Do Large School Food Authorities Pay Less for Food used in the National School Lunch Program?

Michael Ollinger, Economic Research Service, USDA, ollinger@ERS.USDA.gov

Joanne Guthrie, Economic Research Service, USDA, jguthrie@ERS.USDA.gov

and

Audrey Peo, University of Delaware, audreypeo@gmail.com

The views expressed in this document are those of the authors and do not necessarily reflect the views of the U.S. Department of Agriculture.

Selected Paper prepared for presentation at the 2016 Agricultural & Applied Economics Association Annual Meeting, Boston, Massachusetts, July 31-August 2

ABSTRACT

Do Large School Food Authorities Pay Less for Food used in the National School Lunch Program?

Michael Ollinger, Joanne Guthrie, and Audrey Peo

School food authorities (SFAs) run meal service programs in each school district and are reimbursed at a national rate for meals served to eligible students participating in the National School Lunch Program (NSLP). Previous research (Ollinger et al., 2011) showed that meal costs were lower for SFAs that serve more meals, and Newman, Ralston, and Clauson (2008) found that some large volume buyers reduce their food costs by negotiating price discounts. This paper builds on that research by examining factors affecting purchase costs. The main findings are that cost dropped with the volume of product purchased and with the number of meals served for most foods and varied across regions. A major surprise was that small and middle size SFAs in buying cooperatives and SFAs using school food management companies had higher costs than did other SFAs not using co-operatives or food management companies.

Keywords: National School Lunch Program, School Breakfast Program, school meals, school food authorities,

The views expressed in this document are those of the authors and do not necessarily reflect the views of the U.S. Department of Agriculture.

Do Large School Food Authorities Pay Less for Food used in the National School Lunch Program?

The National School Lunch Program (NSLP) funded 30.7 million lunches and 13.2 million breakfasts in 2014 (Oliveira, 2015). School food authorities (SFAs) run programs in each school district and are reimbursed by NSLP for the full and reduced price and free meals they serve to participating students. With a few exceptions, all SFAs are reimbursed at a national rate under the implicit assumption that meal costs are the same across SFAs. Yet, Ollinger et al.'s (2011) cost function analysis indicates that there is an average cost deviation of $0.38 per meal across 21 locations spanning the U.S., and Ollinger and Guthrie (2015) found that one-third of the breakfast and two-thirds of the lunch cost differences were due to input prices. Newman, Ralston, and Clauson (2008) offer clues to the source of meal price differences across locations, finding that some large volume buyers reduce their food costs by negotiating price discounts.

Economists recognize that identical products may have different prices. Chipty and Snyder (1999) and Inderst and Wey (2006) show that high volume buyers can use bargaining power to get better terms. Katz (1987) argues that sellers can price discriminate among buyers, charging prices based on market conditions, but Matthewson and Winter (1996) assert that buyer groups form to enhance buyer power. Combined, this research suggests that a SFA's costs per unit of food may vary with purchasing volumes, market conditions, and purchasing practices.

The School Food Purchase Study III (SFPS-III) is the only study that directly examined the cost of food purchases. This report provides national estimates of costs per unit of foods purchased for the NSLP and the School Breakfast Program (SBP) for the 2009/2010 school year

and showed that mean prices drop with SFA size. However, the study does not deflate prices by a regional deflator, nor does it account for factors other than size that may influence prices paid.

The purpose of this paper is to evaluate the extent to which the volume of purchased food, market conditions, purchasing practices, and SFA characteristics, such as the number of meals served, affect food purchase costs. We consider cost per unit for eight food groups in nine regions across the contiguous 48 states and four urbanicities. The food groups are: fruits and vegetables, bakery and baking products, milk and dairy, meat and poultry, desserts, snacks, prepared foods, and nondairy drinks. Urbanicities are urban-rural areas and include urban, suburban, town, and rural areas.

Below, we provide an empirical framework followed by presentation of an econometric model and discussions of the data, estimation procedures and results. Finally, we give a conclusion.

Economic Framework

SFAs are cost minimizing organizations that are required to generate sufficient revenue to meet all costs while at the same time provide tasty and nutritious meals. SFAs purchase food, employ labor, and use SFA facilities to prepare and serve meals. With a few exceptions, all SFAs are reimbursed at a national rate. Yet, evidence provided by Newman, Ralston, and Clauson (2008, Ollinger et al.(2011), and Ollinger and Guthrie (2015) suggest that meal and food costs may vary by the number of meals served and SFA location.

Economic theory suggests that purchasing costs may drop with larger volume purchases. Food is sold by vendors that may benefit from economies of scale in production and may be able to lower their marketing costs by selling to fewer, larger-volume buyers. SFAs, on the other hand, vary in the number of meals they serve, giving rise to considerable variation in purchase volumes. These two features -- economies of scale of the seller and buying power for the buyer -- provide the possibility of negotiated price discounts for volume purchases. Chipty and Snyder (1999) show that large buyers can use bargaining power to negotiate better terms with suppliers because, as noted by Inderst and Wey (2006), large customers may account for a substantial share of a seller's revenue. Both parties benefit from the transaction because the buyer gets lower price and the seller benefits from scale economies and lower marketing costs.

Small SFAs may gain buying power by joining together as cooperatives. Katz (1987) argues that sellers price discriminate among large and small buyers by charging small buyers a higher price and larger buyers a lower price. However, Matthewson and Winter (1996) assert that buyer groups will form to enhance buyer power. The net result is lower search costs and prices but less innovation and fewer choices. For many SFAs interested in meeting basic needs and facing budgetary pressures, this may be a worthwhile tradeoff.

Pannell-Martin and Boettger (2014) identify several purchasing strategies that affect prices. They remind us that suppliers have no incentive to control costs under a cost-plus fixed fee pricing scheme, but also may raise prices if they bear the risk of rising costs under fixed price contracts. They also point out that centralized purchasing can lead to lower food purchase costs because there is greater buying power.

Markets also play a role in prices paid. Economic theory holds that prices should drop as the number of suppliers rises. Additionally, SFAs with schools that have access to kitchens have

greater purchasing flexibility since these facilities could be used to prepare foods that may otherwise be purchased. The net effects of market forces is to put downward pressure on prices.

Pannell-Martin and Boettger (2014) assert that purchasing managers may pay a higher price for branded foods.[1] Other important product characteristics are whether the product is canned, sold as single-serve units, purchased using funds from USDA, a USDA commodity, etc.

Following Chipty and Snyder (1999) and Inderst and Wey (2006), Matthewson and Winter (1996), and Pannell-Martin and Boettger (2014), we hypothesize that cost per unit (CU) of food purchased by SFAs is a function of the quantity purchased (Q), purchasing practices (**P**), market conditions (**M**), and product characteristics (**K**). We also account for SFA characteristics (**S**). Thus, cost per unit of food 'f' for SFA 'i' is:

(1) $CU_{if} = CU\ (Q_{if}, \mathbf{P}_i, \mathbf{M}_f, \mathbf{K}_f, \mathbf{S}_i)$.

We expect that (1) $dCU/dQ < 0$ if buyer discounts are granted for large volume purchases and (2) $dCU/dM < 0$.

Econometric Model

The School Food Purchase Study III (SFPS-III) is the only recent study that directly examined the cost of SFA food purchases. This report made national estimates of the unit price of food acquisitions by SFAs participating in the NSLP during school year 2009/10. Their data show that costs per unit dropped with SFA size (number of meals served) and varied with purchasing practices and other characteristics. However, this study did not use a multivariate analysis, did

[1] Branded products in this survey referred to foods from nationally known Fast Food and other restaurants.

not control for important related effects, and did not consider the quantity of a product purchased (only the number of meals served).

Equation (2) is an econometric model of the impact of volume discounts (Q), purchasing practices (**P**), the market environment (**M**), product characteristics (**K**), and SFA characteristics (**S**) on cost per unit (CU) of food "f" for SFA "i".

$$2) \qquad CU_{f,i} = \alpha_0 + \beta Q_{f,i} + \sum_j \rho_j P_{j,f,i} + \sum_h \delta_h M_{h,f,i} + \sum_k \lambda_k K_{k,f,i} + \sum_l \omega_l S_{l,i} + \xi_{f,i}.$$

where $CU_{f,i}$ is the normalized cost per ounce of food product "f" identified by food codes in the survey. These products are differentiated by type of main ingredient or product type but not by container size. For example, chicken nuggets and fish nuggets are two separate products, but cereal in 12 ounce boxes and the same types of cereal in 18 ounce boxes are the same products.[2] The quantity of food (Q) is given in ounces because this is largest common unit to all foods.

We normalized the dependent variable (cost per unit) by (1) converting purchase units into a common unit (ounces) and computing cost per ounce for each food code for each SFA, (2) deflating estimated cost per ounce by a geographic deflator derived from the USDA's Quarterly Food at Home Price Database 2 (QFAHPD2), and (3) dividing deflated costs per ounce by the mean deflated cost of the same food code for all SFAs. The resulting index eliminated product related cost differences across food codes and enabled results to be interpreted as percent differences from the mean cost.

Variable definitions are given in table 1. Market conditions include both the number of vendors that offer the food product and whether schools have on-site cooking facilities. We

[2] single serve products are treated as different product from bulk products.

include on-site cooking facilities because these give schools greater flexibility in food preparation. Purchasing practices account for whether (1) the SFA considers price when deciding on a vendor from which to purchase foods, (2) the SFA is part of a buying cooperative, (3) purchasing practices are decentralized, (4) products are purchased under lump sum contracts, and (5) the SFA uses fixed price contracts. Product characteristics include variables for share of unbranded products, processed products from USDA donated foods, fruits and vegetables purchased in cooperation with a Department of Defense (DOD) program, and commodity purchased with USDA credits.[3] SFA characteristics include the number of meals served, share of meals served in elementary schools, share of meals provided at a reduced price or free, and lunches as a share of all meals served. Variables also include dummy variables for whether revenues from programs other than schools meals exceeded 25 percent of revenues, the SFA serves a' la carte foods, and the SFA uses a food service management company. There are also dummy variables controlling for region and urbanicity.

Data

The data came from the USDA's School Food Purchase Study (SFPS-III) and USDA's Quarterly Food at Home Price Database 2 (QFAHPD2). The SFPS-III was collected over the 2009/2010 school year and include a wide variety of data on SFA characteristics, purchasing practices, and food costs for a nationally representative sample of 390 SFAs stratified across nine regions of the

[3] School districts are offered assistance of a certain value of USDA foods and can order them through the state distribution channel. These foods may include cheese, ground beef, etc. Credits can also be used to purchase fruits and vegetables through the Department of Defense Fruit and Vegetable Program (DoDFresh).

U.S. The SFA characteristics include data on student enrollment, geographic locations, number of school meals, reimbursement rates, whether the schools offer a la carte foods, type of menu planning, etc. The purchasing practices is information, such as, use of cooperative agreements, pricing strategies, use of USDA commodities, etc. Food cost information include a product, description, amount purchased, unit of purchase, and costs.

The SFPS-III gives data in local prices. Yet, it is well known that the cost of food varies across the U.S., making it necessary to deflate local prices. We use the QFAHPD2 for 2010 to construct a deflator because this dataset has foods that are representative of the types of foods purchased by schools. Our procedure was to create a price index for each of the 54 food groups in the QFAHPD2 based on school food purchases from the SFPS-III and the prices included in QFAHPD2. We then matched location data for SFAs in the SFPS-III with the location data for the 39 marketing groups in the QFAHPD2.

The key data is the cost per unit of food. SFAs may purchase single-serve products, such as boxes of single-serve cereal, or bulk units of different sizes, e.g. different size boxes of cereal. We defined costs for bulk items as total food costs divided by total ounces purchased for a Food Nutrition Service (FNS) product. Costs were summed directly from the data. The quantity of ounces purchased is defined as the number of ounces per unit times the number of units, e.g. boxes of cereal, times the number of units per case times the number of cases. Cost per unit is total costs divided by total ounces or cost per ounce

The original dataset contained 1,052 food products, such as turkey hot dogs, identified by a food code. Some products were purchased by only a small number of SFAs and could bias the estimates, so we dropped products that were used by fewer than five percent of all SFAs, i.e. products with fewer than 20 observations. We also dropped observations with a cost per unit

greater than five times or less than 20 percent of the mean cost per unit of the food code. The final dataset had 549 food codes and 69,344 observations spread across 390 SFAs.

Discussion of Data

Table 2 gives the means of variables that vary by SFA and food group. Notice that there was an average of about three or four vendors per food group, foods purchased as single-servings accounted for more than 45 percent of milk and dairy, dessert, snack, and non-diary drink purchases, and that USDA and DOD foods make substantial contributions to purchases of fruits and vegetables, bread and baking products, milk and dairy products, meat and poultry, and, to a lesser extent, desserts. Still, the vast majority of purchases are from commercial sources.

Table 3 has the means of variables that vary by SFA but not by food group. These include dummy variables for regions and urbanicities. Notice that almost all SFAs use prices in their vendor selection decisions and that the vast majority of SFAs offer a'la carte foods. The data also show that less than 4 percent of purchases are of branded products.

Table 4 shows a link between higher costs and lower volume of purchases for products within each food group. The table shows that SFAs in the 10^{th} percentile bought an average of 1,100 ounces of fruits and vegetables at a cost index value equal to 1.12 whereas SFAs in the 90^{th} percentile bought an average of 92,900 ounces of each fruit and vegetable at a cost index value equal to 0.88. It also shows that the mean quantity of each fruits and vegetables purchased equaled about 11,600 ounces, SFAs bought more ounces of milk/dairy than any other type of product (88,800 ounces at mean values) and the least snacks (4,200 ounces at mean values).

Pannell-Martin and Boettger (2014) assert that purchasing practices – using price in vendor selection, buying in cooperatives, decentralized purchasing, lump sum purchasing, and fixed price purchasing – affect costs. Table 5 shows purchasing practices and costs per ounce. It indicates that SFAs using price as a vendor selection criteria had lower costs than SFAs not using this criteria. Other purchasing practices give mixed results. However, if the four food groups with mainly bulk purchases – fruits and vegetables, bread and baking meat and poultry, and ready-to-eat foods -- are distinguished from those with a large number of single-serve products, then SFAs buying in cooperatives, using centralized purchasing, not purchasing in a lump sum, and not using fixed prices had lower mean purchase costs in 9 of 12 cases.

Econometric Methods

The data are panel data given by an SFA identifier and a food code. We suspect that unobserved product qualities, such as marketing or distribution channels, are constant across SFAs, suggesting the need for a random or fixed effects model. Random effects models account for unobserved heterogeneity that is constant over time and correlated with the independent variables. Fixed effects models, in contrast, are most appropriate if (1) unobserved variables are constant over time and uncorrelated with the independent variables and (2) within unit variation in the dependent variable is greater than cross unit variation (Chamberlain, 1980). We used a Hausman (1978) test to guide our choice; the test significantly rejects the hypothesis that there are no fixed effects.

Allison (2009) reminds us that there must be at least two observations of each food product and the dependent variable must change at least once for each group member in a fixed effects dataset. If

these criteria are not met, all observations associated with the group are dropped. The groups in our data are food products. None are dropped since there is substantial variation across SFAs.

Each food code has at least 20 observations of different SFAs. Cameron and Miller (2015) demonstrated that analyses of these types of data can understate the standard errors and overstate the t-statistics if there is little variation within each group (SFAs within each food product). SFAs, however, have vastly different characteristics, making data clustering unlikely.

The data are nationally representative survey data stratified across nine regions. We account for survey design by using survey strata and survey weights in the analysis to arrive at nationally representative results.

Results

Results for all variables are reported in table 6 and table 7 gives the expected sign and the sign of the estimated value. The R^2 values range from 0.11 for breads and baking products to 0.695 for fruits and vegetables. Cost per ounce dropped with an increase in the volume purchased in all food groups; costs also dropped with the number of meals in five of the eight food groups. Cost per ounce, as expected, also declined with an increase in the number of vendors and for use of price by SFAs as a selection criteria.

Pannel-Martin and Boettger (2014) and Matthewson and Winter (1996) suggested that buyer cooperatives could negotiate lower costs. Surprisingly, SFA's using cooperatives had substantially higher costs. However, costs diminished with the number of meals served and for rural areas and towns, suggesting that some SFAs do benefit from agreements. Very large SFAs (65 million meals served) would save money by entering a co-operative purchasing arrangement

for fruits or vegetables but smaller SFAs would not. Larger SFAs would benefit from cooperative purchasing for other foods also. SFAs that serve more than one million meals would benefit from cooperative purchases of desserts and ready-to-eat foods, and SFAs that serve more than five million meals would benefit from cooperative purchases of all other foods. Note, that one million meals for desserts and ready-to-eat foods is close to the 40th percentile of meals served and 5 million meals for the other products is near the 90th percentile of meals (table 4).

Other purchasing practices give mixed benefits in terms of costs. Decentralized purchasing yielded lower costs in three food groups but higher costs in two others. Purchasing in a lump sum resulted in higher costs in six food groups but lower costs in the other two food groups. Fixed price contracts generated higher costs for fruits and vegetables, bread and baking products, milk and dairy, and meat and poultry, but lower costs in the other four food groups.

Results for product characteristics were consistent with expectations. Cost dropped as the share of unbranded products rose and for canned goods. Costs also dropped for products granted a rebate because they were processed with USDA-provided commodities. DOD and USDA commodities had higher costs. This is not surprising since these are priced at market rates and purchased with USDA credits. Lower costs for single-serve products in three food groups is surprising and requires further analyses. It could be that single-serve products vary in size, suggesting that a more detailed variable is needed to reflect actual costs.

Several SFA characteristics have consistent signs across food groups. SFAs using a food service management company and those with a higher share of lunches served had higher costs. SFAs with non-meal revenues greater than 25 percent had lower costs. Other variables show no consistent relationship. Locations also appear to be important. SFAs in the Northeast, Delta, Southeast, Mountain, and Pacific regions had lower costs while SFAs in the Northern and

Southern Plains, towns, and rural areas had higher costs. Other locations had more mixed results.

Conclusion:

This paper examined the extent to which the volume of purchased food, market conditions, purchasing practices, and SFA characteristics, such as the number of meals served, affect food purchase costs. The main findings are that cost dropped with the volume of product purchased and with the number of meals served for most foods. Cost also dropped as the number of available suppliers rose and if the SFA used prices as a criterion for product selection. There were also substantial differences in costs across regions and urbanicities. It was not surprising that costs dropped for canned goods and products made with donated USDA commodities and rose for branded products. It was surprising that SFAs using food service management companies had higher costs than other SFAs.

A major surprise was that small and middle size SFAs in buying cooperatives had higher costs than did others. Results suggest that very small SFAs in buying cooperative (about 2,000 meals served per year) would have to pay about 15 percent more than others. Large SFAs (over 5 million meals per year) would have cost reductions in seven food groups. Other purchasing techniques, such as decentralized purchasing, lump sum purchasing, and using fixed price contracts had mixed results.

The paper raises several questions that require further research. Most importantly, if costs per unit drop with greater purchasing volume, why does participating in a buyer group with other SFAs raise costs? Also, what benefits do food management companies provide that justify their use (results suggest they raise food costs)? Additionally, idiosyncratic factors play a big role in explaining cost variation. What are these idiosyncratic factors? With USDA's school meal

programs under pressure to improve nutritional quality and student satisfaction within their budget constraint, it is important to understand what cost factors SFAs can and cannot control.

References

Agralytica Inc. 2012. School Food Purchase Survey, 2009-10. Alexandria, VA.

Allison, Paul. 2009. *Fixed Effects Regression Models*. Sage Publications: Thousand Oaks, California.

Chamberlain, Gary A. 1980. "Analysis of Covariance with Qualitative Data." *Review of Economic Studies* 47:225–38.

Chipty, Tasneem and Christopher M. Snyder. 1999. "The Role of Firm Size in Bilateral Bargaining: A Study of the Cable Television Industry." *The Review of Economics and Statistics* May: 81(2): 326-340.

Hausman, J. A. 1978. "Specification Tests in Econometrics". *Econometrica* ***46*** *(6)*: 1251–1271.

Inderst, Roman and Christian Wey. 2006. "Buyer power and supplier incentives." *European Economic Review.* 51(May): 647-667.

Katz, M. L. 1987. "The welfare effects of third degree price discrimination in Intermediate goods markets." *American Economic Review* 77, 154-167.

Matthewson Frank and Ralph A. Winter. 1996. "Buyer groups." *International Journal of Agricultural Economics* 15(winter): 137-64.

Newman, Constance, Katherine Ralston, and Annette Clausen. 2008. "Balancing Nutrition, Participation, and Cost." *Amber Waves*. U.S. Department of Agriculture, Economic Research Service. www.ers.usda.gov/amber-waves/2008-september/balancing-nutrition,-participation,-and-cost-in-the-national-school-lunch-program.aspx.

Oliveira, Victor. 2015. *The Food Assistance Landscape: FY 2013 Annual Report.* Economic Information Bulletin No. 137. U.S. Department of Agriculture, Economic Research Service. www.ers.usda.gov/publications/eib-economic-information-bulletin/eib137.aspx.

Ollinger, Michael, Katherine Ralston, and Joanne Guthrie. 2011. *School Foodservice Costs: Location Matters.* Economic Research Report No. 117. U.S. Department of Agriculture, Economic Research Service. www.ers.usda.gov/publications/err-economic-research-report/err117.aspx.

Ollinger, Michael and Joanne Guthrie. 2015. *Economies of Scale, the Lunch-Breakfast Ratio, and the Cost of USDA School Breakfasts and Lunches.* Economic Research Report No. 196. U.S. Department of Agriculture, Economic Research Service. http://www.ers.usda.gov/media/1935405/err-196.pdf

Pannell-Martin, D. and Julie A. Boettger. 2014. *School Food and Nutrition Service Management*. SFS22, LLC: Aiken, South Carolina.

Table 1: Variable definitions.

Variable	Definition
Dependent Variable (CU)	
Index of delivered cost per ounce.	$DC_{if} = \frac{\sum_{t=0}^{n} ffoodcost_{ift}}{\sum_{t=0}^{n} foodounces_{ift}}$ where DC_{if} is the delivered cost of a food code "f" for SFA "i", $foodcost_{ift}$ is the cost of food "f" purchased at time "t" by SFA "i", and $foodounces_{ift}$ is the ounces of the food "f" purchased at time "t" by SFA "i". DC_{if} was deflated using the geographic deflator described in the text, and Index of delivered cost per ounce = Log[(DC_{if}) / ($\sum_{i=0}^{n} DC_{if}$)/n)], for "n" SFAs.
Volume purchased (Q)	
Log ounces	Log of thousands of ounces purchased.
Market (M)	
On-site kitchen	One if 75 percent or more of SFA schools have an on-site kitchen; zero otherwise.
Log number vendors	Log of number of vendors available from which to purchase food.
Purchasing Practices (P)	
Vendor Selection: Pricing	One if SFA chooses products based on prices and zero otherwise.
Purchasing Co-operative	One if SFA purchases products with buyer groups and zero otherwise.
Decentralized Purchase	One if purchasing decision made at the school level and zero otherwise.
Lump Sum purchase	One if purchasing decision made in one lump sum for all or a group of foods; else zero.
Fixed Price contracts	One if use a strictly fixed price contract for purchases and zero otherwise.
Product Characteristics (K)	
Share unbranded	One minus share of products purchased from fast food restaurants, e.g. McDonalds.
Single-serve	One if some purchased products are single serve and zero otherwise.
Canned	One if product is canned and zero otherwise.
Processed from USDA commodity.	One if a purchased processed product was given a rebate or other discount by the supplier because the product contained USDA donated commodities; zero otherwise.
DOD food	One if some fruits or vegetables were purchased from DOD with USDA credits; else zero.
USDA food	One if some products were USDA commodities purchased using USDA credits; else zero.
SFA Characteristics (S)	
Log size	Log of total number of lunches and breakfasts served.
Share elementary	Lunches and breakfasts served to elementary school children as share of all meals served.
Share reduced	Lunches and breakfasts served as reduced or free meals as share of all meals.
Share lunches	Lunches served as a share of lunches and breakfasts served.
Other programs_25	One if revenues from programs other than lunches or breakfasts was greater than 25 percent of revenue and zero otherwise.
A la carte foods	One if SFA served a la carte foods and zero otherwise.
Food Serv. Mgmt.	One if SFA use a food service management company; zero otherwise.

Table 2: Mean values of variables that vary by food group.

	----------Food Groups----------							
	Fruit and vegetables	**Bread and Baking**	**Milk and Dairy**	**Meat and Poultry**	**Desserts**	**Snacks**	**Ready-to-Eat Foods**	**Non-Dairy Drinks**
Market (M)	----------number----------							
Number of Available vendors	4.08	3.70	2.73	3.90	3.20	4.49	4.41	4.68
Purchasing Practices (P)	----------share of all SFAs----------							
Purchasing Co-operative	0.47	0.47	0.46	0.45	0.47	0.47	0.50	0.52
Decentralized Purchasing	0.14	0.16	0.17	0.12	0.17	0.13	0.10	0.11
Lump Sum	0.17	0.27	0.19	0.21	0.17	0.22	0.24	0.20
Fixed Price	0.16	0.61	0.24	0.31	0.35	0.35	0.38	0.43
Product Characteristics (K)								
Single serve	0.067	0.035	0.477	0.00	0.664	0.612	0.106	0.849
Canned Goods	0.10	0.00	0.00	0.04	0.00	0.00	0.614	0.00
Processed from USDA commodity	0.06	0.49	0.30	0.77	0.54	0.06	0.78	0.18
DOD	0.66	0.03	0.00	0.00	0.00	0.00	0.00	0.00
USDA commodity	0.21	0.24	0.31	0.51	0.01	0.00	0.08	0.08
Ounces purchased from Commercial sources as share of total purchases.	0.91	0.92	0.85	0.67	0.98	0.99	0.87	0.99
Number of Products		93	37	40	54	17	136	54

Table 3: Mean values of variables that do not vary by food group. All variables are dummy variables with values equal to share of total sample.

Variable Type	Mean	Description
Market (M)		
Share with on-site kitchen	0.579	
Purchasing Practices (P)		
Vendor Select: Pricing	0.957	
Product Characteristics (K)		
Share unbranded	0.966	
SFA Characteristics (S)		
Share elementary	0.518	
Share Reduced Price Meals	0.583	
Share of Lunches	0.709	
Share of SFAs with non-meal revenues greater than 25 percent of total.	0.101	
Share with a la carte foods	0.851	
Share using Food Service Management	0.160	
Region		
Appalachia	0.067	Kentucky, North Carolina, Tennessee, Virginia, and West Virginia
Delta	0.041	Arkansas, Louisiana, and Mississippi
Great Lakes	0.115	Michigan, Minnesota, and Wisconsin
Midwest		Iowa, Illinois, Indiana, Missouri, and Ohio
Mountain	0.057	Arizona, Colorado, Idaho, Montana, New Mexico, Nevada, and Utah
Northeast	0.248	Connecticut, District of Columbia, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont
Northern Plains	0.025	Kansas, North Dakota, Nebraska, and South Dakota
Pacific	0.101	California, Oregon, and Washington
Southeast	0.062	Alabama, Florida, Georgia, and South Carolina
Southern Plains	0.113	Oklahoma and Texas
Location		
City	0.113	
Town	0.226	
Rural	0.425	
Suburb	0.236	

Table 4: Changes in Costs at Selected percentiles of Volume of NSLP Meals Served.

Food Groups	Variable	Units	----------Percentile ----------							
			Min.	10	30	50	mean	70	90	Max.
Fruits/ Vegetables	Delivered cost	$/ounce	0.20	1.12	1.03	0.95	1.02	0.95	0.88	4.98
	Total ounces	thousands	0.004	1.10	3.59	8.23	11.6	19.8	92.9	7,070
	Total meals	thousands	5.3	651	1,058	1,940	1,670	2,569	6,583	179,291
Bread/ Baking	Delivered cost	$/ounce	0.20	1.03	1.00	0.98	1.03	0.95	0.92	4.80
	Total ounces	thousands	0.012	1.39	4.02	9.48	12.4	20.4	94.3	10,260
	Total meals	thousands	5.3	742	1,473	1,688	1,654	2,176	5,695	179,291
Milk/ Dairy	Delivered cost	$/ounce	0.20	1.03	1.00	0.98	0.99	0.96	0.94	4.21
	Total ounces	thousands	0.008	6.0	38.9	88.8	108.5	167.9	721.8	62,031
	Total meals	thousands	5.3	855	1,222	2,093	1,651	1,932	5104	179,291
Meat/Poultry	Delivered cost	$/ounce	0.25	1.05	0.99	1.00	1.00	0.94	0.93	3.25
	Total ounces	thousands	0.016	1.23	4.17	10.0	13.8	25.3	119.1	7,548
	Total meals	thousands	5.3	836	1,722	2,181	1,874	3,344	4,576	179,291
Desserts	Delivered cost	$/ounce	0.21	1.12	1.01	0.96	1.01	0.94	0.88	4.37
	Total ounces	thousands	0.005	0.57	2.16	5.17	8.3	13.67	63.0	2,782
	Total meals	thousands	22.5	779	1,110	1,619	1,672	3,174	4,842	179,291
Snacks	Delivered cost	$/ounce	0.22	1.13	1.02	0.99	1.03	0.95	0.87	3.51
	Total ounces	thousands	0.006	0.32	1.22	2.62	4.2	7.03	34.9	1,451
	Total meals	thousands	5.3	1019	1,345	1,177	1,557	1,817	4,900	179,291
Ready-to-Eat Foods		$/ounce	0.20	1.10	1.01	0.98	1.02	0.96	0.93	4.71
	Total ounces	thousands	0.005	1.18	4.18	10.47	14.9	26.5	123.3	7,514
	Total meals	thousands	5.3	846	1,317	1,733	1,768	2,878	6,232	179,291
Non-Dairy Drinks	Delivered cost	$/ounce	0.22	1.06	1.01	0.95	0.99	0.94	0.89	4.69
	Total ounces	thousands	0.012	2.41	9.43	23.5	40.3	61.5	328.2	19,061
	Total meals	thousands	5.3	1,094	1,116	1,225	1,643	2,351	6,230	179,291

Table 5: Cost Differences by Use of Purchasing Practice and Food Group

	----------Purchasing Practices----------									
Food Groups	**Vendor selection: ----Pricing----**		**Purchasing: Co-operative**		**Purchasing: Decentralized**		**Pricing: -Lump Sum-**		**Pricing -Fixed Prices**	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	----------cost index----------									
Fruit and vegetables	1.022	1.042	1.022	1.024	1.012	1.025	1.044	1.019	1.037	1.021
Bread and Baking	1.026	1.069	1.025	1.031	1.036	1.027	1.033	1.027	1.030	1.026
Milk and Dairy	0.990	1.070	1.005	0.982	0.978	0.996	0.969	0.998	1.024	0.983
Meat and Poultry	1.001	1.043	0.993	1.010	1.076	0.993	1.032	0.995	1.009	1.000
Desserts	1.014	0.962	0.997	1.026	1.046	1.006	0.998	1.015	0.986	1.027
Snacks	1.027	1.080	1.018	1.038	1.081	1.021	1.017	1.032	0.987	1.051
Ready-to-Eat Foods	1.018	1.054	1.005	1.033	1.054	1.015	1.044	1.011	1.007	1.027
Non-Dairy Drinks	0.997	0.934	0.979	1.010	0.936	1.001	1.010	0.990	0.973	1.009

Table 6: Fixed Effects Regression Results of Impact of Purchasing Volume and Practices on the Cost per Ounce Paid by SFAs Participating in the National School Lunch Program.

	Fruit / Vege-tables	Bread and Baking	Milk and Dairy	Meat and Poultry	Desserts	Snacks	Ready-to-Eat Foods	Non-Dairy Drinks
Constant	-1.28*** (0.041)	0.441*** (0.047)	0.196*** (0.065)	.335*** (0.054)	0.376*** (0.130)	0.012 (0.085)	0.346*** (0.061)	-2.75*** (0.105)
Log ounces	-0.070*** (0.0008)	-0.044*** (0.001)	-.022*** (0.001)	-.026*** (0.001)	-.061*** (0.002)	-0.05*** (0.002)	-.037*** (0.001)	-.035*** (0.001)
Market (M)								
On-site kitchen	-0.015*** (0.003)	0.004 (0.004)	0.007 (0.006)	-.012*** (0.004)	0.0002 (0.004)	0.012** (0.006)	0.003 (0.004)	0.004 (0.005)
Number vendors	-0.014*** (0.003)	-0.003 (0.004)	-.018*** (0.007)	-.042*** (.0004)	0.021*** (0.006)	0.006 (0.007)	-.031*** (0.003)	-.008* (0.004)
Number vendors * log size	0.001*** (0.0002)	0.0001 (0.0002)	0.001*** (.0004)	.003*** (.0003)	-.001*** (0.0004)	-0.0004 (0.0005)	0.002*** (.0003)	.0005** (.0002)
Purchasing Practices (P)								
Vendor Selection: Pricing	-0.029*** (0.006)	-0.707*** (0.046)	-.785*** (0.054)	-.351** (0.043)	-.961*** (0.121)	-0.699*** (0.080)	-.577*** (0.056)	1.257*** (0.098)
Vendor Selection: Pricing *size	-	0.054*** (0.004)	0.059*** (0.004)	.025*** (0.003)	-.001*** (0.0004)	0.049*** (0.006)	0.002*** (.0002)	-.095*** (0.008)
Purchasing Co-operative	0.344*** (0.031)	0.343*** (0.051)	0.600*** (0.062)	0.28*** (0.046)	.440*** (0.047)	0.345*** (0.058)	0.235*** (0.044)	0.263*** (0.057)
Purchasing Co-operative *rural	-0.109*** (0.010)	-0.119*** (0.014)	-.136*** (0.016)	-.103*** (0.013)	-0.061** (0.011)	-0.162*** (0.015)	-.073*** (0.011)	-.109*** (0.013)
Purchasing Co-operative *city	-0.012 (0.010)	0.089*** (0.017)	0.064*** (0.018)	.058*** (0.016)	0.054*** (0.014)	0.008 (0.018)	0.052*** (0.013)	-0.002 (0.013)
Purchasing Co-operative *town	-0.107*** (0.001)	-0.037*** (0.012)	-.092*** (0.015)	-.050*** (0.013)	-.061*** (0.011)	-0.003 (0.015)	0.018* (0.010)	-.078*** (0.013)
Purchasing Co-operative * log size	-0.019*** (0.002)	-0.022*** (0.004)	-.038*** (0.004)	-.018*** (0.003)	-.032*** (0.003)	-0.022*** (0.004)	-.017*** (0.003)	-.017*** (0.004)
Decentralized Purchasing	-0.020*** (0.005)	-0.027*** (0.007)	0.033*** (0.008)	.022*** (0.006)	0.010 (0.006)	0.010 (0.010)	-0.001 (0.006)	-.043*** (0.010)
Lump sum purchasing	0.047*** (0.004)	0.018** (0.004)	-.032*** (0.006)	.039*** (0.006)	-.014*** (0.005)	0.015*** (0.006)	0.055*** (0.004)	0.017*** (0.005)
Fixed price contracts	0.034*** (0.004)	0.009** (0.004)	0.036*** (0.006)	.014*** (0.004)	-0.010** (0.004)	-0.015*** (0.006)	-.009*** (0.003)	-.028*** (0.004)
Product Characteristics (K)								
Share unbranded products	-0.025*** (0.005)	-0.005 (0.009)	-.045*** (0.010)	-.038*** (0.010)	-.032*** (0.010)	-0.063*** (0.011)	-.039*** (0.006)	-.054*** (0.011)
Canned	-0.021** (0.010)	-	-	-0.026 (0.024)	-	-	-.073*** (0.02)	-
Single-serve	0.135** (0.066)	0.082*** (0.024)	-.179*** (0.042)	-	-.294*** (0.035)	-0.134*** (0.025)	.142*** (0.022)	0.053** (0.025)
Processed from USDA commodity	-0.199*** (0.012)	-0.231*** (0.012)	-.366*** (0.011)	-.329*** (0.008)	-.157*** (0.010)	-0.324*** (0.019)	-.218*** (0.005)	-
DOD food	0.018*** (0.004)	-	-	-	-	-	-	-

USDA commodity	0.047*** (0.005)	0.018*** (0.005)	0.176*** (0.008)	.032*** (0.005)	-	-	-	-
SFA Characteristics (S)								
Log size	0.034*** (0.002)	-0.017*** (0.003)	-.017*** (0.004)	-0.01*** (0.003)	-0.011 (0.010)	0.009 (0.006)	-.025*** (0.004)	0.117*** (0.007)
Share elementary schools	0.078*** (0.012)	-0.060*** (0.014)	0.081*** (0.018)	0.015 (0.013)	0.042 (0.015)	0.170 (0.022)	-.033*** (0.012)	0.043** (0.021)
Share reduced price meal	0.096** (0.013)	0.009 (0.016)	0.093* (0.020)	0.0004 (0.018)	-0.03* (0.016)	-0.029 (0.024)	.098*** (0.018)	0.027 (0.019)
Share lunches	0.190*** (0.015)	0.068*** (0.024)	0.097*** (0.026)	0.048** (0.021)	0.151*** (0.025)	0.183*** (0.039)	0.222*** (0.021)	0.145*** (0.026)
SFAs has non-meal revenues greater than 25 percent of total.	-0.039*** (0.006)	0.007 (0.008)	-.038*** (0.009)	-.022*** (0.008)	-0.010 (0.008)	-0.043*** (0.009)	-0.015* (0.008)	-0.016** (0.008)
A la carte foods	-0.018*** (0.005)	-0.033*** (0.005)	0.006 (0.006)	-0.06*** (0.005)	0.017*** (0.005)	0.020** (0.010)	0.010 (0.008)	-.042*** (0.011)
Food Service Management.	0.062*** (0.005)	0.056*** (0.006)	0.012 (0.008)	0.010 (0.006)	0.005 (0.006)	0.000 (0.000)	0.010** (0.005)	0.06*** (0.007)
Location								
Northeast	-0.068*** (0.006)	-0.063*** (0.007)	-.112*** (0.008)	-.042*** (0.007)	-.067*** (0.007)	-.089*** (0.008)	-.028*** (0.008)	-0.001 (0.007)
Great Lakes	0.017*** (0.005)	0.036*** (0.007)	-0.009 (0.011)	-0.002 (0.009)	-0.005 (0.007)	0.009 (0.009)	0.027*** (0.008)	-0.010 (0.009)
Northern Plains	0.107*** (0.016)	0.067*** (0.010)	0.090 (0.010)	0.058 (0.009)	0.039*** (0.011)	-0.035* (0.021)	-.132*** (0.010)	0.033* (0.017)
Appalachia	-0.006 (0.004)	-0.028*** (0.004)	-.086*** (0.005)	.039*** (0.004)	-.032*** (0.005)	-.066*** (0.006)	0.004 (0.005)	0.037*** (0.006)
Delta	-0.025** (0.010)	-0.066*** (0.014)	-.022*** (0.005)	.017*** (0.007)	.195*** (0.012)	-.119*** (0.031)	0.007 (0.011)	-0.045** (0.018)
Southeast	-0.076*** (0.004)	-0.079*** (0.005)	-.056*** (0.006)	.012*** (0.005)	-.015*** (0.006)	-.201*** (0.007)	-.058*** (0.006)	-.037*** (0.009)
Southern Plains	-0.007 (0.005)	0.043 (0.004)	0.002 (0.006)	.116*** (0.005)	-.067*** (0.006)	.038*** (0.007)	0.091*** (0.006)	0.142** (0.007)
Mountain	-0.096*** (0.004)	-0.062*** (0.005)	-.019 (0.008)	-.005 (0.006)	-.055*** (0.006)	.062*** (0.009)	0.031*** (0.005)	-0.018* (0.010)
Pacific	-0.097*** (0.005)	-0.069*** (0.005)	-.105*** (0.006)	-.069*** (0.005)	-.015** (0.006)	-.006 (0.008)	0.004 (0.005)	0.002 (0.008)
City	0.033*** (0.009)	-0.069*** (0.017)	-.061*** (0.017)	-.041*** (0.013)	-0.011 (0.012)	0.015 (0.016)	-0.028** (0.011)	0.022** (0.010)
Town	0.072*** (0.008)	0.036*** (0.010)	0.078*** (0.012)	.077*** (0.011)	.076*** (0.009)	0.037*** (0.011)	0.007 (0.009)	0.054*** (0.010)
Rural	0.121*** (0.009)	0.108*** (0.011)	0.130*** (0.014)	.093*** (0.013)	.105*** (0.010)	0.237*** (0.014)	0.071*** (0.010)	0.085*** (0.012)
Number of Food products	117	93	37	40	54	17	136	54
Obs.	14,458	13,441	5,163	5,263	5,325	2,463	15,717	5,469
R-square	0.695	0.112	0.213	0.247	0.086	0.159	0.132	0.136

Table 7: Variable Expectation and Assessment of Results.

Variable	Expected Sign	Justification	Outcome
Volume purchased (Q)			
Log ounces	.(-)	Quantity Discounts with increased purchase volume	(-)
Market (M)			
On-site kitchen	(-)	Greater cooking flexibility enables more selective purchasing	(-)
Log number vendors	(-)	More competitive pricing.	(-)
Purchasing Practices (P)			
Price Vend. Select	(-)	Priority given to pricing	(-)
Buyer groups	(-)	Permits SFAs to combine resources to obtain greater bargaining power relative to suppliers.	(+)
Decentralized Purchase	(+ or -)	This is a decision as to what to buy. Better food choices possible, but effect on price is uncertain since purchasing still centralized	(+ and -)
Lump sum purchase	(+)	Less opportunity to negotiate lower prices	(+ and -)
Fixed price contracts	(+)	The risk of a cost increase imposed on seller, encouraging higher prices.	(+ and -)
Product Characteristics (K)			
Share unbranded	(-)	Branded products are costly	(-)
Canned	(-)	Less costly than fresh product	(-)
Single-serve	(+)	More packaging per ounce of product	(+ and -)
Processed from USDA commodity.	(-)	See above.	(-)
DOD food	(+ or -)	See above.	(+)
USDA food	(+ or -)	See above.	(+)
SFA Characteristics (S)			
Log size	(-)	Larger SFAs make more overall purchases.	(-)
Log share elementary	(+ or -)	Included as control variable.	(+ and -)
Log share reduced	(+ or -)	Included as control variable.	(+)
Log share lunches	(+ or -)	Included as control variable.	(+)
Other programs_25	(+ or -)	Included as control variable.	(-)
A la carte foods	(+ or -)	Included as control variable.	(+ and -)
Food Serv. Mgmt.	(-)	Better food purchase management skills should lower costs.	(+)