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Too cool for farm to school? Analyzing the determinants of farm to school programming continuation

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ABSTRACT

Among the various food school programs adopted in the U.S., the Farm to School Program (FTSP) is unique in its aims to improve school children's dietary outcomes and to support farm income. As repeated food school interventions/programs are more likely to affect students' dietary outcomes than one-time efforts, school districts' continued participation in FTSP activities is paramount for the program's effectiveness. We use data from the Farm to School Census to evaluate differences across school districts participating in the FTSP which decided to continue or not the program, and to assess the determinants of their continuation decision, using a sample-selection probit estimator. Mean comparisons show that, compared to school districts staying in the program, school districts ceasing FTSP are smaller, more reliant on federal assistance programs, with a higher share of students on federal benefits programs, lower overall per-student expenditures, higher per-student food services expenditure and lower awareness of the USDA geographic preference option. However, these factors do not appear to be direct determinants of the probability of continuation, except the awareness of the USDA geographic preference option, which is strongly associated with continuation. Also, we find that the types and number of FTS activities (particularly promotional activities, and activities taking place in the cafeteria) contribute to explaining the decision to continue FTSP more than the challenges experienced when procuring local foods. We find mixed results regarding the association between state-level policies and a school district's probability of participating and continuing in FTSP. In summary, while policy efforts to ensure continued FTSP participation by smaller and more disadvantaged school districts are needed, efforts to increase awareness of the federal geographic procurement preference option, and policies focusing on promotional and cafetia based activites, may sustain continued FTSP participation in the long-run.

1. Introduction

Improving school children's diets is an important policy goal across the globe; several types of school food programs exist, aiming to improving school enrollments and learning outcomes, children nutrition and to reducing hunger (Sumberg and Sabates-Wheeler, 2011). The daily availability of healthy food options in schools is important to ensure healthful children's diets: for example, in the U.S., an average of about 47% of school-age children's daily energy intake and 35% of daily energy consumption occurs in schools (Briefel et al., 2009). The U.S. National School Lunch Program, a policy effort supporting access to food is schools, is the second largest food assistance program (after the Supplemental Nutrition Assistance Program) in the Nation, providing free or low-cost lunches to about 30 million children daily (USDA, 2019).

Within the growing interest for promoting the healthfulness of children's diets as well as supporting local agribusinesses, Farm to School Programs (FTSP) aim at achieving the two goals of fostering children's health diets and promoting local food systems (Allen and Guthman, 2006; Ohmart, 2002; Pinchot, 2014; Taylor and Johnson, 2013; Vallianatos et al., 2004). FTSPs promote the presence of locally or regionally sourced foods in schools by emphasizing fresh fruits and vegetables over processed food, local over national vendors, and small over large farmers. (Allen and Guthman, 2006).

Evidence supporting the effectiveness of FTSPs to improve children diets or farms' economic performance is mixed. FTSPs aim to improve

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children's diets by facilitating school children multiple exposures to a variety of fruits and vegetables inside the school environment through activities such as taste tests, food coaches, and school gardens (Taylor and Johnson, 2013). Existing studies evaluate the benefits and performance of FTSPs in terms of students' knowledge and acceptance of fruits and vegetables (*e.g.* Joshi et al., 2008; Holland et al., 2015; Somerset and Markwell, 2008). However, a systematic review of the literature on FTSP-related activities (Prescot et al., 2020) finds limited evidence that such activities are beneficial for diet-related student outcomes.[2]

Some of the existing literature indicates that the duration of an intervention affects the effectiveness of school-based program to improve students' dietary outcomes. For example, a meta-analysis of the literature on school-based intervention programs' effectiveness in preventing and managing childhood obesity (Gonzalez-Suarez et al. 2009), found that interventions lasting more than one year had higher odds-ratios of decreasing obesity prevalence. Similarly, Sobal-Goldberg et al.'s (2013) meta-analysis of school-based obesity prevention randomized-control-trial studies, found that longer duration (*i.e.* programs more than one year long) was a factor influencing a program's effectiveness in reducing BMI. Knai et al.'s (2006) systematic review of the literature on school-based interventions promoting fruit and vegetable consumption, highlights that interventions lasting at least twelve months may increase effectiveness. Thus, to the extent that longer exposure to FTSP may improve diet-related student outcomes, assessing factors that are related to a school district decision to continue FTSPs may help (indirectly) to achieve better outcomes.

The goal of this article is to understand what factors are related to repeated participation in FTSP. To that end, we examine first the characteristics of school districts continuing FTSP participation versus those of school districts that did not continue participating in the program. Second, we perform an econometric analysis to investigate the factors associated with a school districts' probability to continue FTSP participation, including school districts' characteristics, activities implemented, challenges experienced in procuring local foods, and State-level FTSP policies.

Previous studies have examined schools' participation in FTSPs and its drivers. Lyson (2016) and McCarthy et al. (2017) examined the relationship of FTSP participation rates and federal and state-level policies. Botkins and Roe (2018) analyzed how school characteristics and local farm production factors are associated with FTSP participation and activities. Previous work has neither analyzed the factors related to FTSP continuation decisions, nor studied the relationship between specific FTSP legislation (in our case, seventeen State-level FTSP policies) and program participation and continuation. Our objective is to provide policymakers and school districts' directors the knowledge necessary to create policies or to engage in activities that will foster continued participation in the program.

Understanding what factors are associated with the probability of schools continuing FTSP participation is also important to assess prospects of institutional market access for farms engaged in "local" food production. Data from the 2015 Farm to School Census (FTSC) indicates that schools purchased $598 million worth of "local" foods in the 2013/14 school year (Martinez, 2016).[3] As Low et al. (2015) estimated the value of farms' local food sales in 2012 at $6.11 billion, $598 million would represent a sizable portion of local farm sales. Thus, assessing the factors contributing to school districts' decision to remain in FTSP, may provide some guidance on designing strategies to sustain institutional demand for local foods.[4]

The paper continues as follows. In the next section we provide more background information on the FTSP and use FTSC data to characterize the features of school districts continuing to implement FTSP, and how they differ from those ceasing participation. Then, we illustrate our empirical framework to assess what factors are associated with a school district decision to participate in, and then to continue FTSP, followed by a description of the data, the variables used in the estimation, the estimation method employed and our identification assumptions. We continue with a discussion of the empirical results and their policy implications. A brief illustration of the limitations of our analysis and avenues for future research concludes.

2. Characterizing school districts by FTSP continuation status

Although FTSPs are supported by several funding sources, including state-level governments, foundations, alternative financial institutions, and business sponsorships (National Farm to School Network, 2018), the United States Department of Agriculture (USDA) National Farm to School Program, created as part of the Healthy Hunger-Free Kids Act of 2010, is the major source of FTSP direct funding. From 2013 to 2018, the USDA awarded up to $5 million annually for training, planning, supporting and implementing FTSPs; grants awarded in 2019 and 2020, reached $9 million and $12.1 million, respectively (Food and Nutrition Service, 2017; National Farm to School Network, 2019, 2020). In addition, the USDA supports FTSP indirectly through a range of grants and loans (USDA, 2018b). [5]

The number of schools implementing FTSPs has increased more than twelve-fold in the 2004–2014 period (Martinez, 2016). Almost every State has either adopted or proposed one or more regulations to help the development of FTSPs (National Farm to School Network, 2017). According to the 2015 FTSC data, nearly 42,587 schools, or 42% of school districts (out of 12,585 completing the survey) implemented FTSPs in the 2013/14 and 2014/15 school years for a total of 23.6 million school children exposed to FTSPs (Food and Nutrition Service, 2015).

Information on school districts remaining in the program is not readily available. The 2013 FTSC collected information regarding FTSP participation during the 2011/12 school year, and on whether school districts not in the program during the 2011/12 school year, planned to start FTSP activities in 2012/13; thus, it does not contain information on whether school districts participating in 2011/12 continued in 2012/13. To quantify the extent of FTSP continuation and to understand whether there are systematic differences between school districts that continued and those that did not, we combined the two available FTSC years,

[2] It should be noted that, while the literature emphasizes that multiple and repeated interventions may be needed to improve children's long-term acceptance of fruits and vegetables by children (*e.g.* Blom-Hoffman et al., 2004; Lakkakula et al., 2010; Wardle et al., 2003), FTSP intervention effectiveness is hard to assess due to the heterogeneity of the interventions studied in terms of duration, activities and/or frequencies (Prescott et al. 2020). Also, interventions studied in the academic literature are likely shorter than the time a school district participates in FTSP before deciding not to continue (e.g. the interventions studied by Blom-Hoffman et al. (2004), Lakkakula et al. (2010), and Wardle et al. (2003) are, respectively, five, ten and two weeks).

[3] It is hard to quantify how much of this revenue was generated from FTSP purchases directly from farms, as more than 70% of participating school districts obtain local foods via distributors (Low et al. 2015).

[4] Also, as FTSP intensity effect on farms' economic performance changes in function of the profitability of the operation (Thilmany et al. 2018), farmers are willing to participate in FTSPs for reasons other than economic ones, including educating children about agriculture, providing the health benefits of fresh, sustainably produced food, and knowledge/awareness dissemination to the community (Izumi et al., 2010; Ohmart, 2002). Additionally, Plakias et al. (2020) also estimate that school district's local spending becomes larger as they consider larger radii for their definition of "local". Thus, while having larger definition of "local" sourcing may facilitate access to local foods, such broader definition, as well as using intermediaries, may result in smaller benefits for nearby farmers.

[5] The USDA also supports FTSP indirectly through a wide range of grants and loans (USDA, 2018b).

focusing on those school districts participating in 2011/12, and their participation status in 2013/14, as reported in the 2015 FTSC.[6]

We matched the two years of data for school districts responding to both the 2013 and the 2015 FTSC, identified using Common Core Data identifiers, and then proceeded by visual inspection of the school districts names, and the ZIP codes where the schools were located.[7] Approximately 74.2% of the school districts responding to the 2013 FTSC participated in the 2015 survey. Of the 6798 school districts appearing in both survey years[8] without missing information, 2826 implemented FTSPs in the school year 2011/2012; of those, 723 did not participate in the program during the school year 2013/2014.

Table 1 reports average values of school districts characteristics (school year 2011/2) for those school districts participating in FTSP in 2011/12, conditional on whether they were still in FTS in 2013/14. The rightmost column includes *p*-values of tests for differences in means between the two groups. The average number of students in school districts continuing FTSP in 2013/14 is statistically larger than school districts that did not continue (by about 80 students per school); also, continuing school districts have a smaller share of students receiving free and reduced-price school meals (by about 3.4%); the also show, on per-student basis, lower federal reimbursements (approximately $21/year), higher overall expenditure (about $ 15/year) and lower food service expenditure ($203/year). FTSP continuing schools are, on average, more aware of the "geographic preference" option within USDA procurement rules for local foods.[9] In terms of racial /ethnic diversity of the student body, they have about a 1% larger share of students being Asian, and 0.8% lower Native Americans. Thus, overall, school district ceasing FTSP appear to be on average smaller, more reliant on federal assistance programs, with a higher share of students on federal benefits programs, lower per-student overall expenditure, but larger food services expenditures. The most striking difference is the incidence of respondents being aware of the geographic preference procurement rule for local foods, one third lower in school districts that did not continue participating in FTSP (29.6%) than in those that continued (46.4%).

The top panel of Table 2 shows the average number of FTS activities, and frequency of implementation of each activity, during the 2011/12 school year conditional on whether they were also in the program in 2013/14. The bottom panel of Table 2 includes the number of challenges experienced in procuring local foods, and the incidence of each specific challenge for the 2011/12 school year, by FTSP continuation status. The rightmost column of Table 2 reports *p*-values of tests for difference in means for each FTSP activity and local food procurement challenge between non-continuing and continuing school districts. School districts continuing FTSP in the 2013/14 school year implemented about 40% more activities in 2011/12 than those that did not (4.67 vs. 2.56). Also, we observe a higher incidence of school districts continuing FTSP to have adopt each single activity compared to those that did not continue, with relative differences ranging from 75% (Media Cover: 0.118 vs 0.048) to 21% (Serve Local: 0.88 vs. 0.69). The one exception is "Farm Trip", which sees a lower incidence among continuing school districts than those ceasing FTSP (−15%, 0.28 vs. 0.33). These values suggest that, compared to school districts that ceased FTSP, continuing school districts are more involved in programming, and tend to implement more - and more diverse - activities.

Contrary to what one may expect, we find continuing school districts to have experienced on average more challenges than school district that did not continue FTSP (3.95 vs. 3.45). Additionally, for seven of the challenges to producre local foods experienced in 2011/12, we find more school districts continuing FTSP in 2013/14 declaring to have experienced them than school district that did not continue for seven indicators. These challenges are high prices (0.46 vs. 0.42), and challenges related to delivery and logistic issues, including lack of reliable delivery of what was ordered (Delivery: 0.28 vs 0.22), quality (0.26 vs. 0.20) and quantity (0.13 vs. 0.09) delivered not matching what was ordered, lack of compliance with the school districts purchasing regulation (Regulations: 0.17 vs. 0.12), and issues related to availability, either in terms of time of the year (Seasonality; 0.72 vs. 0.58) or with respect to processed/precut products (Processed: 0.24 vs. 0.19). These findings may suggest that experiencing local food procurement challenges may not be a contributing factor discouraging school districs to remaining in FTS (or even participating) *per se*; instead, experiencing more challenges can be a signal of commitment to FTSP.

The graphs presented in Fig. 1 show the shares of school districts participating in FTS in the 2011/12 school year, conditional on continuing (or not) FTS programming in 2013/14, as a function of the number of FTSP activities implemented in 2011/12 (Top chart) and the number of challenges experienced to procure local foods (Bottom chart). Consistent with the differences in means discussed above, Fig. 1 suggests a direct relationship between the number of activities that are implemented by a school district and FTSP continuation. 16.8% of school districts that continued FTSP in 2013/14 implemented only one activity in 2011/12 against 35.6% of school districts that did not continue. The gap narrows as one considers two activities (16.4% continuing vs. 21.5% non-continuing), and then it reverses. In other words, we observe a larger share of school districts continuing FTSP in 2013/14 which implemented 3 or more activities in 2011/12, compared to those which did not continue being in the program.

With respect to the number of challenges to procure local foods, we observe a larger share of school districts continuing FTSP declaring to have experienced no challenges (22.1% continuing vs. 13.6% non-continuing). However, we cannot see a clear pattern on how the share of school districts continuing (or not) FTSP correlates with the number of challenges. Thus, while the graphs in Fig. 1 suggest a positive relationship between probability of continuation and the number of activities, no clear relationship emerges between continuation and the number of challenges in procuring local foods.

[6] It is possible for a school district to participate in 2011/12, cease in 2012/13 and join again in 2013/14. It is also possible that a school district participated in both 2011/12 and 2012/13 to cease in 2013/14. While the first case represents a discontinuity in participation unknown to the researcher which may lead to some issues when one tries to model continuation and participation decisions, the latter should not be of concern if one considers school districts' characteristics referring to the school year 2011/12 when modeling continuation.

[7] It should be noted that, while the 2013 FTSC targeted primarily public-school districts, the 2015 FTSC surveyed public, private, and charter school districts. Since the school districts retained in our dataset are those appearing in both years of the FTSC, it is highly likely that our sample includes mostly public-school district. For more details on the school districts surveyed in 2013 and 2015, please see the documentation concerning the FTSC available at https://farmtoschoolcensus.fns.usda.gov/about

[8] 45 school districts were dropped because of student count misreporting. Also, school districts in Hawaii or Alaska were excluded, along with other 532 because of the unavailability of data for some of the variables included in the empirical model (i.e local food supply-chain and demand characteristics).

[9] Following the 2008 Farm Bill schools are encouraged to purchase "local" products and allowed to use a "geographic preference" when procuring local agricultural products. Although limiting sourcing to unprocessed (or minimally processed) products, federal regulations do not indicate how to apply geographic preference, or the extent to which preference should be given to local products. Additionally, schools use different definitions of "local", varying to include short distances (i.e.500 or 100 miles), to broader definitions including a State or a region. Despite the flexibility schools have in using the geographic preference options, selection criteria must be clearly stated in any invitation for bids. It should be noted that geographic preference applies to the determination of the winning bid and does not affect the price received by business responding to the invitation for bids. For more details see USDA FNS (2011).

Table 1
Characteristics of School District Participating in FTSP in 2011/12 - Characteristics refer to the School Year 2011/12.

Variable	Description	School districts with FTSP in 11/12; no FTSP in 2013/14[a]		School districts FTSP in 11/12 and 13/14[b]		P-val diff. in means (1)–(2)
		Mean(1)	S.D.	Mean(2)	S.D.	
Size	Average school size (1000 students)	0.381	0.223	0.461	0.235	0.000
%Reduced	Percent of students eligible for free and reduced-price school meals	48.119	21.431	44.648	21.461	0.000
Reimburs	Federal Money Reimbursement per student ($1000/year)	0.260	0.162	0.239	0.138	0.000
TotalExp	Total school system expenditure per student ($1000/year)	1.327	0.540	1.341	0.553	0.000
FoodCost	Total expenditure on food services per student ($100/year)	2.592	1.244	2.395	0.987	0.000
FoodRevenue	Food service revenue from food sales per student ($100/year)	1.625	0.898	1.671	0.893	0.235
Awareness	Binary variable = 1 if aware of geographic preference option in local food procurement rules	0.296	0.457	0.464	0.499	0.000
%NativeAm	Percent of Native Americans students in the school district	2.289	9.736	1.527	7.032	0.024
%Asian	Percent of Asian students in the school district	1.821	4.151	2.799	5.135	0.000
%Hisp	Percent of Hispanic students in the school district	14.515	21.810	14.486	19.409	0.973
%Black	Percent of Black students in the school district	7.840	16.792	7.908	14.622	0.917
%Pacific	Percent of Pacific Islander students in the school district	0.121	0.358	0.144	0.332	0.115
%TwoMore	Percent of students with two or more races in the school district	2.650	3.221	2.886	2.741	0.057
%White	Percent of White (non-Hispanic) students in the school district	70.763	28.495	70.250	26.185	0.657

Source: authors' elaboration on USDA Farm to School Census data (2013; 2015).
Note:
[a] N = 723.
[b] N = 2103.

3. Empirical model

To model school districts' decision to remain in FTS in 2013/14 conditional on participating in 2011/12, we begin by modeling the *i*-th school district decision to participate in FTSP (that is, P_i or "Participation") in 2011/12 a way similar to Botkins and Roe (2018):

$$P_i = f\left(\boldsymbol{SD}_i, \boldsymbol{SC}_i, \boldsymbol{Dem}_i, \boldsymbol{Pol}_i, \boldsymbol{R}_i | \boldsymbol{\beta}^P, \boldsymbol{\delta}^P, \lambda^P, \boldsymbol{\theta}^P, \boldsymbol{\mu}^P\right) + \varepsilon_i^P \quad (1)$$

where $\mathbf{SD_i}$ is a vector of school district *i* characteristics (such as: student body size and composition; cost of food served in the cafeteria etc.); $\mathbf{SC_i}$ is a vector of local food supply-chain attributes, signaling the local market readiness to support FTS (including presence of food hubs, farm direct sales, etc.) and procurement of local foods;[10] $\mathbf{Dem_i}$ includes market-level demographic characteristics (total population, poverty etc.); $\boldsymbol{Pol_i}$ is a vector of variables capturing the policy environment supporting FTSP, or the State-level FTS policies currently in place (e.g. establishing or supporting a school garden program; directing schools to purchase food locally etc.); and $\mathbf{R_i}$ is a vector of time-invariant controls, including the level of urbanization/rurality of the area where school district *i* is located, and the region it belongs to. The conformable vectors $\boldsymbol{\beta}^P, \boldsymbol{\delta}^P, \lambda^P, \boldsymbol{\theta}^P$, and $\boldsymbol{\mu}^P$ (where the superscript *P* stands for "Participation") are parameters to be estimated. It should be noted that equation (1) differs from Botkins and Roe's (2018) model as we include the vector **Pol** and, for technical reasons,[11] we abstract from spatial spillover.

We treat equation (1) - participation equation - as a "selection" equation: a school district will continue participating in FTSP if and only if $P_i = f(\cdot) + \varepsilon_i^P > 0$. We assume that once a school district participates in the program in a given year, they will continue FTSP activities in future school years if the benefits from remaning in the program (i.e. positive educational and nutritional outcomes for children, students and parents' satisfaction with the programs etc.) exceed the costs.[12] Assume that this cost-benefits trade-offs can be represented by the latent variable *C** (Continuation) and that the decision to continue can be modeled as:

$$C_i^* = g\left(\boldsymbol{SD}_i, \boldsymbol{Dem}_i, \boldsymbol{Act}_i, \boldsymbol{Ch}_i, \boldsymbol{Pol}_i, \boldsymbol{R}_i | \boldsymbol{\beta}^C, \lambda^C, \boldsymbol{\alpha}^C, \boldsymbol{\gamma}^C, \boldsymbol{\theta}^C, \boldsymbol{\mu}^C\right) + \varepsilon_i^C \quad (2)$$

where the vectors $\mathbf{SD_i}$, $\mathbf{Dem_i}$, $\mathbf{Pol_i}$ and $\mathbf{R_i}$, are discussed above, and $\mathbf{Act_i}$ and $\mathbf{Chal_i}$ include variables representing, respectively, FTSP activities currently implemented and the challenges experienced for the procurement of local foods.

Assuming $\varepsilon^P \sim N(0,1)$, $\varepsilon^C \sim N(0,1)$ and $Corr(\varepsilon^P \varepsilon^C) = \rho$,[13] equations (1) and (2) can be estimated simultaneously, using the sample selection probit model proposed by Van de Ven and Van Pragg (1981). To guarantee identification, we assume that the variables in **SC** affect only program participation and not continuation. In other words, we assume that the local food supply-chain characteristics (*i.e.* the density of farmers markets, presence of food-hubs, etc.), signal the ease of implementation of FTSP, informing school districts about local foods availability, the ease of procuring local foods etc. Once a school district participates in FTS, the structure of the local food-supply chain becomes less important as school districts have experienced first-hand procurement challenges ($\mathbf{Chal_i}$) and implemented specific activities ($\mathbf{Act_i}$).

We estimate four different specifications of equations (1) and (2). All model specifications include the same school district characteristics, local food supply-chain characteristics, demand side factors, and time invariant controls, and differ in how the vectors **Act**, $\mathbf{Chal_i}$ and $\mathbf{Pol_i}$ are operationalized. In the first model specification, Specification 1, the continuation equation includes the number of activities ($NAct_i$), and the

[10] As pointed out by two anonymous reviewers, school districts' past experiences in procuring local foods may be a better predictor of FTSP participation than local food supply-chain factors. As we discuss in the next section, data limitations prevented the inclusion of variables capturing challenges to procuring local foods in equation (1). We remediated by including local food supply-chain variables, which, for the subsample of school districts continuing FTSP seem to be good predictors of local food procurement challenges, while also being uncorrelated with unobserved drivers of participation.

[11] Botkins and Roe (2018) use the spatially weighted proportion of nearby school districts participating in FTS program to explain participation. We opted for not including this variable for two reasons. First, including a spatial lag will introduce endogeneity bias in the model. Second, as we model participation and continuation jointly, constructing spatial lags for both participation and continuation could introduce multicollinearity in our model.

[12] Long et al. (2019) suggest that FTS can be beneficial for school district in meeting new nutritional fruits and vegetable requirements as FTS procurement reimbursement policies can decrease cost increases associated with providing additional fresh fruits and vegetables in school meals.

[13] Note that, if $Corr(\varepsilon^P \varepsilon^C) = 0$ there would be no need to model participation and continuation jointly, and a standard probit regression would suffice to have unbiased estimates.

Table 2
Summary Statistics of FTSP Specific Variables for School Districts.

Variable	Description	School districts with FTSP only in 11/12[a]		School districts with FTSP in 11/12 & 13/14[b]		P-val diff. in means
		Mean (1)	S.D.	Mean (2)	S.D.	(1)–(2)
Activities						
NAct[c]	Number of FTS activities implemented in 2011/2012	2.562	1.931	4.267	3.019	0.000
Serve Local	School district served locally produced foods in the cafeteria	0.689	0.463	0.872	0.334	0.000
Taste Demos	School district held taste testing/demos of locally produced foods	0.220	0.414	0.429	0.495	0.000
Food Coach	School district used cafeteria food coaches	0.169	0.375	0.284	0.451	0.000
School Garden	School district conducted edible school gardening or orchard activities	0.205	0.404	0.320	0.467	0.000
Serve Garden	Served products from school-based gardens or school-based farms	0.131	0.338	0.247	0.432	0.000
Taste Garden	Held taste testing/demos of school-based gardens/farms products	0.091	0.288	0.186	0.390	0.000
Field Trip	Conducted student field trips to farms	0.325	0.469	0.282	0.450	0.028
Farmer Visit	Farmer(s) visit the cafeteria, classroom or other school-related setting	0.112	0.316	0.188	0.391	0.000
Themed Promo	Promoted local efforts through themed or branded promotions	0.100	0.300	0.293	0.455	0.000
Promote Local	Promoted locally produced foods at school in general	0.209	0.407	0.485	0.500	0.000
Media Cover	Generated media coverage local foods in schools	0.048	0.215	0.188	0.391	0.000
Hosted Events	Hosted community events	0.102	0.303	0.140	0.347	0.009
F2S Month	Farm to school month	0.084	0.278	0.220	0.414	0.000
Curriculum	Integrated farm to school concepts into educational curriculum	0.076	0.265	0.130	0.336	0.000
Challenges Procuring Local Foods						
NChal[c]	Number of challenges faced in 2011/2012	3.450	3.199	3.948	3.211	0.000
Seasonality	Hard to find year-round availability of key items	0.578	0.494	0.721	0.449	0.000
Availability	Local items not available from primary vendors	0.371	0.483	0.361	0.408	0.638
Range	Vendors for local items don't offer a broad range of products	0.288	0.453	0.311	0.463	0.250
High_price	Prices too high	0.418	0.494	0.463	0.499	0.036
Unstable_price	Unstable product prices	0.184	0.388	0.181	0.385	0.845
Delivery	Lack of reliability in delivering ordered items	0.220	0.414	0.275	0.447	0.004
Regulations	Lack of compliance with institution's purchasing regulations & policies	0.120	0.326	0.165	0.371	0.004
Processed	Lack of availability of processed/precut products	0.189	0.392	0.237	0.425	0.009
New_suppliers	Hard to find new suppliers/growers or distributors	0.239	0.427	0.238	0.426	0.955
Information	Hard to get information about product availability	0.201	0.401	0.206	0.405	0.738
Orders	Hard to place orders with vendors	0.079	0.270	0.095	0.293	0.202
On-time	Getting on-time deliveries	0.113	0.317	0.126	0.331	0.391
Quality	Product delivered meeting quality requirements and other specifications	0.203	0.403	0.255	0.436	0.005
Quantity	Having quantity delivered equal to quantity ordered	0.090	0.286	0.133	0.340	0.002
Deliv Prob	Resolving problem with deliveries	0.047	0.212	0.058	0.235	0.246
Pay Needs	Inability to pay farmers according to needs due school district payment procedures	0.109	0.312	0.125	0.331	0.262

Source: authors' elaboration on USDA Farm to School Census data (2013; 2015).

[a] N = 723.

[b] N = 2103.

[c] NAct and NChal take integer values, all other variables are binary.

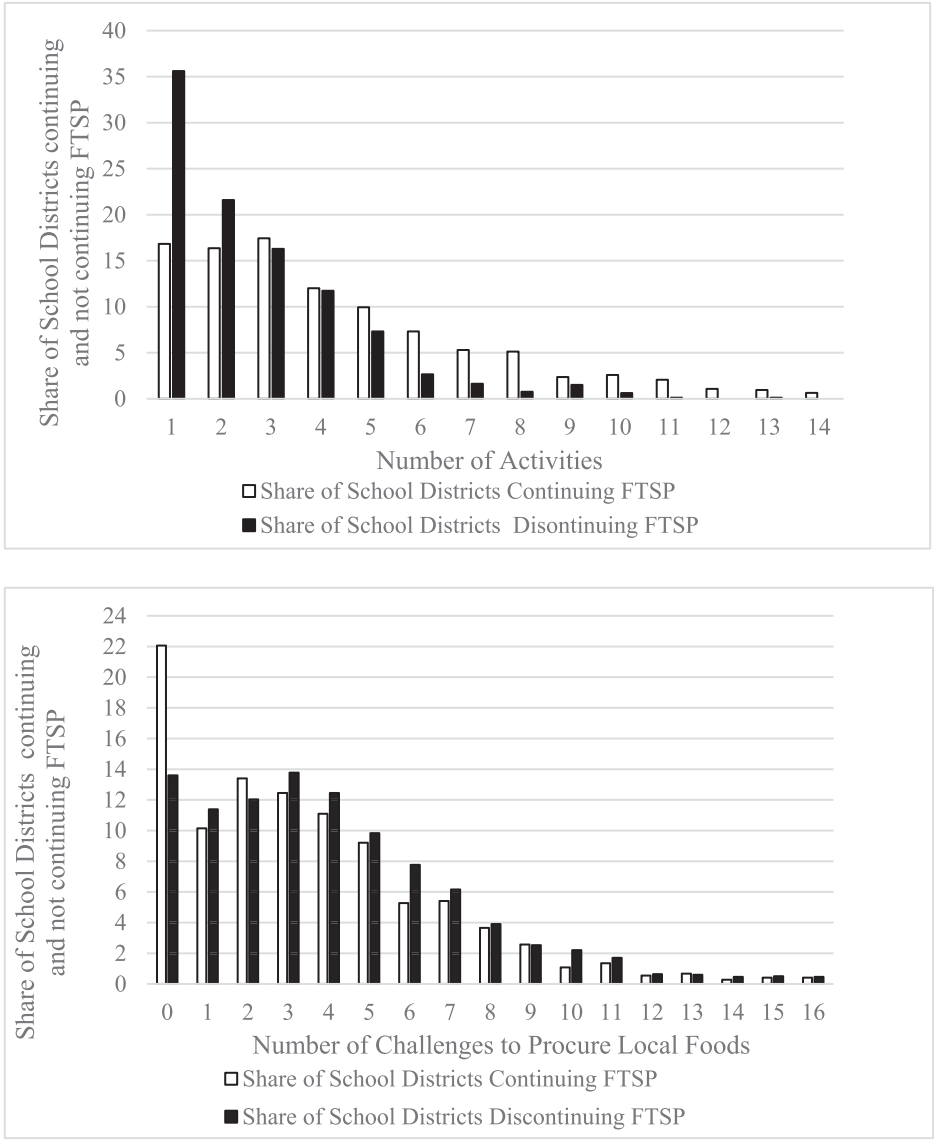

Fig. 1. Share of school districts participating in FTSP in 2011–2012 by numbers of FTSP activities (Top Panel) and challenges to procure local foods (Bottom Panel), conditionally on FSTP continuation in 2013–14. Source: authors elaboration on Farm to School Census data.

number of challenges ($NChal_i$). The total number of active state-level FTS policies in the State where a school district is located ($NPol_i$) is included in both continuation and participation equations. Specification 1 is:

$$P_i = \sum_{k=1}^{K} \beta_k^P SD_{ki} + \sum_{j=1}^{J} \delta_j^P SC_{ji} + \sum_{l=1}^{L} \lambda_l^P Dem_i + \theta^P NPol_i + \sum_{r=1}^{R} \mu_r^P R_{ri} + \varepsilon_i^P \tag{3a}$$

$$C_i = \sum_{k=1}^{K} \beta_k^C SD_{ki} + \sum_{l=1}^{L} \lambda_l^C Dem_{li} + \alpha^C NAct_i + \gamma_1^C NChal_i + \theta^C NPol_i + \sum_{r=1}^{R} \mu_r^C R_{ri} + \varepsilon_i^C \tag{3b}$$

In the continuation equation of Specification 2, we replace the number of activities and challenges with indicator variables capturing, respectively, whether a school district implemented one of the M activities (Act_m), and experienced one of N possible challenges in procuring local foods ($Chal_n$). Similarly, we replace the total number of state-level policies in both continuation and participation equations, with G indicator variables capturing whether a school district is located in a State adopting any of the G FTS policies (Pol_g). Specification 2 is:

$$P_i = \sum_{k=1}^{K} \beta_k^P SD_{ki} + \sum_{j=1}^{J} \delta_j^P SC_{ji} + \sum_{l=1}^{L} \lambda_l^P Dem_{li} + \sum_{g=1}^{G} \theta_g^P Pol_{gi} + \sum_{r=1}^{R} \mu_r^P R_{ri} + \varepsilon_i^P \tag{4a}$$

$$C_i = \sum_{k=1}^{K} \beta_k^C SD_{ki} + \sum_{l=1}^{L} \lambda_l^C Dem_{li} + \sum_{m=1}^{M} \alpha_m^C Act_{mi} + \sum_{n=1}^{N} \gamma_n^C Chal_{ni} + \sum_{g=1}^{G} \theta_g^C Pol_{gi} + \sum_{r=1}^{R} \mu_r^C R_{ri} + \varepsilon_i^C \tag{4b}$$

Fig. 1 shows that school districts in FTS tend to implement multiple activities during the same school year; in particular, about two thirds of school districts continuing FTSP participation in 2013/14 implemented three or more activities in 2011/12, against 42.8% of school districts ceasing participation. Similarly, although we could not see a clear pattern for the challenges to procure local foods, school districts experience multiple challenges at once (about 54% of continuing and 63% of non-continuing school districts experienced three or more challenges).

Similarly, school districts are likely exposed to combinations of different state-level policies. Thus, it is possible that certain combinations of activities, challenges, or policies, may affect differently the decision to continue or participate in FTSP. To account for this possibility, we created two other model specifications (Specification 3 and 4) where in place of total numbers (Specification 1) or individual indicators (Specification 2), we use variables representing combinations of activities, challenges, and state-level policies, based on the results of Principal Component Factor Analysis (PCFA) as illustrated in the next section. In Specification 3, we include the sum of school district i m^h activities, $m^h Act_{hi}$, (n^j challenges $n^j Chal_{ji}$; g^f state-level policies $g^f Pol_{fi}$) contributing to the h-th (j-th; f-th) retained principal component, contributions based on the loadings of the different activities (challenges; state-level policies) on the component.

$$P_i = \sum_{k=1}^{K} \beta_k^P SD_{ki} + \sum_{j=1}^{J} \delta_j^P SC_{ji} + \sum_{l=1}^{L} \lambda_l^P Dem_{li} + \sum_{f=1}^{F} \theta_f^P g^f Pol_{fi} + \sum_{r=1}^{R} \mu_r^P R_{ri} + \varepsilon_i^P \tag{5a}$$

$$C_i = \sum_{k=1}^{K} \beta_k^C SD_{ki} + \sum_{l=1}^{L} \lambda_l^C Dem_{li} + \sum_{h=1}^{H} \alpha_h^C m^h Act_{hi} + \sum_{j=1}^{J} \gamma_j^C n^j Chal_{ji} + \sum_{f=1}^{F} \theta_f^C g^f Pol_{fi} + \sum_{r=1}^{R} \mu_r^C R_{ri} + \varepsilon_i^C \tag{5b}$$

Marginal effects derived from estimates of αs, γs, and θs, will provide a direct measure of which group of activities, challenges, or policies in each group identified by the data, is related the most with the probability of FTSP continuation.

In the fourth specification we use the variables' loadings on each component to create 0–100 indexes to measure the relative intensity of different groups of activities ($ActiInd_h$), challenges ($ChalInd_j$), and state-level policies ($PolInd_f$). Specification 4 is:

$$P_i = \sum_{k=1}^{K} \beta_k^P SD_{ki} + \sum_{j=1}^{J} \delta_j^P SC_{ji} + \sum_{l=1}^{L} \lambda_l^P Dem_{li} + \sum_{f=1}^{F} \theta_f^P PolInd_{fi} + \sum_{r=1}^{R} \mu_r^P R_{ri} + \varepsilon_i^P \tag{6a}$$

$$C_i = \sum_{k=1}^{K} \beta_k^C SD_{ki} + \sum_{l=1}^{L} \lambda_l^C Dem_{li} + \sum_{h=1}^{H} \alpha_h^C ActInd_{hi} + \sum_{j=1}^{J} \gamma_j^C ChalInd_{ji} + \sum_{f=1}^{F} \theta_f^C PolInd_{fi} + \sum_{r=1}^{R} \mu_r^C R_{ri} + \varepsilon_i^C \tag{6b}$$

As the variables of interest in (6a) and (6b) are 0–100 indexes, the magnitude of the marginal effects derived from the estimates of αs, γs, and θs are not directly comparable across groups of variables. However, they represent how the relationship between a group of activities (challenges or policies) and the probability of remaining in the program changes as a school district's index moves from 0 - the "worst" combination in the data of activities/challenges/policies in a given group - to 100, indicating a school district with the "best" combinations of variables in said group.

4. Data, variables, PCFA, estimation and identification

The main dataset used in the estimation encompasses FTSC school districts data that were present in both the 2013 and the 2015 FTSC surveys. The process for identifying school districts present in both years of the FTSC was discussed in Section 2 above. The dependent variable used for the participation (selection) equation is an indicator variable capturing FTSP participation in the 2011/12 school year, from the 2013 FTSC. Continuing school districts were those participating in FTSP in both the 2011/12 and 2013/14 school years.[14] The explanatory variables included in the model are discussed below.

4.1. School districts characteristics

Both participation and continuation equations include controls for school districts characteristics to capture how the decision to participate and continue in the program be related to schools' internal characteristics. The choice of variables follow Botkins and Roe (2018): number of students in the school district, the ethnic/racial composition of the student body, percentage of students eligible for free and reduced meals; and other school characteristics including, costs, cafeteria sales, and federal money reimbursements, all from the 2013 FTSC, originally sourced from the Common Core of Data.

4.2. Demand and local food-supply chain characteristic

Demand-side variables included in both participation and continuation equations are *%HHLowAccess*, the percentage of households with no car and low access to a food store in 2012; county-level poverty rate (*CountyPovRate*), and population (*CountyPop*) obtained from the USDA Food Environment Atlas (ERS, 2015). Summary statistics for these variables are reported in the middle and bottom panels of Table 3.

Because the FTSC does not ask all respondents about the challenges experienced in procuring local foods, which may discourage FTSP participation, we cannot control for these variables in the participation equation without necessarily losing a considerable number of observations, and likely introducing additional bias in our estimates.[15] Thus, following Botkins and Roe (2018), we include a series of variables that capture local food supply-chain measures. Two of these variables, the

[14] Given that we do not observe FTSP participation for school year 2012/13, we assume that participation of continuing school districts is uninterrupted. In other words, when we observe a school district participation in FTSP in 2011/12 and 2013/14, we assume that they also participated in 2012/13 as well. The implications, and limitations, of this assumption are discussed in the conclusion section.

[15] The 2013 FTSC asked about local food procurement challenges to school districts in FTSP during the 2011/12 school year, and those not in FTS with no plan to implement FTSP in the future. The "challenges" questions were not asked to school districts declaring not to participate in FTSP in 2011/12 but starting in the following school year ("No, but started activities in the 2012/2013 school year") or in the future ("No, but plan to start activities in the future"). A sizeable number of school districts were not asked about their challenges to procure local foods - specifically, in the estimation sample, 1228 school districts which amount to 18% of the sample, and 30.8% of non-participating school districts in 2011/12. Furthermore, including "*Challenges*" in the participation equation, and dropping all observations with missing values, may introduce sample selection bias, as school districts' exclusion from the sample would be systematic. Also, all of the 1228 observations to be dropped belong to non-participant school districts, which would result in this type of school districts to be underrepresented in our data, reducing the validity of our estimates.

Table 3
Summary statistics of school district, local food supply-chain, and demand characteristics for the estimation sample (N = 6798).

Variable	Description	Mean	S.D.	Min	Max
School District Characteristics					
Size		0.392	0.238	0.003	3.26
$Size^2$		0.21	0.33	0	10.628
%Reduced		48.342	20.721	0	99.66
Reimburs		0.257	0.143	0	2.286
TotalExp		1.359	3.32	0.106	259.175
FoodCost		2.533	1.117	0	24
FoodRevenue		1.622	0.848	0	9.137
Awareness		0.385	0.487	0	1
%NativeAm		2.043	8.647	0	100
%Asian		1.79	4.102	0	64.602
%Hisp		13.596	19.722	0	99.686
%Black		7.515	15.868	0	100
%Pacific		0.129	0.432	0	17.444
%TwoMore		2.588	2.853	0	70.408
%White		72.328	26.467	0	100
Local Food Supply-Chain Characteristics					
AvFarmInc	Average farm income of the county ($100 million, IDW)	0.273	0.208	0.01	1.19
%FarmsDirectSales	Percentage of farms with directs-to-retail sales, IDW	3.081	2.874	0.215	19.849
CountyFoodHubss	Binary variable = 1 if food hub in county; 0 otherwise (2012)	0.111	0.314	0	1
PerCapitaFM	Number of farmers' markets (FM) per 10,000 people (2012)	0.044	0.062	0	0.858
MilkPriceRatio	Milk price ratio: county/national average (2010)	0.952	0.125	0.722	1.217
Demand Characteristics					
%HHLowAccess	% Households with no car and low access to a food store (2012)	2.466	1.661	0	29.508
CountyPovRate	County poverty rate (2015)	14.975	5.475	3.4	47.4
CountyPop	County Population (in 1,000,000) (2015)	0.344	0.964	0.001	10.112

inverse distance weighted (IDW)[16] farm income *AvFarmInc* and proportion of farms with direct sales, *%FarmsDirectSales*, graciously supplied by Elizabeth Botkins, were used to capture overall farm activity in the area and schools ease of access to local foods, respectively. Other supply-chain variables, obtained from the USDA's Food Environment Atlas (ERS, 2015), are *PerCapitaFM*, the number of farmer's markets per 10,000 people; *CountyFoodHubs*, a binary variable capturing the existence of food hubs in the county where a school district is located; and *MilkPriceRatio,* the ratio of a county milk price to the national average (in 2010): this variable is included because local milk is the one kind of "local food" served in many schools; additionally, milk price is strongly correlated with non-produce foods (Botkins and Roe, 2018). These variables are only included in the participation equation; therefore, they serve as exclusion restrictions and play a key role in the identification of our estimates. Their validity as exclusion restrictions is discussed in Section 4.6. Summary statistics of the Local Food Supply-Chain Variables are presented in Table 3, third panel from the top.

4.3. Activities, challenges and state-level policy variables (Specifications 1 and 2)

The continuation equation includes variables capturing FTSP activities implemented and challenges to procure local food experienced during the 2011/12 school year. Table 2 reports the total number of activities (top Panel, first row) and challenges (bottom panel, first row), used in Specification 1, and the fourteen activities' and sixteen challenges' indicator variables included in Specification 2. The average number of FTSP activities by participating school districts in 2011/12 is 3.83, and 4.27 for continuing school district. Serving local foods in cafeterias (*Served*) is the most common activity for both school districts participating in 2011/12 (82.5%) and continuing in 2013/14 (87.2%), followed by promoting locally produced food (*Promo*) and holding taste testing/demonstrations (*Tastetest*). The average number of challenges to procure local foods faced by school districts in FTS are 3.82 and 3.98 respectively, for participating and continuing school districts. Year-round unavailability, higher prices, unavailability of local items from primary vendors, and lack of offer of a broad range of local items by vendors are the most cited challenges. Both the participation and continuation equations include State-level policy variables, created using the information on the sixteen state-level related policies from the National Farm to School Network State FTS Legislative Survey: 2002–2017 (National Farm to School Network, 2017). In Specification 1 we use the number of active policies as of 2011; in Specification 2 we use indicator variables equal to one for each policy active in 2011.[17] A description of these variables, the corresponding policies, and their incidence are presented in Table 4.

4.4. Activities, challenges and state-level policies combinations; FTS intensity indexes (specifications 3 and 4)

Model specifications 3 and 4, include combinations of activities, challenges, and policies, obtained using Principal Component Factor Analysis. Because all the variables considered are binary, which violates the multivariate normality assumption of PCFA, we employ a tetrachoric correlation matrix (Harris 2006). The sums of the activities, challenges and state-level policies showing the highest loading on each retained factor, are used in Specification 3. Activities, challenges and state-level policies intensity indexes obtained from each retained factor are used in specification 4. We follow Kaiser's rule and retain factors with eigenvalues larger than one; then we perform a Principal Component Analysis, applying the "Varimax" rotation to the matrix of factor-loadings. Fig. 2 reports the scree plots of factor analyses performed on activities

[16] For the purposes of constructing these variables, local food is defined as food produced within 400miles radius (Food, Conservation and Energy Act of 2008) and to control for the accessibility of schools to local food based on distance, the inverse distance weighted (IDW) farm income and proportion of farms with direct sales were used. This procedure is explained in detail in Botkins and Roe (2018). Please note that IDW is calculated only for the continental U.S., thus, Alaska and Hawaii were excluded from the analysis (see Botkins and Roe (2015) for more details).

[17] Each binary indicator variable for the presence of a policy is coded as 1 if the policy was adopted, codified, and included in annual state budget documents or annual public law documents, and 0 if there is no ongoing policy in a given category, or if the policy is dead, pending, the legislature had not yet voted on the bill, or if did not include FTS or local food related parts.

Table 4
State-level FTSP Policies in the state in which the school district is located (N = 6798).

Abbreviation	Description	Active in 2011	
		Mean	S.D.
NPol	Number of state-level FTS policies in the State where a school district is located	4.103	3.029
FTSP Support Taskforce	Creates a task force (council, working group) in support of FTS activities	0.422	0.494
Authorize Grants	Authorized grants to support FTS activities	0.414	0.493
FTSP Database	Directs to track & publish names of parties interested in participating in FTSP	0.362	0.481
Directs Local Purchase	Directs schools to purchase foods locally	0.362	0.481
Educational Activities	Supports food-based, ag-based, and garden-based educational activities	0.350	0.477
Appropriation	Allocates money or creates a fund for FTS activities	0.311	0.463
FTSP Established	Establishes a FTSP within a state agency	0.294	0.456
School Garden Support	Establishes or supports school garden program	0.168	0.374
Coordinator	Establishes a statewide FTSP coordinator position	0.154	0.361
State Promo Event	Creates a statewide program/event celebrating FTS activities	0.140	0.347
Fund Local Foods	Provides schools additional funds for meal served that include local foods	0.129	0.336
Celebrates FTS Activities	Celebrates or encourages FTS activities	0.101	0.301
Temporary FTSP	Creates a temporary FTSP	0.075	0.263
FTSP Encouraged	Encourages FTS activities as part of a broader state policy	0.066	0.248
Infrastructure Development	Supports infrastructure development for local food aggregation, procurement & distribution	0.063	0.242
FTSP as Equity	Lists economic, health, or racial disparities as factors motivating FTS activities	0.030	0.172

Source: Authors elaborations based on State Farm to School Legislative Survey: 2002–2017 (National Farm to School Network, 2017).

and challenges (Top chart) and state-level policy indicators (Bottom chart). The loadings of the (rotated) components are reported in Tables 5 (activities and challenges), and Table 6 (state-level policies).

The top chart of Fig. 2 shows four factors with eigenvalues larger than one, which account for 87.5% of the total variance among activities and challenges. Performing a tetrachoric PCA, and retaining four factors, the rotated factor-loadings show the largest activities' loadings on factors 2 and 3, whereas local food procurement challenges show large loadings on factors 1 and 4. Activity indicators with the highest loadings on factor 2 either take place in the cafeteria (Serving local foods, teste demonstrations, food coaches) or represent promotional activities (Themed promotions, promotion of local foods, media coverage and celebration of farm to school month). The activitity indicators with the largest loadings on factor 3 are educational (Curriculum), thsoe related to the presence of a school garden (School Garden,Serve Garden and Taste Garden) and involving farmers / farm activities (Farmer Visit, Field Trip, and Hosted events , The sum of these activities' indicators gives the variables *NCafeteria/Promo Activities* and *N Education /Garden/ Farm Activities.*[18] We obtain two Activity Intensity Indexes (AII), dividing the difference between each factor and its minimum value, by the factor's entire range of values, then multiplied by 100. Using consistent terminology, the resulting indexes are *Cafeteria/Promo AII* and *Education /Garden/Farm AII,* which will be used in specification 4.

The variables with the largest loadings on Factor 1 are those related to logistic issues (among others: on-time delivery, issues with delivery, ordering issues) or prices (high prices, unstable prices, specific pay needs); the challenge indicators with the largest loadings on factor 4 are related to availability issues (e.g. seasonality, availability, quality range etc.) The resulting challenges variables used in specification 3 are *N Price/Logistic Challenges* and *N Availability Challenges.*[19] The 0–100 standardized Challenges Intensity Index (CII) from factor 1 is the *Price/ Logistics CII*; that obtained for factor 4 is the *Availability CII.*

Applying the same procedure to the state-level policy indicators, we encountered two issues. First, some of the "classification tables" used to determine tetrachoric correlations had missing values. Second, our tetrachoric correlation matrix showed negative eigenvalues. As a result, only ten of the sixteen state-level policy variables were subjected to PCFA,[20] and only seven factors considered. The scree plot at the bottom of Fig. 2 shows four factors having eigenvalues larger than 1, explaining 81.6% of the common variance of the remaining state-level policies. The loadings of the (rotated) components in Table 6 show Authorize Grants, FTSP Established, Directs Local Purchase, and FTSP Database to be the variables with the highest loadings on Factor 1. The resulting aggregate variables are *N Grants/Founded/Local/DB Policies* and the 0–100 Policy Intensity Index (PII) *Grants/Founded/Local/DB PPI*. Appropriation, School Garden Support, and Directs Local Purchase show the largest loadings on Factor 2 - the resulting aggregates are *N Approp/Garden/ Local Policies* and *Approp/Garden/Local PII*. Authorize Grants, Educational Activities, and FTSP Support Taskforce show high loadings on Factor 3 - from which we create the variables *N Grants/Educational/ Support Policies* and *Grants/Educational/Support PII.* Last, Coordinator and State Promo Events show the largest loadings on Factor 4; thus, we obtain the variables *N Coordinator/Promo Policies* and *Coordinator/ Promo PII*. For completeness we create a fifth aggregate policy variable obtained from the sum of the state-level policy indicators omitted from the PCFA (*N Excluded Policies*). Summary statistics for the combined variables are reported in Table 7.

4.5. Other controls

Both participation and continuation equations include USDA's Food and Nutrition Service regional-level fixed effects, and indicator variables to represent the urban/rural status of the county where the school district is located according to the Rural Urban Continuum Codes (ERS, 2013), to account for time-invariant factors that may affect school districts decision.[21]

4.6. Estimation and identification

The different model specifications are estimated using the *Heckprobit* routine in Stata 14 which implements Van de Ven and Van Pragg (1981)

[18] More specifically, *NCafeteria/Promo Activities* is the sum of Serve Local, Taste Demos, Food Coach, Themed Promo, Promote Local, Media Cover, and F2S Month. *N Education /Garden / Farm Activities* is given by the sum of School Garden, Serve Garden, Taste Garden, Field Trip, Farmer Visit, Hosted Event, and Curriculum.

[19] *N Price / Logistic Challenges* includes the sum of High_Price, Unstable_Price, Delivery, Regulations, Processed, Information, Orders, On-time, Quality, Quantity, Deliv Prob, and Pay Needs. *N Availability Challenges* is the sum of Seasonality, Availability, Range, Processed, New_suppliers and Information. As two challenges (Processed and Information) show almost the same loadings on both Factor 1 and 4, they are included in both variables.

[20] The six State-level Policies excluded from the PCFA are FTSP as Equity, Infrastructure Development, Temporary FTSP, Celebrates FTS Activities, Fund Local Foods, and State-Promo Events. These variables capture six of the seven policies least represented in the data (the seventh being FTSP Encouraged, third to last).

[21] State-level fixed effects were not used as to avoid multicollinearity with the state-level policies: their inclusions resulted in unreasonably large standard error. However, we used standard errors clustered at the state-level to capture some of the common variations within states, and to partially account for the lack of a spatial lag in our models.

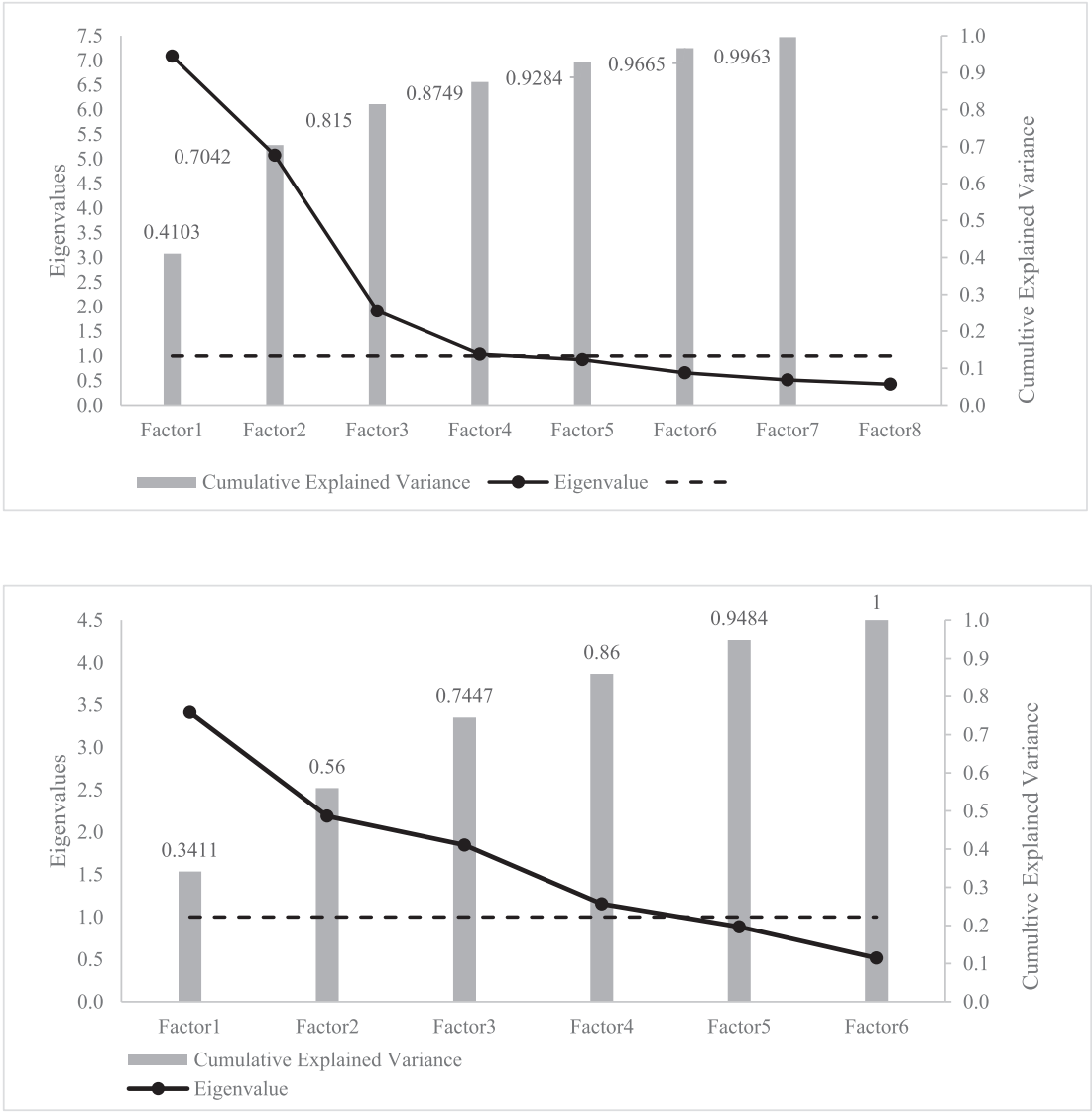

Fig. 2. Factor Analysis with Tetrachoric Correlation Matrix. Eigenvalues (Left Y Axis, Solid Lines) and Cumulative Explained variance (Right Y Axis, Grey Bins). Top Chart - Activities and Challenges to Procure Local Foods. Bottom Chart - State-Level Farm to School Policy Indicators. Source: Author's Elaboration on 2013 Farm to School Census (USDA-FSN) and 2002–2017 State Farm to School Legislative Survey: 2002–2017 (National Farm to School Network).

sample selection probit estimator, clustering standard errors at the state-level to account for correlations of unobservables across states. To determine which model specification fits the data best, we use the Bayesian Information Criterion (BIC), which allows to evaluate model fit while penalizing model complexity. The model with the smallest value of BIC will be considered as best fitting; see Raftery (1995) for more details. Marginal effects of the independent variables on the probability of continuing FTSP are obtained modifying the formulas of the traditional Heckman (1979) selection model marginal effects derived in Hoffmann and Kassouf (2005) – all formulas and derivations are available upon request.

Our identification strategy is based on the validity of the exclusion restrictions. Before illustrating in detail our identification assumptions and providing some empirical evidence in support of their validity, we want to remind the readers that our parameter estimates will still be capturing associations, as we make no claim of measuring causal relationships. Our identification assumption is that local food supply-chain variables affect participation (but not continuation) and that both the challenges to procure local foods, and FTS activities implemented in 2011/12, affect continuation decision only. While it makes intuitive sense that past activities will influence a school district's decision to remain in the program, , there is no a-prior reason for hurdles in procuring local foods not to discourage participation. However, as discussed in Section 4.3, information on local food procurement challenges is not available for all school districts, thus, *Challenges* cannot be used in the participation equation. We circumvent this issue by using the characteristics of the local food supply-chain in place of local food procurement challenges in the participation equation, assuming that a more robust local food supply-chain should result in fewer issues to acquire local foods, regardless of whether a school district participates in FTS. In other words, this is similar to assuming that challenges to procure local foods are endogenous and the local food supply-chain variables are used as instruments. We tested whether the supply-chain variables capture enough of the variation in *Challenges* while at the same time being exogenous to FTS participation decision. The test results are reported in the Online Appendix A and suggest that the local food supply-chain variables *can* (conditionally on model specification) satisfy the conditions needed to capture the relationship between *Challenges* and the probability of participation - although in some cases our results may be affected by weak instruments problems. See the Online Appendix A for more details.

Table 5
Principal Component Factor Analysis Using Tetrachoric correlation; Variable Loadings of the Rotated Retained Factors. Activities and Challenges to Procure Local foods.

Variable	Factor 1	Factor 2	Factor 3	Factor 4
Activities				
Serve Local	−0.034	**0.733**	−0.201	0.178
Taste Demos	0.076	**0.641**	0.390	−0.068
Food Coach	0.079	**0.460**	0.386	−0.052
School Garden	0.004	0.021	**0.799**	0.098
Serve Garden	−0.025	0.170	**0.648**	0.226
Taste Garden	−0.014	0.280	**0.744**	0.072
Field Trip	0.111	−0.070	**0.497**	−0.077
Farmer Visit	0.127	0.369	**0.513**	−0.166
Themed Promo	0.070	**0.748**	0.198	−0.010
Promote Local	−0.011	**0.808**	0.193	0.052
Media Cover	0.011	**0.666**	0.452	−0.008
Hosted Events	0.055	0.300	**0.564**	−0.112
F2S Month	0.013	**0.621**	0.197	−0.039
Curriculum	0.111	0.269	**0.682**	−0.103
Challenges Procuring Local Foods				
Seasonality	0.383	0.232	−0.073	**0.611**
Availability	0.358	−0.039	0.069	**0.484**
Range	0.389	0.039	0.048	**0.478**
High_price	**0.453**	0.242	0.025	0.271
Unstable_price	**0.614**	0.095	−0.029	0.189
Delivery	**0.738**	0.046	0.011	0.182
Regulations	**0.588**	0.075	0.022	0.101
Processed	**0.444**	0.150	0.067	**0.447**
New_suppliers	0.410	−0.062	0.114	**0.548**
Information	**0.490**	−0.168	0.139	**0.485**
Orders	**0.743**	−0.061	0.104	0.224
On-time	**0.836**	−0.021	0.038	−0.006
Quality	**0.683**	0.092	0.023	0.192
Quantity	**0.716**	0.057	0.032	0.083
Deliv Prob	**0.737**	0.007	−0.030	0.096
Pay Needs	**0.561**	−0.002	0.057	0.130

Source: Author's Elaborations on Farm to School Census Data.
Note: Based on loadings, factors can be interpreted as follows:
Factor 1: Price/Logistic Challenges.
Factor 2: Cafeteria/Promo Activities.
Factor 3: Education/Garden/Farm related Activities.
Factor 4: Availability Challenges.

Table 6
Principal Component Factor Analysis Using Tetrachoric correlation; Variable Loadings of the Rotated Retained Factors. State-Level Policies.

Variable	Factor1	Factor2	Factor3	Factor4
FTSP Support Taskforce	0.191	0.135	**0.840**	0.174
Authorize Grants	**0.513**	0.456	**0.506**	−0.509
Directs Local Purchase	**0.733**	**0.500**	−0.171	−0.114
FTSP Database	**0.871**	−0.334	0.257	0.044
Educational Activities	−0.174	0.250	**0.817**	−0.392
Appropriation	0.119	**0.936**	0.150	−0.068
FTSP Established	**0.869**	0.229	−0.111	0.163
School Garden Support	−0.061	**0.787**	0.475	0.253
Coordinator	0.002	0.352	−0.035	**0.705**
State Promo Event	0.106	−0.042	−0.038	**0.911**

Source: Author's elaboration from State Farm to School Legislative Survey Data (National Farm to School Network, 2017).
Note: Based on loadings, factors can be interpreted as follows:
Factor 1: Grants/Founded/Local/DB Policies.
Factor 2: Appropriation/Garden/Local Policies.
Factor 3: Grants/Educational/Support Policies.
Factor 4: Coordinator/Promo Policies.

5. Empirical results

The estimated coefficients, marginal effects and model diagnostics for our four model specifications are reported in Tables 8 (specification 1), 9 (specification 2) and 10 (specifications 3 and 4). Since the behavior

Table 7
Summary statistics of FTS variables in Specification 3 & 4. Estimation sample (N = 6798).

Variable	Mean	S.D.	Min	Max
Sum Variables in Each Index (Specification 3)				
N Cafeteria/Promo Activities	1.019	1.693	0	7
N Curric/Garden/Farm Activities	0.573	1.235	0	7
N Availability Challenges	2.230	2.405	0	12
N Price/Logistics Challenges	2.021	1.632	0	6
N Grants/Founded/Local/DB Policies	1.432	1.426	0	4
N Appropriation/Garden/Local Policies	0.840	1.009	0	3
N Grants/Educational/Support Policies	1.185	1.144	0	3
N Coordinator/Promo Policies	0.219	0.473	0	2
N Excluded Policies	0.538	0.894	0	3
FTS Intensity Indexes (Specification 4)[a]				
Cafeteria/Promo AII	43.178	20.494	0	100
Curric/Garden/AII	26.877	20.321	0	100
Availability CII	52.920	13.713	0	100
Price/Logistics CII	22.263	15.513	0	100
Grants/Founded/Local/DB PII	41.392	31.393	0	100
Appropriation/Garden/Local PII	45.598	25.522	0	100
Grants/Educational/Support PII	57.538	25.350	0	100
Coordinator/Promo PII	18.581	20.089	0	100

Source: Author's Elaborations on Farm to School Census Data.
[a] AII- Activity Intensity Index.CII- Challenges Intensity Indexes.PII- Policy Intensity Indexes.

of most school districts characteristics, local food supply-chain characteristics and demand characteristics are very similar across model specifications, we report (and discuss) their estimates and average marginal effects only for specification 1 in Table 8, and exclude them, for brevity from Tables 9 and 10. Full sets of estimates, including coefficients and average marginal effects, for the location fixed-effects, as well as, for specifications 2, 3 and 4, school districts, local food supply-chain and demand characteristics are available in the Online Appendix B, Tables B1–B4.

Before discussing estimated parameters and marginal effects, it is worth noting that estimates of the error correlation terms (Rho) are statistically different from zero in all model specifications, supporting our choice of estimating the two equations jointly. Also, the values of the estimated error correlations are large, ranging from −0.76 (Specification 4) to −0.82 (Specification 3). As for model selection, Specification 1 has the largest value of BIC (11,513.68), suggesting that more complex specifications provide a better fit than the most parsimonious specification. Specification 2 shows the lowest BIC (11,303.43); the specifications using variables based on groups of activities, challenges and state-level policy variables perform somewhere in between Specification 1 and 4 (BICs are 11,406.01 and 11,389.08 for specifications 3 and 4, respectively).

The estimates in Table 8 show that school districts characteristics have a stronger relationship with the probability of participation than continuation. School districts' size shows a concave relationship with participation and a convex relationship with continuation, although the estimated coefficients are not statistically significant in the latter. With respect to the AMEs, an increase of 1,000 students in a school district is related to 22.7 percentage points higher probability of participation and a 17.7 percentage points higher probability of continuing FTSP. An increase of the school district size by 400 students (about the sample average) is associated with, respectively about 9 percentage points higher participation probability, and 7.1 percentage points continuation probability.

The percentage of students receiving free and reduced meals has a negative and statistically significant association with participation (AME of about −0.18 percentage points) and no statically significant relationship with continuation, similar to total expenditure, which shows a −3.77 percentage points AME for continuation and −5.34 for participation. Reimbursements shows a positive relationship with participation, whereas per-student food cost and food revenue show no

Table 8
Selected estimated coefficients and Average Marginal Effects. Sample-selection probit estimates – Specification 1.

Variables	Estimated Coefficients and St. Errors						Average Marginal Effects.					
	Participation[a]			Continuation[b]			Participation			Continuation		
	Coefficient		St Err	Coefficient		St Err	AME		St Err	AME		St Err
School District Characteristics[a]												
Size	1.0861	***	0.3020	0.1590		0.2513	0.2266	***	0.0599	0.1771	***	0.0617
Size^2	−0.5489	***	0.1948	0.1286		0.1145						
%Reduced	−0.0044	**	0.0019	0.0033		0.0020	−0.0018	**	0.0008	0.0005		0.0006
Reimburs	0.5887	*	0.3525	−0.1120		0.2536	0.2348	*	0.1406	0.0474		0.0783
TotalExp	−0.1339	***	0.0476	−0.0532		0.0530	−0.0534	***	0.0190	−0.0377	*	0.0193
FoodCost	0.0433		0.0407	−0.0212		0.0286	0.0173		0.0162	−0.0009		0.0101
FoodRevenue	0.0667		0.0431	−0.0013		0.0351	0.0266		0.0172	0.0093		0.0133
Awareness	0.0624		0.0460	0.1398	**	0.0554	0.0249		0.0183	0.0568	***	0.0168
%NativeAm	0.0068	***	0.0024	−0.0038		0.0031	0.0027	***	0.0010	−0.0003		0.0011
%Asian	0.0192	**	0.0075	0.0006		0.0062	0.0077	**	0.0030	0.0030		0.0024
%Hisp	0.0064	***	0.0017	−0.0041	**	0.0018	0.0025	***	0.0007	−0.0005		0.0006
%Black	0.0021		0.0017	−0.0045	**	0.0019	0.0008		0.0007	−0.0012	**	0.0006
%Pacific	−0.0672		0.0444	0.0484		0.0694	−0.0268		0.0177	0.0068		0.0235
%TwoMore	0.0206	***	0.0069	−0.0104		0.0084	0.0082	***	0.0027	−0.0006		0.0028
Demand Characteristics[c]												
%HHLowAccess	−0.0265	*	0.0155	−0.0073		0.0205	−0.0106	*	0.0062	−0.0064		0.0060
CountyPovRate	−0.0129	*	0.0072	−0.0015		0.0048	−0.0051	*	0.0029	−0.0024		0.0018
CountyPop	−0.0621		0.0434	−0.0226		0.0375	−0.0248		0.0173	−0.0168	**	0.0081
Local Food Supply-Chain Characteristics[d]												
AvFarmInc	−0.3808	**	0.1656				−0.1519	**	0.0661	−0.0554	**	0.0266
%FarmsDirectSales	0.0742	***	0.0253				0.0296	***	0.0101	0.0108	***	0.0038
CountyFoodHubss	0.2358	**	0.0929				0.0941	**	0.0371	0.0343	**	0.0154
PerCapitaFM	1.3899	***	0.3742				0.5544	***	0.1493	0.2023	***	0.0578
MilkPriceRatio	0.4389		0.5007				0.1751		0.1998	0.0639		0.0741
FTS Variables[e]												
N Activities				0.1145	***	0.0131				0.0391	***	0.0039
N Challenges				0.0037		0.0057				0.0013		0.0020
N Policies	0.0056		0.0246	0.0029		0.0118	0.0022		0.0098	0.0018		0.0050
Constant	−1.1549	***	0.4038	0.7662	***	0.1931						
Rho	−0.7758	***	0.1414									
BIC	11,513.7											

Note: Standard errors clustered at the state-level. *, **, and *** represent, respectively, coefficients and marginal effects statistically different from 0 at the 10%, 5% and 1% significance level. RUCCs and Region Fixed Effects coefficients and marginal effects omitted for brevity.

[a] N = 6798.

[b] N = 2826.

[c] For a description of school district characteristics, please see Table 1.

[d] For a description of Demand Characteristics and Local Food Supply-Chain Characteristics see Table 3.

[e] For a description of N Activity and N Challenges, see Table 2. For a description of N Policies, see Table 4.

association with both participation and continuation. Awareness of the USDA geographic preference option for local food procurement shows a statistically significant relationship with the probability of continuation and no relationship with that of participation. This variable's AME suggests that school districts aware of the geographic preference rule are 5.7 percentage points more likely to continue FTSP.[22] This result resonates with the finding that knowledge of the geographic preference option was about 36 percentage points larger in school districts continuing FTSP than non-continuing (Section 2).

The percentage of Native Americans, Asian and Hispanic students in a school district are associated positively with participation whereas the percentage of Hispanics and Blacks show a negative association with continuation. In terms of marginal effects, a 10 percentage points increase in the percentage of Native Americans, Asian and Hispanic students, is associated with 2.7, 7.7 and 2.5 percentage points higher probabilities of participation, respectively. A 10 percentage points increase in the share of students being Black is associated with −1.2 percentage points probability of continuation.

Lack of access (*%HHLowAccess)* and county poverty rates are inversely related to the probability of participation, whereas county-level population shows a negative and statistically significant AME for continuation; the probability of continuation declines by about 1.7 percentage points every one million individuals. The estimated marginal effects of the local food supply-chain characteristics on participation are similar in sign, magnitude, and significance to some of the results in Botkins and Roe (2018) - particularly to those in Table 8, model with NASS fixed effects, thus will not be discussed here. With respect to the indirect (through participation) association of these variables and the probability of FTSP continuation, we estimate that a unitary increase in farm income is associated with −5.5 percentage points of the probability of continuation; we find a positive, and statistically significant AME of the share of direct to consumers farm sales (1.1 percentage points), the presence of food hubs (3.4 percentage points) and the number of farmers markets per 10,000 people (20.2 percentage points). Concluding the discussion of Specification 1 results, we find a positive and statistically significant relationship between number of activities and probability of continuation; the estimated AME indicates that every additional activity implemented in 2011/12 is associated with a 3.9 percentage points higher probability of continuing FTSP. Neither the number of challenges

[22] An anonymous reviewer suggested we included in our model variables capturing the different definitions of local foods adopted by school districts. However, 2013 FTSC respondents are asked about their district definition of "local" only if they implemented FTSP in 2011/12 or planning to in 2012/13. Based on the same logic we illustrated for the Challenges indicators, we cannot include variables accounting for the definition of local in the participation equation. Including these variables in the continuation equation, would result in dropping 488 observations, about one sixth of the estimation sample (344 school districts implementing FTSP in 2011/12 did not answer this question; 144 responded "other").

Table 9
Selected estimated coefficients and Average Marginal Effects. Sample-selection probit estimates for Participation and Continuation in FTSP – Specification 2. Activities, Challenges and State-Level Policies.

Variables	Estimated Coefficients and St. Errors.						Average Marginal Effects					
	Participation			Continuation			Participation			Continuation		
	Coefficient		St Err	Coefficient		St Err	AME		St Err	AME		St Err
Activities [a]												
Serve Local				0.2361	**	0.1081				0.0779	**	0.0332
Taste Demos				0.1134	*	0.0606				0.0374	*	0.0206
Food Coach				0.0589		0.0568				0.0194		0.0185
School Garden				0.1457	*	0.0773				0.0480	**	0.0244
Serve Garden				0.1283	*	0.0745				0.0423	*	0.0246
Taste Garden				0.0022		0.0938				0.0007		0.0309
Field Trip				−0.1321	**	0.0539				−0.0436	**	0.0173
Farmer Visit				0.0783		0.0706				0.0258		0.0230
Themed Promo				0.2039	***	0.0777				0.0673		0.0241
Promote Local				0.2333	***	0.0573				0.0769	***	0.0181
Media Cover				0.2276	**	0.0879				0.0751	***	0.0282
Hosted Events				−0.0377		0.0773				−0.0124		0.0254
F2S Month				0.1744	*	0.0932				0.0575	*	0.0303
Curriculum				0.0636		0.0647				0.0210		0.0213
Challenges to Procure Local Foods [a]												
Seasonality				0.2662	***	0.0835				0.0878	***	0.0247
Availability				−0.0845		0.0565				−0.0279		0.0183
Range				−0.0209		0.0770				−0.0069		0.0252
High_price				−0.1145	**	0.0552				−0.0378	**	0.0183
Unstable_price				−0.1031		0.0704				−0.0340		0.0228
Delivery				0.0572		0.0578				0.0189		0.0189
Regulations				0.0802		0.0608				0.0265		0.0197
Processed				−0.0200		0.0639				−0.0066		0.0211
New_suppliers				−0.0905		0.0699				−0.0298		0.0226
Information				0.0398		0.0596				0.0131		0.0197
Orders				0.0711		0.0917				0.0235		0.0300
On-time				−0.0191		0.0715				−0.0063		0.0236
Quality				0.0030		0.0536				0.0010		0.0177
Quantity				0.0791		0.0721				0.0261		0.0237
Deliv. Prob				−0.0235		0.0825				−0.0077		0.0273
Pay Needs				−0.0176		0.0955				−0.0058		0.0313
State-Level Policies [b]												
Coordinator	0.2984	*	0.1781	−0.0966		0.0925	0.1191	*	0.0711	0.0098		0.0300
Appropriation	−0.0074		0.1514	0.0479		0.0913	−0.0030		0.0604	0.0148		0.0310
Authorize Grants	−0.0377		0.1760	0.1639		0.1285	−0.0151		0.0702	0.0488		0.0383
Fund Local Foods	0.1291		0.3203	−0.0173		0.2230	0.0515		0.1278	0.0123		0.0578
FTSP Established	0.0227		0.1345	−0.1065		0.1009	0.0091		0.0536	−0.0319		0.0293
School Garden Support	−0.0669		0.2185	0.1760		0.1368	−0.0267		0.0872	0.0487		0.0525
Directs Local Purchase	−0.0280		0.1648	0.1567	*	0.0896	−0.0112		0.0657	0.0478		0.0302
Educational Activities	0.0873		0.1109	−0.0932		0.1212	0.0348		0.0442	−0.0185		0.0338
FTSP Database	−0.3532	*	0.2009	−0.0088		0.1431	−0.1409		0.0802	−0.0522		0.0432
Temporary FTSP	−0.1457		0.3419	−0.3121		0.2442	−0.0581		0.1364	−0.1233	**	0.0555
FTSP Support Taskforce	0.1222		0.1283	−0.0317		0.0826	0.0487		0.0512	0.0066		0.0215
Infrastructure Development	−0.0345		0.3172	−0.1685		0.1886	−0.0137		0.1266	−0.0604		0.0605
FTSP Encouraged	0.1092		0.2081	−0.0560		0.1361	0.0436		0.0830	−0.0032		0.0445
FTSP as Equity	0.1346		0.3232	−0.3631	*	0.2111	0.0537		0.1289	−0.1010		0.0652
State Promo Event	0.1877		0.1552	−0.2141	**	0.1035	0.0749		0.0619	−0.0444		0.0375
Celebrates FTS Activities	0.1001		0.1721	0.1090		0.0954	0.0399		0.0686	0.0499		0.0423
Constant	−0.9786	**	0.4325	0.7107	**	0.3195						
Rho	−0.7922	***	0.2221									
BIC	11,303.43											

Note: Standard errors are clustered at the state-level. *, **, and *** represent, respectively, coefficients and marginal effects statistically different from 0 at the 10%, 5% and 1% significance level. Omitted coefficients and AME are available in Table B1 in the Online Appendix.

[a] A description of each activity and challenge to procuring local foods is provided in Table 2.

[b] A description of each state-level policy binary indicator is provided in Table 4.

to procuring local food, nor the number of state-level active policies in 2011 produced coefficients and AME statistically different than zero.

The results of Specification 2, reported in Table 9, show eight of the fourteen activity indicators to have a positive and statistically significant relationship with the probability of continuation. School districts where local food was served in the cafeteria during the 2011/12 school year, have a 7.8 percentage points higher probability to continue FTSP in 2013/14. Some promotional activities are also strongly associated with the probability of remaining in the program. School districts promoting local foods are 7.7 percentage points more likely to continue FTSP than those that do not; those generating media coverage of local foods, are 7.5 percentage points more likely; themed or branded promotion 6.7 percentage points; and celebrating farm to school month, 5.8 percentage points. School districts with school gardens in 2011/12 have 4.8 percentage points higher probability to remain in FTS in 2013/14, and an additional 4.2 percentage points if food from the school garden was served in the cafeteria; taste demonstrations are associated with a 3.7 percentage points higher probability of continuing FTSP. Conducting students' field trips to farms is the only activity showing a negative association with FTSP continuation; specifically, schools organizing field trips in 2011/12 showed −3.6 percentage points lower probability of adopting FTSP also in 2013/14.

Table 10

Sample-selection probit estimated coefficients and average marginal effects (AME) of selected variables- Model Specifications 3 and 4. Number of Activities, Challenges and State-level Policy variables with high loadings on different components (Specification 3 - Top Panel); Activities Intensity Indexes (AII), Challenges Intensity Indexes (CII) and State-level Policy Intensity Indexes (PII) (Specification 4 - Bottom Panel).

Variables	Estimated Coefficients and St. Errors						Average Marginal Effects.					
	Participation			Continuation			Participation			Continuation		
	Coeff		St Err	Coeff		St Err	AME		St Err	AME		St Err
Specification 3[i]												
N Cafeteria/Promo Activities				0.1771	****	0.0222				0.0601	***	0.0069
N Education /Garden/Farm Activities				0.0255	*	0.0153				0.0086	*	0.0052
N Availability Challenges				−0.0054		0.0105				−0.0018		0.0035
N Price/Logistic Challenges				0.0190		0.0150				0.0064		0.0051
N Grants/Founded/Local/DB Policies	−0.1250	***	0.0370	−0.0002		0.0298	−0.0499	***	0.0147	−0.0185	**	0.0088
N Appropriation/Garden/Local Policies	0.0718		0.0625	0.0530		0.0505	0.0286		0.0249	0.0285	*	0.0166
N Grants/Educational/Support Policies	0.0383		0.0350	0.0173		0.0366	0.0153		0.0140	0.0115		0.0132
N Coordinator/Promo Policies	0.1752	**	0.0732	0.0544		0.0651	0.0699	**	0.0292	0.0074		0.0211
N Excluded Policies	−0.0702		0.0534	−0.0783	***	0.0298	−0.0280		0.0213	−0.0162	*	0.0096
Rho	−0.8194	****	0.1241									
BIC	11,406.01											
Specification 4[ii]												
Cafeteria/Promo AII				0.0163	***	0.0022				0.0055	***	0.0006
Education /Garden/Farm AII				0.0062	***	0.0013				0.0021	***	0.0004
Availability CII				0.0052	***	0.0017				0.0018	***	0.0005
Price/Logistic CII				0.0007		0.0012				0.0002		0.0004
Grants/Founded/Local/DB PII	−0.0040	**	0.0017	0.0000		0.0014	−0.0016	**	0.0007	−0.0005		0.0003
Appropriation/Garden/Local PII	0.0045	**	0.0019	0.0004		0.0015	0.0018	**	0.0008	0.0008	*	0.0004
Grants/Educational/Support PII	−0.0001		0.0021	0.0016		0.0014	0.0000		0.0008	0.0005		0.0004
Coordinator/Promo PII	0.0036	***	0.0014	−0.0004		0.0014	0.0014	***	0.0005	0.0004		0.0005
Rho	−0.7603	***	0.1475									
BIC	11,389.08											

Note: Standard errors are clustered at the state-level. *, **, and *** represent, respectively, coefficients and marginal effects statistically different from 0 at the 10%, 5% and 1% significance level. Omitted coefficients and AMEs for the two model specifications are available in Table B2 (Specification 3) and Table B3 (Specification 4) in the Online Appendix.

[i] FTS variables in specification 3 are obtained summing variables with the highest loadings on each factor, as presented in Tables 5 and 6.

[ii] All FTS variables in specification 4 are obtained standardizing the components presented in Tables 5 and 6 to the 0–100 range.

The estimated coefficients of the challenges to procure local foods (Table 9, middle panel) show mostly a lack of association with the probability of continuation, except in two cases. School districts who experienced hardships to find year-round availability of key foods in 2011/12 were 8.8 percentage points more likely to continue FTSP in 2013/14 than those that did not. Having experienced local food prices too high in 2011/12 is associated with −3.8 percentage points probability to continue FTSP in 2013/14. The state-level policy indicators (bottom panel of Table 9) show no statistically significant relationships with participation and continuation, with some exceptions. School districts in states that in 2011 had established a FTSP coordinator had 11.9 percentage points higher probability to participate in FTSP than those that did not. School districts in states with a temporary FTSP program in 2011 showed −12.3 percentage points probability to continue FTSP in 2013/14. Interestingly, regardless of their significance, most state-level policy's coefficients show opposite signs in the participation and continuation equation, with few exceptions.

Table 10 reports estimated parameters and marginal effects for Specification 3 (top panel) and Specification 4 (bottom panel). The results of Specification 3 show that the number of cafeteria-based (e.g. serving local foods, presence of food coaches) and promotional activities (e.g. promoting local foods, themed or branded promotion) implemented in 2011/12 has a stronger association with the probability of remaingin in FTS in 2013/14, than the number of activities related to curriculum, school gardens and farm-related activities (e.g. farmer's visit and field trips). Specifically, one additional Cafeteria/Promo activity is related to a 6 percentage points higher probability of continuation, whereas one additional activity belonging to Education/Garden/Farms is associated with less than 1 percentage point higher probability of continuation. In this specification we do not find a statistically significant association between the number of challenges to procure local foods in 2011/12 and the probability to continue FTSP in 2013/2014.

Two of the variables capturing the sum of state-level policies with common variation show a statistically significant relationship with participation: *N Grants/Founded/Local/DB Policies,* negative, and *N Coordinator/Promo Policies*, positive. Only *N Excluded* shows a statistically significant coefficient in the continuation equation, negative in sign. In terms of marginal effects exposure to one more policy among *Grants/Founded/Local/DB* in 2011/12 is associated with a lower (-1.85 percentage points) probability of continuation in 2013/14 (mostly due to the negative AME of −5 percentage points on participation), whereas one more state-level policy among Appropriation/Garden/Local Policies has a 2.85 percentage points AME. Also, the sum of policies excluded from the PCFA, have negative and statistically significant marginal effect on continuation.

Authorizing Grants, Directing Local Purchases, the establishment of a FTSP database and the establishment of FTSP in general, are some of the longest active FTS state-level policies; the estimated negative AME may be due to some of these policies losing effectiveness over time; however it is possible that they played a different role in the earlier years of the programs' implementation. Also, as part of the "Excluded Policies" one can find transitional policies such as the creation of a temporary FTS, or policies with more general scope (i.e. celebrating or encouraging FTSP activities, or the inclusion of FTS activities as part of a broader state policy). These policies may have beneficial effects in the short run, but they may play a different role if one considers decisions which are forward looking in nature (i.e. continuing a program over time).

Moving on to Specification 4, both AIIs show positive and statistically significant coefficients and AMEs. The magnitude of the AMEs indicate that a one-point increase in the Cafeteria/Promo AII is associated with a 0.55 percentage points higher probability of continuation, whereas a marginal change in Education/Garden/Farm AII is associated to a 0.21 percentage points higher probability of continuation. In other words, a school district scoring 100 in the Cafeteria/Promo (Education/Garden/Farm) Index in 2011/12, was 55 percentage points (21

percentage points) more likely, to have remained in FTS in 2013/14 than a school district showing a "0" score. We also find a positive relationship between Availability CII and the probability of continuation; scoring one more point in the Availability CII in 2011/12 is associated in 0.18 percentage points higher probability of continuing FTSP in 2013/14. The positive relationship between enduring availability issues and the probability of continuation may be capturing the school district longevity in terms of program participation; that is, the longer a school district is in FTSP, the more hurdles they may face and overcome.

The Policy Intensity Indexes (PIIs) coefficients (and AMEs) in Specification 4 behave differently than the do in Specification 3, in terms of their relationship with continuation. We find no statistically significant marginal effects of the *Grant/Founded/Local/DB PII* and continuation probability, and a very small one for the *Appropriation/Garden/Local PII* (0.8 percentage points probability for a 0–100 change).

6. Policy implications and discussion

As we discuss our results, and their policy implications, we want to remind the reader that our results depict associations and should not, under any circumstance, be considered as causal. As such, although we believe that our results can still inform policymakers about the factors related to continuation in FTS, we caution against using them directly for policy design.

We have five sets of policy implications. First, the conditional averages illustrated in Section 2, indicate that, compared to school districts in FTSP during both 2011/12 and 2013/14 school years, school districts participating in FTS only in 2011/12are smaller, with relatively more students on free and reduced-price meals, rely more on federal reimbursement and, on average, have higher per-student overall expenditure and higher food service cost. These findings are only confirmed in part by the econometric analysis:[23] only school size (at the average) and per-student general expenditure show statistically significant marginal effects on the probability of participation and continuation (positive and negative, respectively). Thus, the limited scale and related inefficiencies (e.g. larger per-student expenditure) may limit school districts' ability to adopt FTSP in the long-term. Being awareness of the geographic preference rule for local food procurement, likely plays a major role in the decision to continue FTSP. Knowledge of the geographic preference rule was about 36 percent larger in school districts continuing FTS in 2013/14 than non-continuing. The estimated marginal effect for this variable points to a 5.7 percentage higher probability of continuation. Combined, these finding indicate that educating school personnel about the geographic preference rule and its facilitating role to procure local foods may foster program continuation.

Second, although the estimated indirect effects of local food supply chain characteristics on the probability of continuation are statistically significant, intervening on the local supply chains does not seem to be a viable policy option to improve the likelihood of continuation. For example, the estimated marginal effects of farmers markets per 10,000 individuals is large (20.2 percentage points), however, a unitary increase in this variable corresponds to 22.7 times their sample average (0.044). Also, the presence of a food hub in a county is associated with a 3.4 percent higher probability of continuing FTSP. Sextupling the numbers of farmers markets per 10,000 individuals would have the same effect on the probability of FTSP continuation than having a food hub. Given that the number of farmers markets is plateauing (USDA, 2018a) and supporting a new food hub would require a population of about 182,000 individuals per county (Cleary et al 2019), these to for do not seem to be a viable policy levers.

Third, our results show that some activities are associated with a higher probability of continuing FTSP than others. Promotional activities and serving local foods show the strongest association with the probability of continuing FTSP. These are also the activities adopted most by school districts (see Table 2), and whose effectiveness has been subject of scrutiny (Prescott et al 2020).[24] Looking at the results of Specifications 3 and 4, cafeteria-based and promotional activities have about seven times as strong an association with continuation probability than other activities - Specification 3; two and a half times if one compares 0–100 AIIs - Specification 4. Another interesting finding is that "Farm Trip" is negatively associated with the probability of continuing FTSP: this result may be due to the high costs of planning and implementing farm trips, compared to their benefits. Also, we find that school districts implementing activities belonging to the "group" of cafeteria-based and promotional activities, may experience higher probability of continuation than those focusing on garden/farm based or curricular activities. Policymakers may try to devise systems to facilitate synergies across activities.

Fourth, contrary to expectations, we find that most challenges to acquire local foods are not associated with the decision to continue FTSP (except lack of year-round availability and high prices, although in opposite directions). The results of Specification 4 point to a positive association between the intensity of having experienced availability challenges and the probability of continuation. This result is consistent with other literature reporting anecdotal evidence of seasonal variation in local food supply being an opportunity to change menus and serve larger varieties of foods in cafeterias (Wiemerslage 2014). Since more than 80 percent of school districts in FTS in 2011/12 served local foods, a possible interpretation of these results is that school districts directors seeking the benefits of FTSP/local food procurement, are predisposed to continue FTSP in spite of the adversities faced in the past. Another possibility is that our results are the artefact of spurious correlation, as the larger the amounts of food procured locally (and the longer the participation in FTSP or other related programs), the more likely it is that a school district experiences one or more procurement issues. Thus, even though understanding the challenges faced by school districts procuring local food is relevant to policymakers as they can design mechanisms to limit these hurdles, our results are inconclusive in terms of supporting these interventions as a means to improve the probability of continuation in FTSP.

Fifth, we find unclear patterns for the relationship between FTSP continuation and the presence of state-level policies. Most of the estimated coefficients (and AME) for these variables in Specification 2 are not statistically different from zero. Additionally, the estimated coefficients show, in two thirds of the variables, opposite signs in the participation and continuation equation which may suggest that most state-level policies associated with a higher (lower) likelihood to participate in FTS, would then be associated with a lower (higher) probability to continue FTSP. This is a counterintuitive result which may as well be due to endogeneity bias. The results obtained for Specification 3 and 4 are easier to interpret and indicate that policies focused on targeting specific FTSP activities may be the most successful to support lasting participations in FTSP. Policies targeting activities which are widely implemented by schools remaining in the program (such as school gardens and local food procurement) have a positive association with continuation probability. Other policies, playing more of a facilitating role, such as creating a database of parties interested in participating into FTS, may also be beneficial. Also, the lack of statistical significant of some of the policy variables coefficients may be due to the effect of some policies taking longer to manifest. This could be the case

[23] The limited (although statistically significant) differences between continuing and ceasing school districts in terms of free and reduced-price meals participation, federal reimbursements, and food service costs per-student may be the core reason why these factors seem to only affect participation (and not continuation).

[24] However, there is little evidence that serving local foods, and promotions activities have the desired nutritional outcomes in school children. See Prescott et al (2020) for more details.

of policies promoting educational activities, or facilitating the development of infrastructures for local food aggregation. However, it is at least possible that some state-level policies are implemented as a response to increased interest/demand for FTSP in specific states, therefore, it is possible that endogeneity bias may drive some of the "null" results.[25] Additionally, the variables used in our analysis do not account for policy changes over time (i.e. changes in funding level, coverage etc.) which may further contribute to our inability to find consistent patterns across specification.

7. Conclusions, limitation, and future research

In this article we studied the factors associated with school district continued participation in FTS. Since school children are more likely to benefit from prolonged/repeated food school interventions/programs than one-shot interventions, and farmers engaged in "local" food production can benefit from prospects of a continued access to institutional markets, policies should facilitate continued participation over time. Our findings can suggest avenues to lower school districts barriers in program continuation through a policy environment conducive to sustain repeated participation. Our results indicate that smaller school districts, with higher per-student expenditures and lacking awareness of the geographical preference option, are less likely to continue FTSP. We find that school districts participating in FTS, being aware of the geographic preference option for local food procurement are about 5 percent more likely to continue FTSP. The creation of educational/promotional materials targeting school districts' personnel appear as a low hanging policy opportunity for improving continuation.

We also find that the number of activities implemented in 2011/12 is positively associated with the decision to remain in the program in 2013/14. Also, some activities are associated with a higher probability of continuing FTSP than others. Serving local foods and cafeteria-based promotional activities, traditionally associated with FTSP, have the largest association with the probability of program continuation. Combinations of similar/focused activities (i.e. cafeteria based, school garden based etc..) may lead to synergies which, in turn, may lead to continued participation. Findings related to the challenges faced when procuring local foods, and those for state-level policies are more heterogenous and less intuitive, and we cannot dismiss the possibility that they originate from some of the issues we discuss below.

This study has four main limitations. First, because of the way the FTSC participation questions are structured, it is impossible to know whether a school participating in FTSP in 2011/12 and 2013/14 participated in 2012/13 as well: thus, in order to perform our analysis we had to assume uninterrupted participations. We believe that, even if this assumption were not to hold, the introduction of bias in our results would be unlikely.[26] That said, unobserved heterogeneity may still be a problem. Second, for about one third of school districts not participating in FTS in 2011/12, we had no information on challenges they experienced to procuring local foods which his likely to be a determinant of participation in FTS. Thus, we used local food supply-chain characteristics in the participation equation, in place of challenges, under the assumption that they are exogenous to participation and capture enough variation in the challenges faced when procuring local foods. In the Online Appendix A we provide an *ad hoc* assessment of whether our identification assumptions are valid, which may not satisfy all readers. Therefore, we feel the need to emphasize that our results represent associations and are not meant to portray causal relationships. Third, some modeling decisions where due to changes in the FTSC questionnaire across years, and the high non-response rate to some questions. For example, the types of FTSP activities included in the FTSC changed across the survey years; as a result we could only use activities as collected in the 2013 FTSC. Fourth and last, including state-level policy variables in the analysis may have added to the potential of endogeneity bias being present in our results.

Future research should explore more, and better identification strategies to corroborate, or improve upon, our work. Additionally, future research could study what factors favor the repeated adoption of specific activities which are more likely foster positive school children outcomes and/or support farmers' revenue.

[25] An anonymous reviewer suggested that our results may not be due to endogeneity bias, but they may capture how some policies incentivizing FTSPs may not help districts operating the program. A parallel to this explanation is that the same types of incentives (e.g. monetary) may help a school district recruiting and hiring talents (participation) but may fail at retention (continuation). See Loeb and Myung (2020) summary of the empirical economic literature on teacher recruitment and retention.

[26] A violation of the uninterrupted participation assumption would bias our estimates in two cases: A) there are unobserved factors affecting school districts' decisions to not participate in 2012/13 but to participate in 2011/12 and 2013/14; B) observable factors related to the decision to participate in 2011/12 and/or to continue in 2013/14, show a different relationship with their decisions to participate / continue in 2012/13. We have no a-priori reason to believe that the data generating process and the estimated relationship between the covariates in our model and participation/ continuation decisions would differ if we used 2012/13 participation / continuation data.

CRediT authorship contribution statement

Alessandro Bonanno: Conceptualization, Investigation, Methodology, Resources, Supervision, Writing - original draft, review and editing. **Sachintha S. Mendis:** Conceptualization, Data curation, Methodology, Formal analysis, Investigation, Writing - review & editing.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodpol.2021.102045.

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