)	36.829*** (12.72)	10.682 (6.919)	12.623* (7.611)
Demographic controls	Yes	Yes	No	No
School-level fixed effects	No	No	Yes	Yes
Data	All year	Start of FTS	All year	Start of FTS
Number of observations	1880	1340	1880	1340
R-squared	0.377	0.373	0.893	0.892

Note: \*, \*\*, \*\*\* indicate parameter significance at = 10%, 5% and 1%, respectively.

Panel-corrected standard errors constructed using the methods proposed by Beck and Katz (1995) are in parentheses. Controls for menu offerings were included as covariates in all models.



Table 3: Regression Results for Number of NSLP Meals Served

	(5)	(6)	(7)	(8)
<i>FTSstarted</i>	-4.884 (1.071)		-7.171 (0.850)	
Product source:				
FTS	1.823* (1.045)	1.863* (0.966)	1.148 (0.859)	1.267 (0.885)
FFF	8.824*** (2.788)	8.610*** (2.406)	5.538*** (2.123)	5.684*** (2.183)
Demographic controls	Yes	Yes	No	No
School-level fixed effects	No	No	Yes	Yes
Data	All year	Start of FTS	All year	Start of FTS
Number of observations	1880	1340	1880	1340
R-squared	0.132	0.129	0.509	0.503

Note: \*, \*\*, \*\*\* indicate parameter significance at = 10%, 5% and 1%, respectively.

Panel-corrected standard errors constructed using the methods proposed by Beck and Katz (1995) are in parentheses. Controls for menu offerings were included as covariates in all models.

## References

- Beck, N. and Katz, J. N. (1995). What to do (and not to do) with time-series cross-section data. *American political science review*, 89(3):634–647.
- Colasanti, K. J., Matts, C., and Hamm, M. W. (2012). Results from the 2009 michigan farm to school survey: Participation grows from 2004. *Journal of nutrition education and behavior*, 44(4):343–349.
- Driscoll, J. C. and Kraay, A. C. (1998). Consistent covariance matrix estimation with spatially dependent panel data. *Review of economics and statistics*, 80(4):549–560.
- Florida Department of Education (2019). Pk-12 public school data publication and reports. Available at: <http://www.fldoe.org/accountability/data-sys/edu-info-accountability-services/pk-12-public-school-data-pubs-reports/students.stml>. Accessed August 12, 2016.
- Jones, S. J., Childers, C., Weaver, A. T., and Ball, J. (2015). Sc farm-to-school programs encourages children to consume vegetables. *Journal of hunger & environmental nutrition*, 10(4):511–525.
- Joshi, A., Azuma, A. M., and Feenstra, G. (2008). Do farm-to-school programs make a difference? findings and future research needs. *Journal of Hunger & Environmental Nutrition*, 3(2-3):229–246.
- Kloppenburger, J., Wubben, D., and Grunes, M. (2008). Linking the land and the lunch-room: Lessons from the wisconsin homegrown lunch project. *Journal of Hunger & Environmental Nutrition*, 3(4):440–455.
- Kropp, J. D., Abarca-Orozco, S. J., Israel, G. D., Diehl, D. C., Galindo-Gonzalez, S., Headrick, L. B., and Shelnutt, K. P. (2018). A plate waste evaluation of the farm to school program. *Journal of nutrition education and behavior*, 50(4):332–339.

- Peckham, J. G., Kropp, J. D., Mroz, T. A., Haley-Zitlin, V., Granberg, E. M., and Hawthorne, N. (2017). Socioeconomic and demographic determinants of the nutritional content of national school lunch program entrée selections. *American Journal of Agricultural Economics*, 99(1):1–17.
- Ralston, K. and Newman, C. B. (2015). *School meals in transition*. United States Department of Agriculture, Economic Research Service . . . .
- U.S. Department of Agriculture (2015). Farm to school: New usda data show growing farm to school efforts help to reduce plate waste, increase student participation in healthier school meals program. Washington DC. Available at: <http://www.usda.gov/wps/portal/usda/usdahome?contentid=2015/10/0292.xml>. Accessed November 20, 2016.
- U.S. Department of Agriculture (2016). Farm to school program fact sheet: Research shows farm to school works. Washington DC. Available at: <https://fns-prod.azureedge.net/sites/default/files/f2s/ResearchShows.pdf>. Accessed November 22, 2016.
- U.S. Department of Agriculture, Food and Nutrition Service (2012). Nutrition standards in the national school lunch and school breakfast programs; final rule. *Federal Register*, 77(17):4088–4167.
- U. S. Department of Agriculture, Food and Nutrition Services (2018). Summary of annual data, fy 2013 –2017. Washington DC. Available at: <https://www.fns.usda.gov/pd/overview>. Accessed September 12, 2018.
- U. S. Department of Agriculture, Food and Nutrition Services (2019). National school lunch program: Participation and lunches served. Washington DC. Available at: <https://fns-prod.azureedge.net/sites/default/files/resource-files/slsummar.pdf>. Accessed April 15, 2019.

Yoder, A. B. B., Foecke, L. L., and Schoeller, D. A. (2015). Factors affecting fruit and vegetable school lunch waste in wisconsin elementary schools participating in farm to school programmes. *Public health nutrition*, 18(15):2855–2863.

Yoder, A. B. B., Liebhart, J. L., McCarty, D. J., Meinen, A., Schoeller, D., Vargas, C., and LaRowe, T. (2014). Farm to elementary school programming increases access to fruits and vegetables and increases their consumption among those with low intake. *Journal of Nutrition Education and Behavior*, 46(5):341–349.

## 6 Supplementary Material

Table A1: Summary Statistics for Salads Served by School and Source of Products

School	Conventional			FTS			FFF		
	Number of School-Day Offered	Mean Number of Meals Served/ Offering	Standard Deviation	Number of School-Day Offered	Mean Number of Meals Served/ Offering	Standard Deviation	Number of School-Day Offer	Mean Number of Meals Served/ Offering	Standard Deviation
1	141	7	5.4	13	4.6	3	0	NA	NA
2	141	9.5	6.4	0	NA	NA	0	NA	NA
3	161	8.6	4.4	7	11.4	5.3	0	NA	NA
4	88	7.5	13.4	46	14	24.3	5	10.8	11
5	94	17.3	10.7	38	12.9	6.3	6	16.3	5.7
6	117	0.04	0.03	37	4.4	3.4	4	6.5	3.1
7	162	7.9	8.5	0	NA	NA	0	NA	NA
8	159	6.5	4.2	0	NA	NA	0	NA	NA
9	95	64.5	42.4	51	55.4	31.6	6	55.7	37.1
10	132	15.4	10.8	11	18.8	9.4	0	NA	NA
11	67	5.8	7.1	35	3.2	6.8	1	0	NA
12	103	28.5	14.9	45	24	14.2	4	31.8	16.3
13	141	5.4	4.6	23	7.6	5.3	0	NA	NA
14	100	15.2	5.9	37	13	6.7	5	15.6	5.6
15	109	16.9	10.3	34	18.7	9.4	5	19.4	10.1
16	109	19.9	12.3	44	21.9	10.2	6	30	5.7
17	109	14.2	12.4	36	9.7	8.1	0	NA	NA
18	143	19.8	8.8	0	NA	NA	0	NA	NA
19	132	3.8	5.3	1	2	NA	0	NA	NA
20	92	17.1	13.3	41	15.2	7.6	6	16.7	4.1
21	141	6.4	4.5	0	NA	NA	0	NA	NA
22	107	11	14.6	29	3.483	2.8	5	22.2	23.5

Notes: School-day observations represents school days when schools offered both salad and non-salad meals.

Table A2: Regression Results for Number of NSLP Meals Served with Driscoll-Kraay Standard Errors

	(1)	(2)	(3)	(4)
<i>FTSstarted</i>	8.851 (5.417)		-1.231 (2.889)	
Product source:				
FTS	12.260** (4.863)	12.606** (4.948)	6.587** (3.250)	7.425** (3.375)
FFF	36.519*** (7.830)	36.829*** (7.695)	10.682 (8.611)	12.623* (8.756)
Demographic controls	Yes	Yes	No	No
School-level fixed effects	No	No	Yes	Yes
Data	All year	Start of FTS	All year	Start of FTS
Number of observations	1880	1340	1880	1340
R-squared	0.377	0.373	0.893	0.892

Note: \*, \*\*, \*\*\* indicate parameter significance at = 10%, 5% and 1%, respectively.

Panel-corrected standard errors constructed using the methods proposed by Driscoll and Kraay (1998) are in parentheses and p-values are in brackets. Controls for menu offerings were included as covariates in all models.

Table A3: Regression Results for Number of Salads Served with Driscoll-Kraay Standard Errors

	(5)	(6)	(7)	(8)
<i>FTSstarted</i>	-4.884*** (1.566)		-7.171*** (1.218)	
Product source:				
FTS	1.823* (1.131)	1.863* (1.156)	1.148 (0.965)	1.267 (1.026)
FFF	8.824*** (2.030)	8.610*** (1.966)	5.538*** (2.077)	5.684*** (2.002)
Demographic controls	Yes	Yes	No	No
School-level fixed effects	No	No	Yes	Yes
Data	All year	Start of FTS	All year	Start of FTS
Number of observations	1880	1340	1880	1340
R-squared	0.132	0.129	0.509	0.503

Note: \*, \*\*, \*\*\* indicate parameter significance at = 10%, 5% and 1%, respectively.

Panel-corrected standard errors constructed using the methods proposed by Driscoll and Kraay (1998) are in parentheses and p-values are in brackets. Controls for menu offerings were included as covariates in all models.