Understanding K-12 Food Procurement: Are Distributors Eating the Students' Lunches?

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Abstract

K-12 public schools serve more than seven billion meals annually, making school food procurement one of the largest service-delivery expenditures of local governments. Yet remarkably little is known about how efficiently school districts purchase food from private suppliers. Using a new item-level database covering 72 California school districts across three metropolitan areas from 2022/23 through 2025/26, we document substantial price dispersion for identical products. Transportation costs and purchase volume explain little of this variation. Instead, prices vary systematically with distributor choice and access to competing suppliers, suggesting an important role for vendor market power. We develop two complementary empirical strategies to quantify distributor market power. First, using equilibrium bidding conditions in first-price procurement auctions, we estimate average markups of 19% of the bid across all bids and 27% on winning bids. Second, exploiting contract rollover pricing in multi-year agreements, we show that contract prices exhibit asymmetric cost pass-through ("rockets and feathers"): prices rise rapidly when costs increase but adjust little when costs fall, causing distributor markups to increase over the life of the contract. Together, these findings identify distributor market power and contract renewal practices as important determinants of procurement costs, suggesting that improvements in procurement design could generate meaningful savings for school districts.

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1 Introduction

State and local governments rely heavily on procurement to deliver public services. Public schools purchase food from private suppliers, Medicaid programs contract with private insurers, and public agencies use e-commerce marketplaces for office equipment and basic supplies. As governments face mounting budget pressures, the efficiency of these purchases has become an increasingly important policy question. Yet despite public procurement accounting for more than 10% of GDP, little is known about why otherwise similar government agencies pay substantially different prices for identical products or whether these differences reflect unavoidable costs or opportunities for more efficient purchasing.

We study these questions in the context of school food procurement, a setting with high stakes for public budgets and children's outcomes. In 2024, K-12 public schools served more than seven billion meals to nearly 30 million children, providing one-third to one-half of daily calories for many low-income students and contributing to health and educational outcomes (USDA Food and Nutrition Service, 2024; Spill et al., 2024; Anderson et al., 2018). Districts purchase billions of dollars of food from private manufacturers and distributors through competitive procurement. California districts alone spend nearly $3 billion annually on food, while federal expenditures on school meal programs exceed $23 billion (Fox and Gearan, 2019; Newman et al., 2008). Financial pressures are substantial: 95 percent of school nutrition authorities report persistent supply-chain disruptions, and 85 percent identify rising food costs as a major operational challenge (USDA Food and Nutrition Service, 2025). Food prices rose approximately 24 percent between 2020 and 2023 (U.S. Department of Agriculture, Economic Research Service, 2025), raising the question of whether districts' purchasing-price growth reflects higher input costs, rising markups, or both. Food markets are also an area of considerable policy interest, with interventions ranging from food labeling (Barahona et al., 2023) and sugar taxes (Allcott et al., 2019) to

proposed restrictions on ultra-processed foods in school meals.[1] How these policies affect prices and procurement costs remains an important open question.

Despite the importance of the setting, systematic evidence on procurement prices remains scarce. The U.S. Department of Agriculture (USDA) last collected nationwide procurement-price data in 2009–2010 (USDA Food and Nutrition Service, 2012), and the existing literature consists primarily of individual district case studies or evaluations of specific procurement initiatives (Long et al., 2021; Krasnoff et al., 2023; Watson et al., 2018). Consequently, policymakers know remarkably little about how much districts actually pay for identical products or why procurement costs differ so substantially across otherwise similar school systems.

This paper addresses this gap by assembling a new item-level database of school food procurement contracts, bids, invoices, and quantities collected through public records requests. Our analysis covers 72 California school districts across three metropolitan statistical areas (MSAs), spanning the school years 2022/23 through 2025/26 (Los Angeles, San Francisco, and San Diego). Matching products by manufacturer item number allows us to compare prices for identical products, holding quality, package size, and formulation fixed. We start by documenting two patterns. First, prices vary considerable between districts located in the same MSA, our preferred market definition. Among products purchased by at least four school food authorities (SFAs) in the same MSA, the gap between the lowest and highest prices averages 19 percent. Second, contracted prices rise almost twice as fast than the local consumer price index (CPI) on average at contract renewal.

We examine several explanations for these patterns, including transportation costs, and potential economies of scale. Supplier concentration offers another possibility:

[1]See e.g. California's proposed ban https://www.gov.ca.gov/2025/10/08/governor-newsom-signs-first-in-the-nation-law-to-ban-ultra-processed-foods-from-school-lunches/, last accessed Nov 5th, 2026.

recent consolidation in food distribution has substantially reduced supplier choice (MacDonald et al., 2023; U.S. Federal Trade Commission, 2015; US Foods Holding Corp., 2018; Performance Food Group Company, 2019; Highview Capital, LLC, 2019). Competition concerns in school food procurement are longstanding with collusive bidding in school milk procurement being a canonical example in industrial organization (Porter and Zona, 1999).

We first examine these explanations descriptively. Districts often form purchasing cooperatives to reduce administrative costs, strengthen bargaining power, and exploit economies of scale. Yet, purchase volume explains little of the observed price variation in our data. Larger buyers do not systematically pay less, and doubling quantity lowers prices by less than 1 percent.

Likewise, transportation costs cannot explain all of the price variation either. Our analysis flexibly controls for the number of delivery locations and a case study illustrates that distant districts can pay lower prices. We show that in the context of Yang's Mandarin Orange Chicken, a popular product that is manufactured and distributed in the Los Angeles area. Notably, we find that Los Angeles districts pay 15 percent more than San Diego districts for the product delivered by the same distributor despite being located 70 miles closer to the manufacturer and distributor. To help explain the difference, we note that the main competitor has a distribution center in San Diego, strengthening local competition and putting downward pressure on prices. This suggests that lack of competition may play an important role in explaining the higher prices in Los Angeles. Consistent with that, we document a high degree of market concentration. We find that the main distributor accounts for 86 percent of purchases in our data and that products cost 4 to 5 percent less when sourced from smaller distributors and 8 percent less when directly sourced from manufacturers, on average.

Building on this evidence, we develop two complementary empirical strategies to quantify supplier market power directly. First, we use bids from formal procure-

ment auctions to recover markups at the time contracts are awarded. We study one district's item-by-item first-price auctions in which the dominant distributor and its main competitor bid against each other. Building on insights from the auction literature (Guerre et al., 2000; Athey and Haile, 2007; Asker, 2010; Krasnokutskaya, 2011; Bajari et al., 2014), we infer marginal costs, and markups, from the bidders' first-order conditions. We estimate an average markup of about 19 percent of the bid across all bids and 27 percent on winning bids, which determine the prices districts actually pay. Markups are higher for the dominant distributor than for its competitor (23 versus 15 percent across all bids). We think that these distributor markups are relatively high, considering that they are applied to the full procurement cost, including the manufacturer's price, not just to distribution services. We note that many items in this procurement drew only a single bid, as observed in other settings (Kang and Miller, 2022), suggesting that our estimated markups are likely conservative relative to all procured items.

Second, we study how markups evolve over the life of multi-year contracts. The contractual renewal arrangements with the dominant distributor states that prices may change in line with the local consumer price index (CPI) or with documented manufacturer cost changes. A concern is that if the distributor has private information about its costs, it can disclose and pass cost increases through to districts, while hiding information on cost reductions, and hence keeping the cost savings, to himself. Across six renewal contracts covering nine school districts, we find that item-level annual price changes bunch at the benchmarked annual CPI change. While several items see price increases exceeding the CPI change, very few items have price changes below it. This suggests that the change in the CPI acts as a price floor. This pattern disappears when the same contract is rebid. In that case, about 80 percent of items have price changes below the CPI, and the median item becomes 5.7 percent cheaper.

To explore the relationship between costs and price changes more directly, we combine USDA commodity values with the fixed commodity content of each product's recipe, yielding a shift-share proxy for item-specific input costs. We then study the relationship between changes in the cost proxy and prices above and the below the CPI change. We find that the relationship is asymmetric. Cost increases above the CPI are passed through about one-to-one, whereas items whose costs grow more slowly show no corresponding price reduction, and their prices rise by about 5 percent regardless. We refer to this pattern as "rockets and feathers". When costs increase, prices increase like rockets. When costs decrease, prices fall like feathers.

Combining the two designs, we argue that distributor prices and markups are backloaded as they grow (faster than CPI-measured inflation) with each renewal. Lastly, we compare the pricing pattern between vendors and provide suggestive evidence that the main competitor engages less aggressively in backloaded prices. This may give the dominant distributor an advantage in the contract award stage for multi-year contracts, as districts only consider the spot price and not potential future price changes at renewals.

Our paper is connected to the following main literatures. First, we shed new light on the degree and the determinants of price variation in school food procurement. Previous work has assessed price variation between U.S. regions based on data from 2009-2010 (USDA Food and Nutrition Service, 2012). Aside from providing more recent data, covering up to school year 2025/2026, are approach differs by focusing on select markets (MSAs). While this comes at the cost of generalizability beyond those markets, it allows us to conduct a detailed analysis on the determinants and in particular the role of market structure in food procurement. Like earlier work on school milk cartels (Porter and Zona, 1999; Pesendorfer, 2000), we find that sourcing school foods through formal procurement protocols are not a guarantee to secure competitive prices. We find that markups can be quite substantial and that they grow over

the duration of the contract. Outside of the U.S., previous work has studied the benefits of combinatorial auctions in procurement design (Kim et al., 2014; Agarwal et al., 2023). Our present work shows results for item-by-item procurement auctions but we also see combinatorial auctions in the data, allowing us to analyze differences in this design dimension in future work.

Second, we contribute to the literature on competition and public procurement costs that has focused on other sectors, mostly infrastructure. Previous work has highlighted that increased production costs (Kessler and Katz, 2001; Goolsbee and Syverson, 2025), state capacity in procurement (Liscow et al., 2023), waste (Bandiera et al., 2009), corruption (Decarolis et al., 2025), de-central procurement (Aryal et al., 2024), and limited bidder participation (Currier, 2026; Allende et al., 2024) can add to increased procurement costs. We leverage variation in purchase volume, transportation distance, and market structure to distinguish between production costs and market power as contributing factors to price variation between districts and over time. Our intertemporal analysis relates to work on incomplete contracts that has often focused on more complex, custom made goods (Bajari et al., 2014; Carril et al., 2026). We argue that information asymmetries at contract renewal can raise procurement costs over the life of a contract, even for standardized products, by enabling asymmetric cost pass-through consistent with "rockets and feathers" pricing (Borenstein et al., 1997; Remer, 2015; Peltzman, 2000).

2 Institutional Setting and Data

School Meals in California. Since the school year 2022/2023, California's statewide universal school meal program California offers free breakfasts and lunch to all public school students in transitional kindergarten (TK) through grade 12 (TK-12). Approximately, 3.5 billion meals have been offered under the program by the end of the school

year 2025/2026. School districts finance these meals through federal, USDA, and California state funds, which together amount to approximately $6 per lunch, with additional support for breakfasts. These reimbursement rates are regulated and do not depend on districts' actual costs. Put differently, schools cannot pass changes in costs to consumers of meals. Funds accrue to a district's cafeteria fund, and any shortfall must be covered from the district's general fund. Higher food procurement costs therefore either reduce the resources available for meal quality or draw on funds that would otherwise support instruction. The stakes are high, considering that spending on school food procurement alone adds to more than $3 billion per year in California alone.

School districts use different food-service operating models, including self-operation, purchasing prepared meals from vendors, and contracting with food-service management companies (FSMCs). The arrangement are not mutually exclusive. Approximately 26% of school distritcs contract with an FSMC to support the procurement process, the preparation of meals, or some other service (Williams et al., 2021). About 12% of California public schools contract with outside meal providers who deliver prepared meals to the school (Anderson et al., 2018). We focus our analysis on self-operated districts and exclude districts that outsource food-service management to FSMCs or purchase prepared meals from outside vendors, comprising the majority of school districts in CA.

How Districts Purchase Food. Districts purchase food as school food authorities (SFAs), either independently or through purchasing cooperatives. Purchasing cooperatives solicit competitive bids on behalf of multiple school districts, ranging in our data from a handful to as many as 30 districts. Throughout the paper, we treat each cooperative as a single purchasing entity. SFAs typically procure several product

categories under separate contracts, including dry and frozen foods, produce, dairy, pizza, and bread.

Procurement is governed by federal "full and open competition" rules, with requirements varying by contract size. Under the federal thresholds effective October 2025, micro-purchases of up to $15,000 do not require competitive quotations, provided the program operator "considers the price to be reasonable based on research, experience, purchase history or other information and maintains documents to support its conclusion". Simplified acquisitions exceeding $15,000 but not exceeding $350,000 require quotations from at least two qualified suppliers. Contracts exceeding $350,000 require formal procurement, either through an invitation for bids (IFB), in which sealed bids are submitted and the lowest responsive and responsible bidder wins, or through a request for proposals (RFP), in which proposals are evaluated based on price and non-price criteria, corresponding to a scoring auction.[2] The contracts studied in this analysis exceed the $350,000 threshold and were thus awarded through either an IFB or an RFP, both of which we observe in the data. Contracts are initially awarded for one school year and can be, and typically are, renewed up to four times. The resulting contracting agreement with the supplier can thus last for five school years. While the general contract terms remain unchanged, prices are general adjusted at renewal to reflect changes in costs and general inflation. We discuss renewal pricing in greater detail below.

Based on discussions with school food procurement managers, we understand the typical timeline to be as follows. Toward the end of the calendar year, school districts finalize their breakfast and lunch menus for the upcoming school year. Districts then use planning tools to translate these menus into a shopping list of food items that need to be procured. These food items are grouped into different food categories,

[2]These are federal thresholds effective October 1, 2025 (2 CFR §200.320; California Department of Education, Procurement in School Nutrition Programs).

e.g. frozen foods, dairy, bread, pizza, and produce. These lists typically include hundreds of different food items in the food categories that we study. In the spring, the district solicits bids for all products within the food category, typically specifying estimated purchase quantity for the upcoming school year. These invitations for bids are publicly advertised, and suppliers can bid on some or all of the solicited products. Trading off cost savings against the inconvenience of handling multiple suppliers, districts sometimes determine the bidder food item by item, whereas in other cases, the district awards the entire food category to a single primary vendor.

The resulting contracts govern purchases during the upcoming school year. For the contracts studied in this paper, prices remain fixed throughout the school year. Under other contracts, particularly those for dairy contracts and sometimes produce, prices may be adjusted as frequently as weekly to accommodate short-term fluctuations in commodity prices. Because products and quantities are determined before bids are solicited, demand may be relatively inelastic with respect to prices (Porter and Zona, 1999). That also means that firms controlling the supply of school foods could profit significantly from higher prices.

Market Structure. Figure 1 summarizes the structure of the market. The top layer describes the buyers. As discussed above, a buyer is an SFA, which could be an individual district or a group of districts organized through a purchasing cooperatives. On the other end, upstream, are manufacturers, which produce branded food products. For the food items considered in this analysis, districts purchase predominantly through regional distributors, the middle layer. Distributors deliver foods to individual school sites or central district's warehouses and kitchen depending on the district's infrastructure. The distribution layer is highly concentrated. As we discuss in more detail below, the dominant distributor holds about 86% of market share. We observe one medium size distributor, which we refer to as the main competitor, as

well as a few small local distributors, which we observe in some markets but not others, defined below. Some districts bypass the distribution layer and purchase directly from manufacturers, which typically requires sufficient storage capacity and logistics infrastructure. For instance, in these cases, a distributor delivers the food to the central district warehouse and districts operate their own trucks to distribute foods to individual school sites.

Several factors may contribute to the high concentration in the distribution market. First, recent acquisitions by the dominant distributor have increased market concentration. Second, economies of scale and scope may favor larger distributors. These firms may obtain lower wholesale prices from manufacturers, reduce transportation costs by coordinating deliveries across districts, and offer broader product portfolios that accommodate heterogeneous demand across SFAs and provide the convenience for districts to coordinate distribution with only one vendor. Third, procurement practices and regulations may create barriers to entry. In particular, RFP evaluations often consider suppliers' past performance and references, potentially favoring established distributors over new entrants. Related to this, the set of school foods and its delivery are highly regulated, meaning that a supplier active in restaurant and grocery store delivery has to meet extra requirement to enter the school food market. Finally, distribution requires fixed investments in warehousing, transportation fleets, and logistics infrastructure, which may further deter entry.

Our analysis focuses on price differences across districts purchasing identical products. Two broad factors may contribute to this variation. First, differences in purchasing volumes and geographic distance from distribution facilities may generate variation in procurement and delivery costs. Second, differences in supplier markups may arise from variation in market structure and procurement practices. SFAs differ in their procurement mechanisms, with some awarding contracts through IFBs and others through RFPs, providing different incentives to compete on prices. Competitive

conditions also vary across procurement events, particularly in the number and identity of participating bidders. This variation reflects changes in market structure over time, including distributor acquisitions, as well as differences in the timing of contract awards and renewals, but also between SFAs, depending among other things on the network of manufacturer sites and distribution centers. Competition further depends on the products being procured. Some products are supplied by multiple distributors while others have fewer potential suppliers. Finally, the presence of local distributors and districts' ability to purchase directly from manufacturers may affect the competitive environment and, consequently, supplier markups. We investigate the relative importance of cost differences and variation in markups in explaining cross-district price dispersion below.

2.1 Data

We assemble a new item-level database of TK-12 school food procurement contracts, bid tabulations, invoices, and quantities obtained through a series of public-records requests. We started the efforts in the end of 2023 with districts located in the broader Los Angeles-Long Beach- Anaheim Metropolitan Statistical Areas (MSAs), henceforth Los Angeles MSA. We have since updated our records and extended the outreach to two other MSAs, the San Francisco-Oakland-Fremont MSA and the San Diego–Chula Vista–Carlsbad MSA, henceforth San Franciso MSA and San Diego MSA. Our most recent records provide food procurement records for the school 2025/2026 for these three MSAs.

We have seen a relatively high response rate for our outreach. Among the districts contacted in school year 2025/26 for example, 75% shared data, 13% reported having no applicable records, and 12% have not yet responded or requested more time. The provided records consist of heterogeneous, unstructured documents, including scanned bid tabulations, contract awards, and invoice line items, which we digitize

and harmonize into a common database. We normalize products using manufacturer item numbers and organize them hierarchically into item categories, subcategories, and broader food groups for some of our descriptive analyses.

Analysis sample. Our analysis focuses on broadline groceries, including dry goods, pasta, spices, sauces, canned fruits and vegetables, baking staples, and pre-portioned frozen foods like proteins, vegetables, and baked goods. We exclude separate bakery bread, pizza, and dairy farm contracts. These broadline items account for about one-third of total food spending and are purchased through large regional distributors or directly from manufacturers. These products can be matched precisely across buyers using manufacturer item numbers.[3]

The ability to match identical products (with identical pack sizes) across buyers is central to our analysis. A key challenge in measuring price dispersion is distinguishing differences in market power from differences in product characteristics such as package size, formulation, or other product differences. Manufacturer item numbers allow us to compare prices paid for the exact same product across purchasing authorities and over time. Prices also differ base on the number of school site drops. A distributor charges a higher price when dropping foods at eight district sites than when dropping at one site only. To address this, we compare commercial, single-drop prices whenever possible, thereby holding delivery complexity constant. The remaining variation therefore reflects differences in procurement conditions rather than product heterogeneity, providing the foundation for our analysis of market power.

We engages in two types of analysis. First, we conduct cross-sectional comparisons of prices between SFAs and vendors. Second, we engage in intertemporal com-

[3]We currently exclude products procured from local vendors, for which identical-product comparisons are less reliable. These include dairy contracts, whose prices are typically indexed and updated weekly, as well as bread from local bakeries, locally sourced produce, and certain prepared pizza products, for which standardized manufacturer identifiers are often unavailable.

parisons of prices within an SFA. Unless otherwise noted, our cross-sectional analysis uses data from school year 2025/26. When most recent records are available for school year 2024/2025, we work with those and adjust them to 2025/2026 prices based on the local consumer price index (CPI), sourced from the Bureau of Labor Statistics. Our most recent data cover 19 SFAs, representing 72 districts across the three MSAs. We broadly cover 50% of districts in the broader LA MSA, 20% of districts in the broader SF MSA, and 14% of districts in the San Diego MSA.

Our intertemporal analysis focuses on two of the 19 SFAs that shared data vendor data for consecutive years from school years 2022/2023 to 2025/2026. One is located in the Los Angeles MSA and one in the San Diego MSA. These intertemporal exercises compare changes in nominal prices, which we benchmark to changes in the local CPI.

2.2 Price Variation Between Districts and Over Time

We begin by documenting two facts that motivate the remainder of the paper: identical products sell at very different prices across school districts, and contract prices grow faster than food inflation at contract renewal.

Price variation between districts. Table 1 summarizes the degree of price variation between SFAs located in the same MSA, our geographic market definition. We aggregate products to broader food groups displayed in the first column, based on the product's description.

By definition, positive price variation requires at least two observed prices. The columns labeled "$N \geq 2$" thus only consider products that are purchased by at least two distinct SFAs in the respective MSA. Notice that we compare single drop prices for identical food items, defined based on their manufacturing item number. We consider two measures of price variation, the first is the coefficient of variation (CV), and

the second is the difference between the highest and the lowest price relative to the mean price:

$$\frac{\max_{s \in MSA}(p_{is}) - \min_{s \in MSA}(p_{is})}{\frac{1}{S_i}\sum_{s \in MSA}(p_{is})}. \tag{1}$$

Here, p_{is} denotes the price per case that SFA s, located in the respective MSA, pays for product i. S_i denotes the number of SFAs purchasing i. Each cell reports a spending-weighted average over products in the corresponding food category.

The overall coefficient of variation is about 8%, varying between 7.3% in Los Angeles to 9.5% in San Francisco, with San Diego in between at 8.4% (see columns $N \geq 2$). We do not find conclusive differences between food categories. While prices for beverages vary by less in Los Angeles and San Francisco, this does not seem to be the case in San Diego. The estimated CV is relatively stable across columns that consider products procured by at least three or even at least 4 different SFAs in the market.

To put the estimated CV in perspective, suppose that the prices SFAs pay for a given product are independent draws from a normal distribution with mean μ and standard deviation σ. With (n) observed prices, the expected gap between the highest and lowest prices, expressed as a share of the mean, is

$$\frac{\mathbb{E}[P_{(n)} - P_{(1)}]}{\mu} = 2 \times \text{CV} \times \mathbb{E}[Z_{(n)}],$$

where $(P_{(n)})$ and $(P_{(1)})$ are the highest and lowest prices, and $(Z_{(n)})$ is the maximum of (n) independent standard normal draws. The empirical analogue of the left hand side is denoted in equation (1).

At a CV of 8% and just two sample prices, the expected range is 9.0% of the mean. With three prices, the expected range increases to 13.5% and with five prices it in-

creases to 18.6%.[4] This is broadly consistent with the gap between prices shown in the last columns in Table 1. Our preferred subsample to describe the cross-sectional price dispersion comprises products with at least 4 price observations per MSA. These denote popular products to which districts likely pay particular attention. Furthermore, the corresponding range estimate is relatively robust between MSAs and broadly consistent with the CV estimate. Figure 2 provides visual evidence on the price dispersion across school districts for this group of products in the Los Angeles MSA. Across 215 products, the price gap between the lowest- and highest-paying districts amounts to 18% of the mean price on average (median 19%), and for one in four products the gap exceeds 22%. Dispersion is present in every food group, ranging from an average of 14% for mixed and prepared foods to 23% for flavor enhancers; for proteins, the group with the largest share of spending, it is 21%.

Our first main observation is that price for identical food items vary substantially between districts. The price differences have important implications for spending. Lowering prices by 10% state-wide would lower spending on school food procurement by about $300 million per year. For an average district in California, this would amount to $300 thousand per year, enough to hire 2-3 additional teachers.

Price growth over time. Next we turn to intertemporal price variation within an SFA over the course of the contract. To this end, we zoom into one large SFA in the Los Angeles MSA that allows us to track prices over two contact renewal cycles. Specifically, we construct a price index, weighting prices in year t by the quantities in the first observed year. Figure 3 tracks the price index between school year 2023/2024 and 2025/2026. As evidenced by the blue circles school food procurement prices in-

[4]The expected maximum of n independent standard normal draws is $\mathbb{E}[Z_{(n)}] = n \int_{-\infty}^{\infty} z\phi(z)\Phi(z)^{n-1}\,dz$, where ϕ and Φ denote the standard normal density and cumulative distribution function. The expected maxima are approximately 0.564, 0.846, and 1.163 for $n = 2$, 3, and 5, respectively.

creased by 11.0% over those two years on average. We contrast the price changes to changes in the CPI for food items in Los Angeles reported by the Bureau of Labor Statistics. Food prices have also increased over the time period but only by 6%. This brings us to our second main observation: food procurement prices grow at a faster pace than general food inflation at contract renewal.

3 Sources of Price Variation

What explains the large price differences for identical products? We consider three candidate explanations in turn: purchase volume, transportation costs, and vendor market power.

3.1 Purchase Volume

Larger buyers may secure lower prices, either through bargaining power or because distributors realize economies of scale in serving them. Figure 4 plots the average residual log price paid by each school food authority, net of MSA and product fixed effects, with SFAs ordered by enrollment. Larger SFAs do not systematically pay lower prices. In the Los Angeles MSA, the largest purchasing cooperative in our sample, which covers 31 districts and more than 260,000 students, pays 2.1% above the average, whereas the two smallest districts, with fewer than 17,000 students each, pay 11.5% and 14.6% below the average. In the San Francisco MSA, the highest-paying SFA is the second largest.

Complementing the average price comparisons between SFAs, we also explore the relationship the prices and quantities at the product level. Figure A1 relates log prices to log annual purchase volumes at the item-by-SFA level after controlling for MSA and product fixed effects. We do see a negative and statistically significant relationship of -0.011, (s.e. 0.001), suggesting that doubling the order volume is associated

with a 1.1% reduction in the price per case. Directionally, this pattern is consistent with scale economies but the point estimate is too small to account for the sizable price differences observed between MSAs.

We conclude that larger purchase volumes may lower prices, but substantial price differences across MSAs remain after accounting for volume.

3.2 Distance and Transportation Costs

A common explanation for procurement price differences, and one that frequently arises in conversations with school food procurement managers, is transportation cost. Longer shipping distances and a greater number of delivery stops increase distribution costs, but they are unlikely to fully explain the magnitude of the price differences documented above. First, whenever possible, we compare single-drop prices, thereby holding delivery complexity constant. Second, we observe substantial price differences that go against what transportation costs would predict. We illustrate this point using Yang's Mandarin Orange Chicken, a popular product purchased by 10 out of the 19 SFAs in our sample.

The product is manufactured in South El Monte, within the Los Angeles MSA. The main distributor operates distribution centers in Los Angeles but has none in San Diego. If transportation costs were the primary determinant of prices, we would expect this distributor to charge less in Los Angeles, where it serves districts over shorter distances.

Panel A of Table 2 shows the reverse. Los Angeles districts, located an average of 34 miles from the distributor's distribution center, pay $187.81 per case. San Diego districts, located an average of 102 miles away, pay $160.32 per case, or 14.6% less, for the same product from the same distributor. One explanation is that the main competitor operates a distribution center in San Diego, giving it a local cost advantage and putting downward pressure on the main distributor's prices. Consistent with this

explanation, the competitor submitted a low bid in response to the focal San Diego SFA's invitation for bids (IFB), putting pressure on the main distributor to offer a lower price. The comparison suggests that proximity to a competing supplier can matter more for prices than proximity to the distributor that serves the district.

Panel B shows that prices vary substantially even within the Los Angeles MSA among districts buying the identical product from the same distributor. Four of the five districts pay between $187 and $196 per case, while District E pays $159.82, 14.9% below the Los Angeles average. District E solicited bids from five vendors, and the next-lowest bid was $162.47, suggesting that competition among bidders, rather than transportation costs, disciplines the price in this case study.

We conclude that while transportation costs likely contribute to price differences between SFAs, substantial price differences across MSAs remain after accounting for distance and the number of drops.

3.3 Cutting out the Middleman

A further source of variation is the distribution channel itself. We examine how prices change when districts source directly from the manufacturer using Tyson's (Jimmy Dean) chicken sausage patties, purchased by nine SFAs in our data.

As illustrated in Figure 5, prices range from $117.50 to $157.18 per case, a 33.8% spread. The two SFAs purchasing directly from the manufacturer pay the lowest price, and pay exactly the same price, despite being located in San Diego and San Francisco, hundreds of miles apart. Every SFA purchasing through the distributor pays more for the identical product, between $124.31 and $157.18 per case, and the distributor's prices vary widely even within the same MSA. While direct purchasing requires storage capacity and logistics infrastructure, the comparison highlights potentially large savings from bypassing intermediaries when these capabilities exist.

More generally, districts may secure lower prices when more vendors (including manufacturers) compete for their business. This is particularly relevant given the high market concentration in the distribution market. The right panel of Figure 6 shows that the main distributor, vendor A, accounts for 86% of purchases in our data. Vendor B accounts for 11%. Districts source just 0.5% of purchases directly from manufacturers. The left panel shows average residual log prices, net off MSA fixed effects. Relative to the dominant distributor, prices for identical products are 3.6% and 5.1% lower at the two smaller distributors and 8.2% lower for direct purchases from manufacturers.

3.4 Summary

Food prices for identical products vary substantially across school food authorities. Popular products, procured by at least four SFAs in an MSA, vary by 18% on average and several products vary by more than 25-30%. These differences are not explained by SFA size, as larger SFAs do not systematically pay lower prices, nor by transportation costs, as distant districts can pay lower prices. Instead, prices also depend on the procurement environment. The market is highly concentrated but districts who can source directly from manufacturers or have access to more vendors are able to secure lower prices. This suggests that vendor market power may contribute to higher average prices and explain some of the price variation between SFAs.

Although these patterns are consistent with variation in vendor market power, they do not constitute direct evidence. The remainder of the paper therefore develops two complementary empirical strategies to directly quantify distributor markups. The first exploits evidence from formal procurement auctions to recover markups at the time contracts are awarded. The second uses within-contract renewal data to measure the evolution of markups over the course of the contract.

4 Markups in Procurement Auctions

To quantify the economic magnitude of markups, we turn to data from formal procurement auctions. As discussed earlier, under California law, school districts must procure food through formal competitive bidding processes (RFPs or IFBs) for contracts exceeding $350,000. Some districts use RFPs (scoring auctions) that evaluate both price and non-price attributes, while others award contracts solely to the lowest bidder through first-price procurement auctions (IFB). We focus on the latter and apply techniques from the empirical auction literature to recover unobserved marginal costs and markups from observed bids.

4.1 Model

We start by considering a first-price procurement auction with $N \geq 2$ symmetric bidders and independent private costs. We allow for asymmetric bidders in the empirical application. A vendor with cost c that bids b wins only if it underbids all rivals $N-1$. With rival bids drawn from G, its expected profit is $\Pi = (b-c)\,(1-G(b))^{N-1}$. As shown by Guerre et al. (2000), the equilibrium first-order condition can be written as

$$\frac{b-c}{b} = \frac{1-G(b)}{(N-1)\,b\,g(b)} = \frac{1}{\eta(b)}, \tag{2}$$

where $\eta(b)$ denotes the elasticity of the probability of winning with respect to the bid. The proportional markup equals the inverse elasticity of winning. If the bid distribution G and density g can be recovered from observed bids, equilibrium markups and, in turn, marginal costs can be inferred. Markups are large where winning probabilities are inelastic, for example because there are few competitors or bidders' costs are highly dispersed. Markups therefore depend on the number of bidders N and on the endogenous dispersion of bids.

4.2 Application and Auction Heterogeneity

We apply the approach to bids from a single school district's procurement of frozen and dry foods, in which the main distributor and the main competitor (denoted again by A and B) submitted independent per-item bids and the contract for each item was awarded to the lowest bidder. We focus on the 58 contested items for which both vendors submitted bids, treating each item as an independent two-bidder first-price auction. We exclude the remaining 160 items, which received only one bid. Because markups are likely higher in uncontested auctions, our estimates provide, if anything, a lower bound on markups in this procurement.

The key empirical challenge is that the items are heterogeneous goods. For example, flour is procured for roughly \$0.40 per pound, whereas bacon sells for more than \$8.6 per pound. Equation (2) holds conditional on common, auction-specific cost shifters, so this heterogeneity must be accounted for before recovering markups. Figure 7 illustrates its importance. Even after normalizing bids by pounds, log bids exhibit a standard deviation of 0.82 across products. Controlling for food subgroups fixed effects reduces the standard deviation to 0.42, but substantial variation remains. By contrast, the difference between the two log bids for the same item has a standard deviation of only 0.12. Auction heterogeneity that is not accounted for inflates the dispersion of bids, which the model then attributes to private cost differences, resulting in overstated markup estimates.

4.3 Identification

Following Krasnokutskaya (2011), we model auction heterogeneity as a multiplicative cost shifter (A1). The cost of bidder i in auction a is

$$c_{ia} = e^{z_a} \times e^{w_{ia}}, \tag{3}$$

where z_a is a latent cost component common to all bidders in auction a and w_{ia} is bidder i's private cost shock. Because equilibrium bidding is homogeneous of degree one in common costs, the common component passes through proportionally into bids,

$$b_{ia} = e^{z_a}\,\beta_i(w_{ia}, N) \qquad \Longrightarrow \qquad \log b_{ia} = z_a + \log \beta_i(w_{ia}, N).^{5} \tag{4}$$

We further assume that (A2) the common and private components are mutually independent, $Z \perp W_i$; (A3) the density f_{W_i} is continuously differentiable and strictly positive on its support; (A4) $E[W_1] = 0$, a location normalization; and (A5) N is common knowledge and there is no binding reservation price. Under these assumptions, the distributions of the common and the private cost components, f_Z and f_{W_i}, are identified (Krasnokutskaya, 2011).

4.4 Estimation

In our application, we observe some determinants of the common component, such as the item's food group, so that

$$\log b_{ia} = \gamma x_a + z_a + \log \beta_i(w_{ia}, N), \tag{5}$$

where x_a is observed and z_a unobserved. While f_z and f_W can in principle be estimate non-parametrically, the limited number of observations require us to impose further parametric restrictions. We proceed by estimating markups in two steps.

Step 1: Bid homogenization. We purge log bids per pound of the common auction component. Following Bajari et al. (2014), we consider three approaches: (i) subtracting food-group means only, which ignores unobserved heterogeneity z_a; (ii) adding item-level random effects, which shrink each item's residual toward the food-group

[5] See Krasnokutskaya (2011) and Lemma 3 in Asker (2010).

mean; and (iii) adding item fixed effects, which remove z_a entirely but are subject to an incidental-parameters problem with only two bids per item. With two bidders, item fixed effects mechanically halve the variance of the residualized bids, which understates their dispersion and hence markups, whereas food-group means alone overstate it. We thus prefer the the random-effects approach and report two choices of the shrinkage parameter: the best linear unbiased predictor (BLUP) and the value at which the variance of the residualized bids matches the estimated variance of private cost shocks. Appendix A.2 provides details.

Step 2: Markups. We then estimate the equilibrium bid distribution from the residualized log bids $\hat{w}_{ia}$ and infer markups from the first-order condition. For each bid of vendor i, the markup is the inverse hazard of the rival vendor j's residualized bid distribution, evaluated at i's own residualized bid,

$$\hat{m}_{ia} = \frac{1 - \hat{F}_j(\hat{w}_{ia})}{\hat{f}_j(\hat{w}_{ia})}, \tag{6}$$

where $\hat{F}_j$ is the empirical distribution function and $\hat{f}_j$ a Gaussian kernel density estimate of vendor j's residualized bids. Because bids are expressed in logs, this ratio directly yields the proportional markup $(b - c)/b$ in equation (2). Appendix A.3 provides details. Note that we estimate separate markup distributions by vendor.

We allow for bidder asymmetry by estimating vendor-specific bid distributions and using them to infer separate markup distributions for the two vendors. This flexibility is important for matching the observed win shares, as the dominant distributor, vendor A, wins more than 70% of contested auctions.

4.5 Results

Table 3 reports estimated average markups of bids over marginal costs by vendor. The first three columns average over all bids; the last three average over winning bids only, which determine the prices districts actually pay. The rows correspond to the bid-homogenization approaches. As expected, controlling for food-group means only yields implausibly large markups of 43% across all bids, because remaining item heterogeneity is attributed to private cost differences. We therefore exclude this specification from the summary mean in the last row.

Across specifications, the estimated average markup is about 19% across all bids and 27% on winning bids. Markups are larger for the dominant vendor A, at 23% across all bids compared with 15% for vendor B. Conditional on winning, the gap between vendors narrows, to 28% for vendor A and 23% for vendor B.

Discussion. These estimates should be interpreted with caution, as they are based on procurement data from a single school district and may not generalize to other districts. Specifically, the data come from SFA E in the San Diego MSA, whose averages prices are perhaps slightly higher than average prices in the San Diego MSA overall, see Figure 4c. We chose this SFA because contracts were awarded through item-by-item first-price procurement auctions and the underlying bid data were available in a sufficiently detailed and tractable format to recover markups.

The estimates suggest economically meaningful market power. Markups of about 27% on transacted bids are substantial because they apply to the entire procurement cost, including the manufacturer's price, not just distribution services. The estimates also highlight the potential importance of competition. Equation (2) implies that markups decline with the number of bidders, N. In the auctions we study, only two vendors competed, and many items received only one bid. Differences in the number of effective bidders may therefore account for economically important differences in

procurement prices across districts, consistent with the case study evidence in Section 3.

5 Rockets and Feathers: Intertemporal Changes in Markups

The previous analysis documents substantial markups at contract award that add to high average prices and contribute to cross-sectional price differences between SFAs. However, the analysis has less to say about the disproportionate price increases observed at contract renewal, see Figure 3, which we turn to next.

Many school food procurement contracts are multi-year agreements with annual price adjustment provisions. The specific languages used by the main distributor at contract renewal is that prices may adjust with the local CPI or, and importantly, documented manufacturer cost changes. If distributors have private information about their costs, they may be able to document cost *increases* and pass them through to SFAs while retaining the gains from cost *decreases*. Such asymmetric pass-through can generate a "rockets and feathers" pattern and increase the provider's markup over the life of the contract.

To assess whether markups rise over the life of a contract, we compare changes in contracted prices to two proxies for cost growth. For item i in contract year t, the change in the log price-to-cost ratio is

$$\Delta \log \left(\frac{p_{it}}{c_{it}} \right) = \Delta \log p_{it} - \Delta \log c_{it}, \tag{7}$$

where p_{it} is the contracted price and c_{it} is the distributor's marginal cost.

5.1 Price changes relative to CPI

Our first proxy for changes in costs is the local CPI. Specifically, the main distributor reports the local one-year change in CPI, excluding housing and shelter, as a benchmark for input cost inflation. We therefore use annual CPI inflation as a first proxy for the average cost growth, averaged across all items provided by the specific distributor:

$$\Delta \text{CPI}_t \approx \frac{1}{I} \sum_{i=1}^{I} \left(\log c_{it} - \log c_{i,t-1} \right). \tag{8}$$

We observe six renewal contracts across two SFAs, one located in Los Angeles and one in San Diego, and start by benchmarking the item by item price change from one school year to the next to the corresponding CPI change for the respective MSA. Figure 8 presents the distribution of item specific log price changes for one example renewal contract with the main distributor A. The vertical dashed line denote the local change in the CPI of 2.88% that corresponds to the time and MSA. Two features stand out. First, there is substantial bunching at the CPI benchmark. Second, there is very little mass to the left of the benchmark, whereas many items experience price increases above the CPI.

This pattern suggests that the CPI serves as a floor rather than a benchmark for annual price adjustments. Our interpretation is that vendors pass through cost increases that exceed the CPI benchmark, but do not symmetrically pass through cost decreases when realized cost inflation falls below the benchmark. Consequently, contract prices ratchet upward over time, generating a "rockets and feathers" pattern in contract renewals and increasing markups over the life of the contract.

Robustness. While the presented pattern relates to one specific renewal, we observe qualitatively similar patterns across the other the other 5 renewal events in out sam-

ple. Changes in log prices bunch at the CPI. In all cases, there is very little mass to the left of the benchmark, whereas many items experience price increases above the CPI.

As a falsification exercise, Figure A2 shows the same histogram for price changes at initial contract award rather than at renewal. The same SFA rebid the contract for school year 2023/24, so prices for that year were set by competitive bidding rather than by the CPI adjustment clause. The histogram looks very different from Figure 8. There is no bunching at the CPI benchmark: only about 1% of the 318 items have a price change within a quarter of a percentage point of it, compared with one third of items at renewal. Instead, most of the distribution lies *below* the benchmark. About 80% of items (84% of spending) have price changes below the CPI change, three quarters see outright price declines, and the median item becomes 5.7% cheaper. At renewal, by contrast, only 8% of items have price changes below the CPI, and the median price rises by 4.1%. Intuitively, when a contract is rebid, competition between vendors reveals that costs did not keep up with the CPI for many items and pushes their prices down. This is consistent with our interpretation that the CPI acts as a price floor at renewal, not as an approximation of cost growth.

5.2 Variation in Commodity Prices

To probe the "rockets and feathers" further, we adopt a second design that exploits continuous variation in cost changes. Each year, USDA procures commodities, including raw meats, cheese, and flour, for use by processors participating in the USDA Foods program. For each approved end product, the processor's End Product Data Schedule reports the quantity of each USDA Foods ingredient credited per case. For example, a case of Mandarin Orange Chicken will use about 38 pounds of chicken legs per case. We interpret these schedules as fixed recipes that measure each product's exposure to commodity price changes. Processors source ingredients commercially for sales outside the program. We use annual changes in USDA's published commodity

values (prices), multiplied by the quantities credited per case, as a proxy for changes in manufacturers' input costs.[6]

Our research design combines these fixed recipes with annual changes in USDA commodity values to construct a shift-share instrument for changes in production costs. The intuition is that the same commodity price change affects products differently depending on how much of the commodity each recipe uses. Specifically, we approximate changes ins costs for product i in year t as follows:

$$\begin{aligned} \Delta log(c_{it}) &= \underbrace{\frac{\sum_{comm} p_t^{comm} \times q_i^{comm}}{p_{i,t-1}} - \frac{\sum_{comm} p_{t-1}^{comm} \times q_i^{comm}}{p_{i,t-1}}}_{\text{Relative commodity cost shifter}} + \epsilon_{it} \\ &= \Delta log(c_{it}^{comm}) + \epsilon_{it}. \end{aligned} \tag{9}$$

Here p_t^{comm} denotes the commodity value per pound in year t for commodity t and q_i^{comm} denotes the number of pounds used per case of the final product i. $p_{i,t}$ denotes again the final commercial price per case, used in our previous analysis. To construct relative cost changes, we benchmark commodity spending to the baseline price per case and then take the first difference.

We then study the relationship between the log change in prices, $\Delta log(p_{it})$, and our proxied relative costs change, $\Delta log(c_{it}^{comm})$ above and below the CPI change.

Results. Combining data from six renewal contracts across two SFAs, Figure 9 relates the approximated percent changes in costs to realized contract price changes at

[6]We note that USDA's published commodity values also determine the pass-through credit on eligible purchases using the End Product Data Schedule. Throughout the analysis, we use the commercial price per case defined as the sum of the net-off-invoice price and this pass-through credit. Manufacturers and distributors can adjust the net-off-invoice price in response to changes in the credit, so the commercial price need not move one-for-one with the credit.

renewal. The horizontal axis reports the relative change in the USDA commodity contribution as defined in equation (9) minus CPI inflation ($\Delta log(c_{it}^{comm}) - \Delta CPI$). A value of zero corresponds to a cost change equal to CPI inflation. The vertical axis reports the realized log change in prices.

The estimated relationship is strongly asymmetric. For items experiencing relative cost increases above the CPI benchmark, contract prices rise approximately one-to-one with costs, as reflected by the upward-sloping relationship to the right of zero. In contrast, costs growing at a lower rate, growing less than the CPI change, exhibit no systematic reductions in contract price growth. Instead, prices continue to increase by about 5% throughout.[7] This asymmetric pass-through is precisely the "rockets and feathers" pattern predicted by the renewal model. When cost increase, prices increase like rockets. When costs decrease, prices fall like feathers. This pattern also implies that markups increase over the life of the contract. When

Table 4 quantifies this asymmetry. Specifically, we regress the change in log prices at contract renewal the proxied cost change interacted with a dummy that turns on when the proxied cost change exceeds the change in the CPI. We control for school-year fixed effects. Column 2 shows results for this specification, weighted by spending. Unweighted results are shown in columns 4-6. For costs changes below the CPI we see no systematic relationship with log price changes. The coefficient is -0.169 (se 0.116) and not statistically significant. In contrast, for items whose cost changes exceed the CPI, the pass-through rate is $-0.169 + 1.239 = 1.07$, so that a 1% increase in costs raises prices by about 1.07%. Column (3) additionally allows the price change to shift discretely at the CPI benchmark.

Within our framework, these estimates imply that vendors are able to preserve their initial markups on products whose costs increase faster than the CPI bench-

[7]This still exceeds the CPI inflation benchmark, likely reflecting other cost shocks not captured by our proxy.

mark, as higher costs are essentially passed through into contract prices in full. In contrast, for products whose costs grow more slowly than the CPI (decline relative to the benchmark) contract prices continue to rise by approximately the CPI adjustment. As a result, markups increase over the life of the contract. We also note that one of the school food authorities in this analysis is a large purchasing cooperative, suggesting that scale alone is insufficient to prevent markup growth.

More broadly, the results suggest that contract renewals constitute an additional source of markup dispersion across school districts. Districts with older contracts may face systematically higher markups than districts that have recently rebid their contracts, contributing to the substantial cross-district variation in procurement prices documented earlier.

6 Combining Designs: Implications for Competition

The previous evidence shows that markups increase at contract renewal. In contrast, and as shown in Figure A.4, prices for many products may fall substantially relative to the previous year when contracts are rebid. This suggests that distributor profits are backloaded, prices are relatively low when a contract is newly bid and rise faster than costs over the subsequent renewals, and that the high markups estimated in Section 4 may in part reflect the option value of profitable renewals. We unpack this point and its potential implications for competition in more detail below.

Backloading by the main vendor. Figure 10 illustrates the backloading in the context of one SFA in the Los Angeles MSA served by the dominant distributor. It compares the year-over-year change in a procurement price index with the change in the Los Angeles food CPI. When the contract was newly bid for school year 2023/24, procurement prices fell by 5.1 percent, while the food CPI rose by 2.6 percent. At two subsequent renewals, procurement prices rose by 5.0 and 4.8 percent, roughly twice as

fast as the food CPI (2.5 and 3.3 percent). This again suggests that markups are lower at the start of the contract than toward its end. As a result, the time elapsed since a district last rebid its contract contributes to the variation in prices and markups between districts documented in Section 2.2.

Rockets and feathers among competitors. The evidence presented on price changes at contract renewal thus far was for pricing by the dominant distributor. We next ask if competing vendors follow the same pricing pattern at renewal. Figure 11 shows the distribution of log price changes at a contract renewal of the main competitor. The histogram again points to substantial bunching. However, this time, the bunching is at 0 and not at the CPI change. Put differently, past prices, rather than the CPI-adjusted prices, act as the price floor. Prices may therefore rise less on average at renewal for the competitor than for the main vendor.

We explore this possibility further in Figure 12, which compares price changes over the contract cycle between the main vendor and its main competitor. For the main vendor, we combine prices from both SFAs, one located in Los Angeles and the other located in San Diego. The main competitor only serves the SFA in San Diego. The patterns are qualitatively similar but differ in magnitudes. For the main vendor, prices fall by 6.2% when a contract is newly bid, compared with a 2.9% increase in the food CPI, and rise by a cumulative 11.9% over the next two renewals, more than twice the 5.3% increase in the food CPI. For the competitor, prices fall by only 1.8% when a contract is newly bid (food CPI: +3.1%) and rise by 9.3% over two renewals (food CPI: +4.8%). The comparison becomes even more striking for the main vendor when the analysis is restricted to the same SFA in San Diego. As shown in Figure A3, prices fall by 8.8% when a contract is newly bid with the main vendor and rise by a cumulative 14.1% over the next two renewals.

We note that distributors serve different products in their contracts, which experience their own idiosyncratic cost changes. Nevertheless, the evidence suggests that the main vendor engages in more aggressive price increases at contract renewal. At the same time, the main vendor reduces its prices more aggressively when contracts are up for bids. This practice may give the main vendor an advantage in the original procurement when SFAs only consider the spot prices and do not take the upcoming price increases at renewal into account. Put differently, the main vendor could secure the contract based on its spot price, even though the discounted average price over the full contract could be higher.

7 Discussion

This paper studies an important but largely unexplored component of public service delivery, the procurement of food for school meal programs. Using a newly assembled database covering 72 California school districts in three metropolitan statistical areas, we document two facts. First, districts pay substantially different prices for identical manufacturer-specified products. For popular products, procured by at least four SFAs in an MSA, the gap between the lowest- and highest-paying SFA averages 19 percent. Second, contracted prices rise faster than the local CPI on average at renewal. Additional descriptive evidence suggests that transportation costs and purchasing scale explain only part of the price dispersion, and instead suggests that supplier market power adds to higher overall prices and explains some of the variation between districts.

We use two complementary empirical approaches to study market power at contract award and renewal. First, we use equilibrium bidding conditions from a first-price procurement auction to recover supplier markups. We estimate an average markup of 19 percent over marginal cost, with markups of 23 percent for the dom-

inant distributor and 15 percent for its main competitor. Second, we use variation in input-cost shocks to study how markups evolve over the life of multi-year contracts. At renewal, vendors pass through estimated cost growth above the CPI benchmark roughly one-to-one, while prices respond little when estimated cost growth falls below it. Prices appear to increase like "rockets" in response to cost increases but fall as "feathers" in response to cost decreases. Together, the results reveal a pattern of backloaded pricing. Prices tend to fall when contracts are rebid, with most changes below the CPI benchmark, and then rise faster than the CPI at renewal. This suggests that variation in prices between districts can partly be explain by the age of the contract. We also find that this pattern is more pronounced for the dominant distributor, resulting to a potential advantage in the contracts award stage.

The results point to several ways districts could reduce procurement costs. Districts could limit markup growth at renewal by requiring documented cost decreases to be reflected in prices alongside cost increases or by rebidding contracts more frequently. Evaluating bids on expected costs over the full contract term, including renewals, could also improve competition by increasing transparency and by leveling the playing field between competitors. The stakes for cost savings are high. A 10 percent reduction in procurement prices would save California districts approximately $300 million annually. These changes could help districts capture some of those savings while maintaining nutrition standards and service quality.

References

Nikhil Agarwal, Pearl Z Li, and Paulo J Somaini. Identification using revealed preferences in linearly separable models. Technical report, National Bureau of Economic Research, 2023.

Hunt Allcott, Benjamin B Lockwood, and Dmitry Taubinsky. Should we tax sugar-sweetened beverages? an overview of theory and evidence. *Journal of Economic Perspectives*, 33(3):202–227, 2019.

Claudia Allende, Juan Pablo Atal, Rodrigo Carril, José Ignacio Cuesta, and Andrés González-Lira. Drivers of public procurement prices: Evidence from pharmaceutical markets. *International Journal of Industrial Organization*, 96:103086, 2024.

M. L. Anderson, J. Gallagher, and E. Ramirez Ritchie. School meal quality and academic performance. *Journal of Public Economics*, 168:81–93, 2018.

Gaurab Aryal, Charles Murray, Pallavi Pal, and Arnab Palit. Bundling demand in k-12 broadband procurement. 2024.

John Asker. A study of the internal organization of a bidding cartel. *American Economic Review*, 100(3):724–762, 2010.

Susan Athey and Philip A Haile. Nonparametric approaches to auctions. *Handbook of econometrics*, 6:3847–3965, 2007.

Patrick Bajari, Stephanie Houghton, and Steven Tadelis. Bidding for incomplete contracts: An empirical analysis of adaptation costs. *American Economic Review*, 104(4): 1288–1319, 2014.

Oriana Bandiera, Andrea Prat, and Tommaso Valletti. Active and passive waste in government spending: evidence from a policy experiment. *American Economic Review*, 99(4):1278–1308, 2009.

Nano Barahona, Cristóbal Otero, and Sebastián Otero. Equilibrium effects of food labeling policies. *Econometrica*, 91(3):839–868, 2023.

Severin Borenstein, A Colin Cameron, and Richard Gilbert. Do gasoline prices respond asymmetrically to crude oil price changes? *The Quarterly journal of economics*, 112(1):305–339, 1997.

Rodrigo Carril, Andres Gonzalez-Lira, and Michael S Walker. Competition under incomplete contracts and the design of procurement policies. *American Economic Review*, 116(2):535–581, 2026.

Lindsey Currier. Competition and the cost of U.S. infrastructure. September 2026. URL https://lcurrier.github.io/papers/Currier_JMP.pdf. Working paper, Harvard University.

Francesco Decarolis, Raymond Fisman, Paolo Pinotti, and Silvia Vannutelli. Rules, discretion, and corruption in procurement: Evidence from italian government contracting. *Journal of Political Economy Microeconomics*, 3(2):213–254, 2025.

M. K. Fox and E. Gearan. School Nutrition and Meal Cost Study: Summary of Findings. Technical report, USDA FNS; Mathematica & Abt Associates, 2019.

Austan Goolsbee and Chad Syverson. 4 the strange and awful path of productivity in the us construction sector. In *Technology, Productivity, and Economic Growth*, pages 119–138. University of Chicago Press, 2025.

E. Guerre, I. Perrigne, and Q. Vuong. Optimal Nonparametric Estimation of First-Price Auctions. *Econometrica*, 68(3):525–574, 2000.

Highview Capital, LLC. Highview Capital Acquires Gold Star Foods; Gold Star to be merged with Good Source Solutions. Business Wire, October 3, 2019.

Karam Kang and Robert A Miller. Winning by default: why is there so little competition in government procurement? *The Review of Economic Studies*, 89(3):1495–1556, 2022.

Daniel P Kessler and Lawrence F Katz. Prevailing wage laws and construction laborc markets. *ILR Review*, 54(2):259–274, 2001.

Sang Won Kim, Marcelo Olivares, and Gabriel Y Weintraub. Measuring the performance of large-scale combinatorial auctions: A structural estimation approach. *Management Science*, 60(5):1180–1201, 2014.

S. M. Krasnoff, T. M. Schmit, and C. B. Bilinski. Economic impact assessment of public incentives to support farm-to-school food purchases. *Food Policy*, 121:102545, 2023.

E. Krasnokutskaya. Identification and Estimation of Auction Models with Unobserved Heterogeneity. *Review of Economic Studies*, 78(1):293–327, 2011.

Zachary Liscow, Will Nober, and Cailin Slattery. Procurement and infrastructure costs. 2023.

A. B. Long, B. B. R. Jablonski, M. Costanigro, and W. M. Frasier. The Impact of State Farm to School Procurement Incentives on School Purchasing Decisions. *Journal of School Health*, 91(5):418–427, 2021.

J. M. MacDonald, X. Dong, and K. O. Fuglie. Concentration and Competition in U.S. Agribusiness. Economic Information Bulletin 256, USDA Economic Research Service, 2023.

C. Newman, K. L. Ralston, and A. L. Clauson. Balancing Nutrition, Participation, and Cost in the National School Lunch Program. *Amber Waves*, 2008.

Sam Peltzman. Prices rise faster than they fall. *Journal of political economy*, 108(3): 466–502, 2000.

Performance Food Group Company. Performance Food Group Company to Acquire Reinhart Foodservice. Press release, July 1, 2019.

Martin Pesendorfer. A study of collusion in first-price auctions. *Review of Economic Studies*, 67(3):381–411, 2000.

R. H. Porter and J. D. Zona. Ohio School Milk Markets: An Analysis of Bidding. *RAND Journal of Economics*, 30(2):263–288, 1999.

Marc Remer. An empirical investigation of the determinants of asymmetric pricing. *International Journal of Industrial Organization*, 42:46–56, 2015.

Maureen K Spill, Rupal Trivedi, Rachel C Thoerig, Arin A Balalian, Marlene B Schwartz, Craig Gundersen, Angela Odoms-Young, Elizabeth F Racine, Margaret J Foster, Julie S Davis, et al. Universal free school meals and school and student outcomes: a systematic review. *JAMA network open*, 7(8):e2424082, 2024.

U.S. Department of Agriculture, Economic Research Service. Food price inflation slowed in 2023 and 2024. Amber Waves, June 2025. URL https://www.ers.usda.gov/amber-waves/2025/june/food-price-inflation-slowed-in-2023-and-2024. Accessed July 8, 2026.

U.S. Federal Trade Commission. FTC challenges proposed merger of Sysco and US Foods. Press release, February 19, 2015.

US Foods Holding Corp. US Foods to Acquire SGA's Food Group of Companies for $1.8 Billion. Press release, July 30, 2018.

USDA Food and Nutrition Service. School Food Purchase Study-III: National Estimates, School Year 2009–10. Technical report, USDA FNS, Washington, DC, 2012.

USDA Food and Nutrition Service. Child Nutrition Tables. Technical report, U.S. Department of Agriculture, Washington, DC, 2024.

USDA Food and Nutrition Service. School Food Authority Survey III on Supply Chain Disruption and Student Participation. Technical report, USDA FNS, Washington, DC, 2025.

J. A. Watson, D. Treadwell, and R. Bucklin. Economic Analysis of Local Food Procurement in Southwest Florida's Farm-to-School Programs. *Journal of Agriculture, Food Systems, and Community Development*, 8(3):61–84, 2018.

K. Williams, M. Kimathi, F. Papa, M. Miller, and N. Beyler. Study of School Food Authority (SFA) Procurement Practices: Final Report. 2021.

Figures and Tables

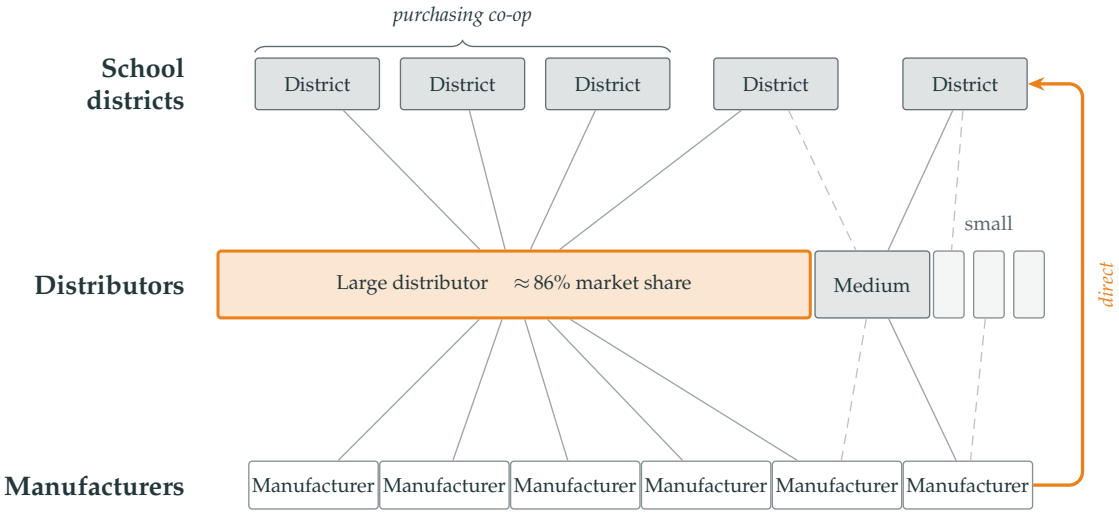


Figure 1: Market Structure in School Food Procurement

Notes: Stylized depiction of the supply chain for dry and frozen school foods. Districts may purchase individually or jointly through purchasing cooperatives. Solid lines denote primary supply relationships and dashed lines secondary ones. The arrow on the right denotes an example district that purchase directly from manufacturers, bypassing distributors.

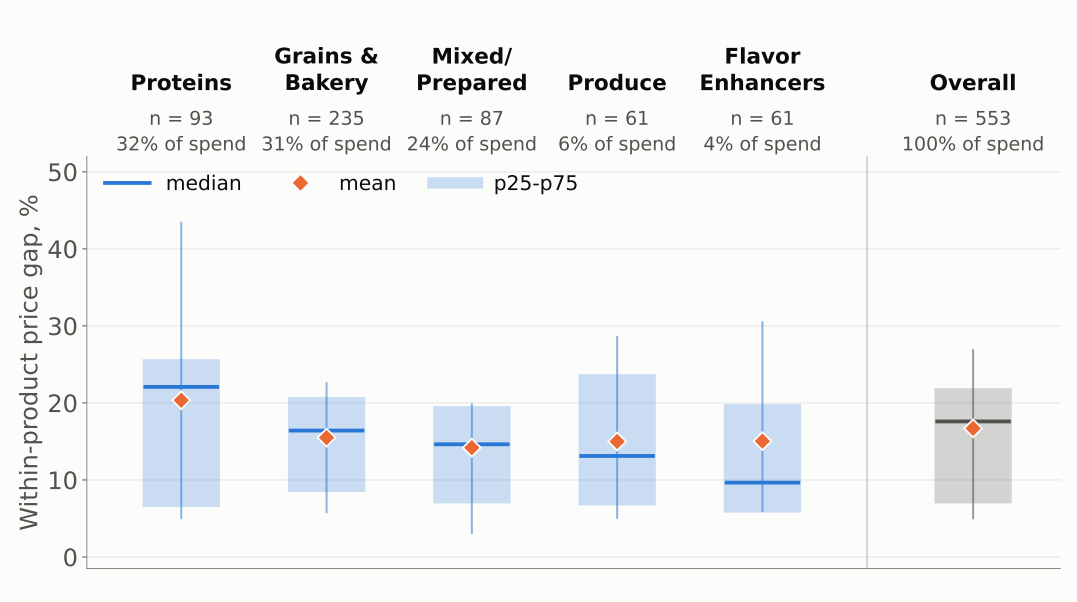


Figure 2: Price Gap Between Highest- and Lowest-Paying Districts, Los Angeles MSA

Notes: This figure summarizes price differences for products with the same manufacturer id between school food authorities in the Los Angeles–Long Beach–Anaheim metropolitan statistical area in school year 2025/2026. We measure difference between the highest and the lowest price paid relative to the mean, see equation (1). We present mean, median, 25th and the 75th percentile of price difference within the food category. All statistics are weighted by spending.

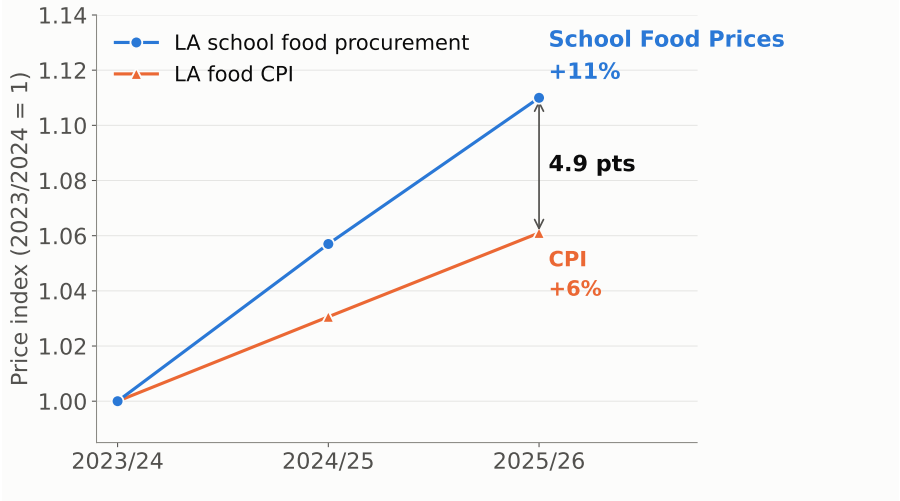
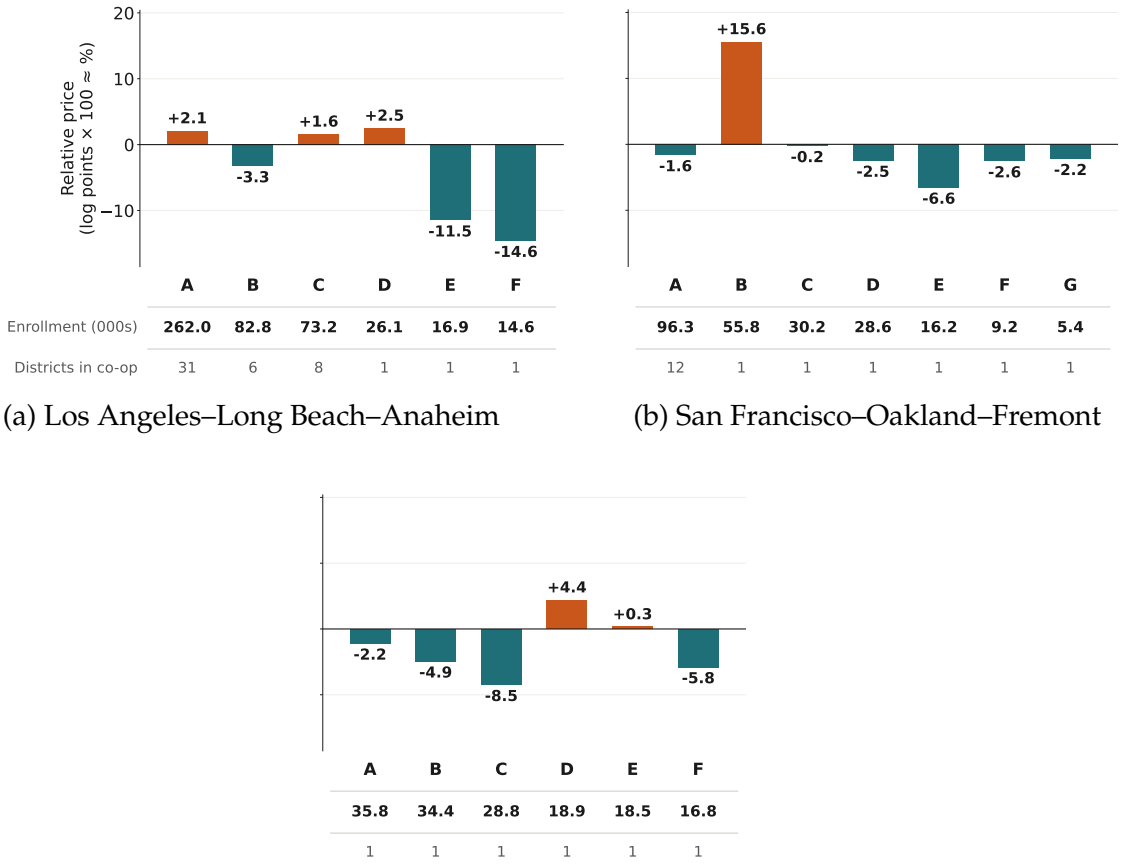


Figure 3: School Food Prices and Food CPI, Los Angeles MSA

Notes: The figure shows a procurement price index for a fixed basket of items purchased in every school year from 2023/24 to 2025/26 by one large school food authority in the Los Angeles–Long Beach–Anaheim MSA (blue circles). We compare this to the BLS food CPI for Los Angeles–Long Beach–Anaheim, measured in December of each school year's first calendar year (orange diamonds). Both series are indexed to 2023/24 = 1.



(a) Los Angeles–Long Beach–Anaheim

(b) San Francisco–Oakland–Fremont

(c) San Diego–Chula Vista–Carlsbad

Figure 4: Relative Price by School Food Authority, Ordered by Enrollment

Notes: The figure shows average residual log prices (multiplied by 100) by school food authority (SFA), net of MSA and product fixed effects, for the Los Angeles–Long Beach–Anaheim (panel a), San Francisco–Oakland–Fremont (panel b), and San Diego–Chula Vista–Carlsbad (panel c) MSAs in school year 2025/2026. All panels share the vertical axis. SFAs are ordered by enrollment (in thousands). The bottom row reports the number of districts in each SFA; SFAs with more than one district are purchasing cooperatives.

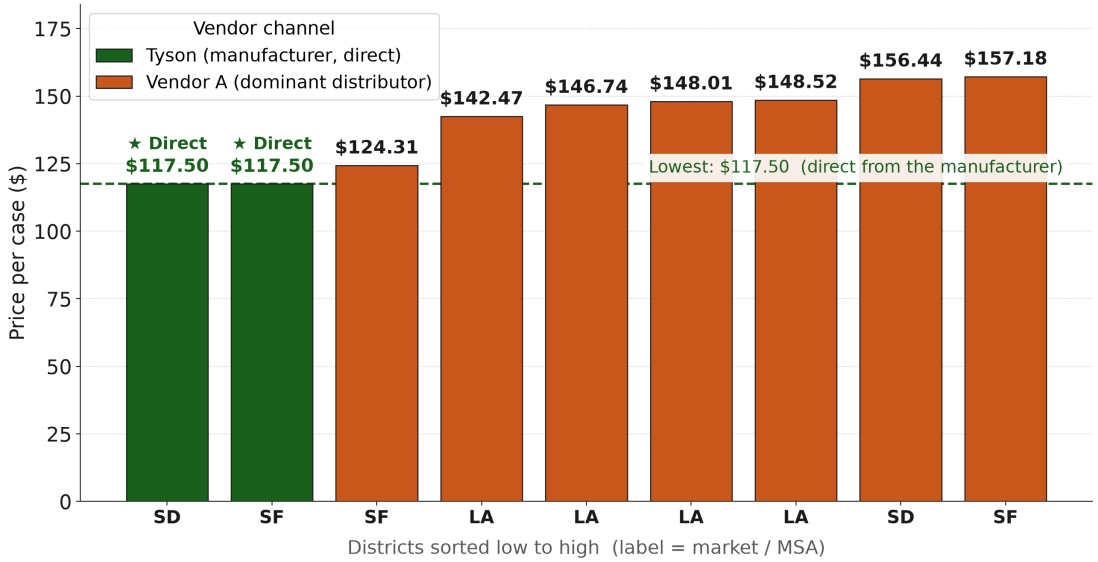


Figure 5: Price Differences by Vendor Channel for Chicken Sausage Patties

Notes: The figure shows prices per case for Tyson's (Jimmy Dean) chicken sausage patties in ascending order. Prices reflect prices per case with identical pack sizes. The data come from 9 school food authorities (SFAs) purchasing the item in school year 2025/2026. The coloring denotes the vendor channel: the two leftmost SFAs procure the item directly from the manufacturer (Tyson); all others purchase through the dominant distributor (Vendor A). The MSA associated with each SFA is shown below the bars.

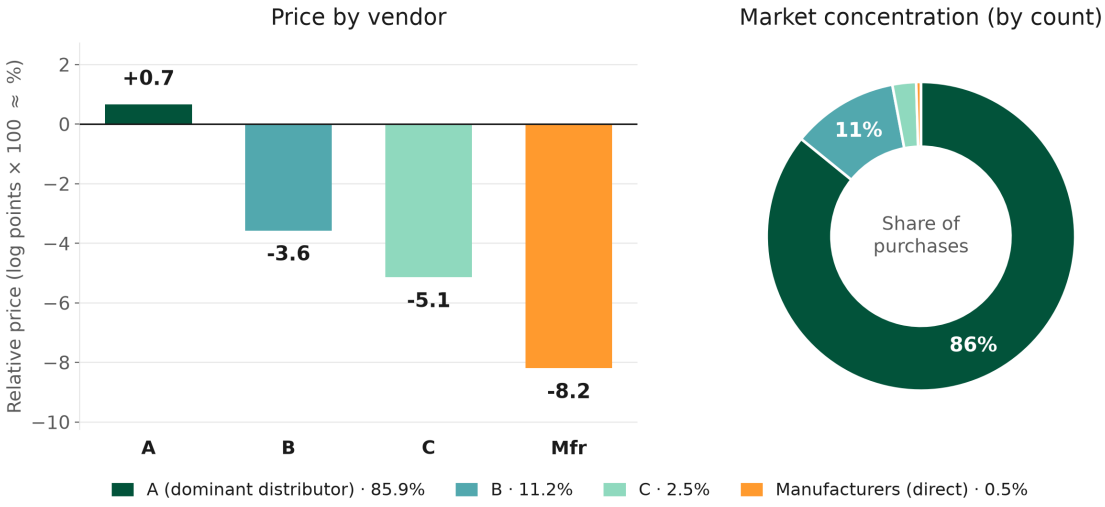


Figure 6: Relative Prices and Market Shares by Vendor

Notes: The left panel shows average residual log prices (multiplied by 100) by vendor for identical products. The right panel shows each vendor's share of purchases (by count). Vendor A denotes the dominant distributor; "Mfr" denotes purchases made directly from manufacturers. Data from school year 2025/2026.

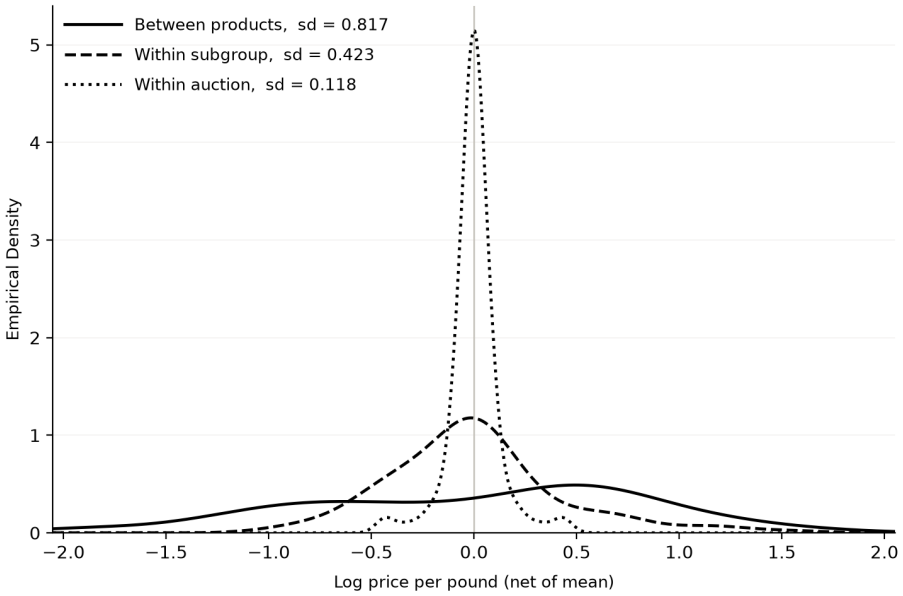


Figure 7: Within- vs. Between-Auction Variation in Bids

Notes: This figure compares the dispersion of submitted bids between products (solid line), between products within the same food subgroup (dashed line), and between bidders within the same auction (dotted line). The data comprise 58 contested item-specific auctions from one school food authority. The horizontal axis denotes log prices per pound, net of the respective mean.

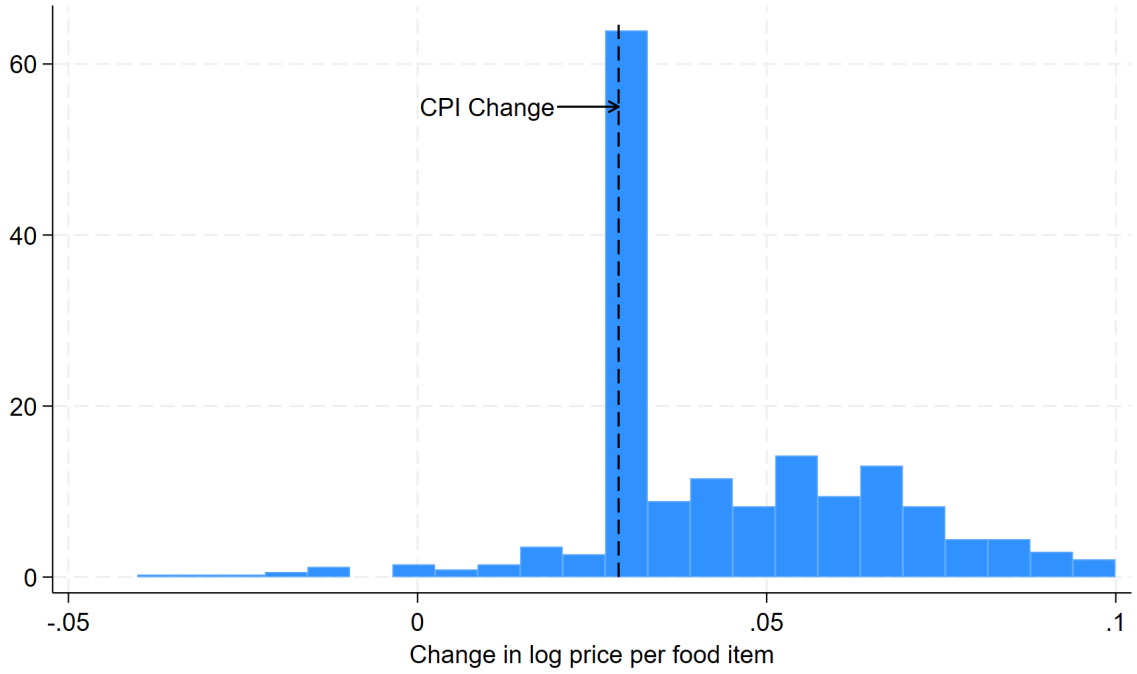


Figure 8: Bunching of price increases at renewal

Notes: The histogram summarizes the distribution of log changes in prices per case, $\log(p_{it}) - \log(p_{i,t-1})$, at contract renewal for school year t. The data come from a single contract renewal (from school year 23/24 to school year 24/25) for one school food authority located in the Los Angeles–Long Beach–Anaheim MSA. The vertical line denotes the annual change in the CPI (less-shelter) for the broader Los Angeles MSA at $+2.88\%$. The CPI change is the stated benchmark for price changes at contract renewal.

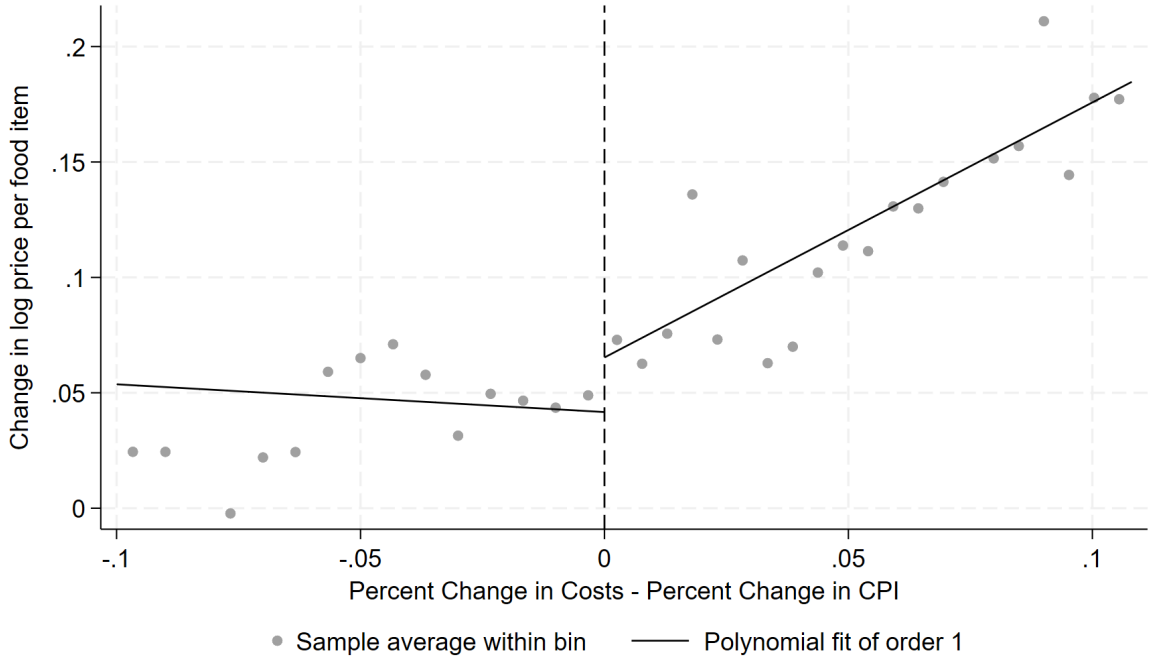


Figure 9: Asymmetric pass-through of costs at contract renewal

Notes: The bin scatter plot relates changes in log prices against percent changes in costs at contract renewal for school year t. The data come from one three contract renewals for two school food authorities located in the Los Angeles–Long Beach–Anaheim MSA. The vertical axis denotes log changes in prices per case, $\log(p_{it}) - \log(p_{i,t-1})$. The horizontal axis denotes approximated percent changes in costs $\frac{c_{it}-c_{it-1}}{p_{it-1}}$, see the text for more details, minus the percent change in the CPI (less-shelter) for the broader Los Angeles MSA. The CPI change is the stated benchmark for price changes at contract renewal. The vertical line delineates relative changes in costs that fall below or above the CPI change. The solid lines show separate linear fits for observations with cost changes below and above the CPI benchmark.

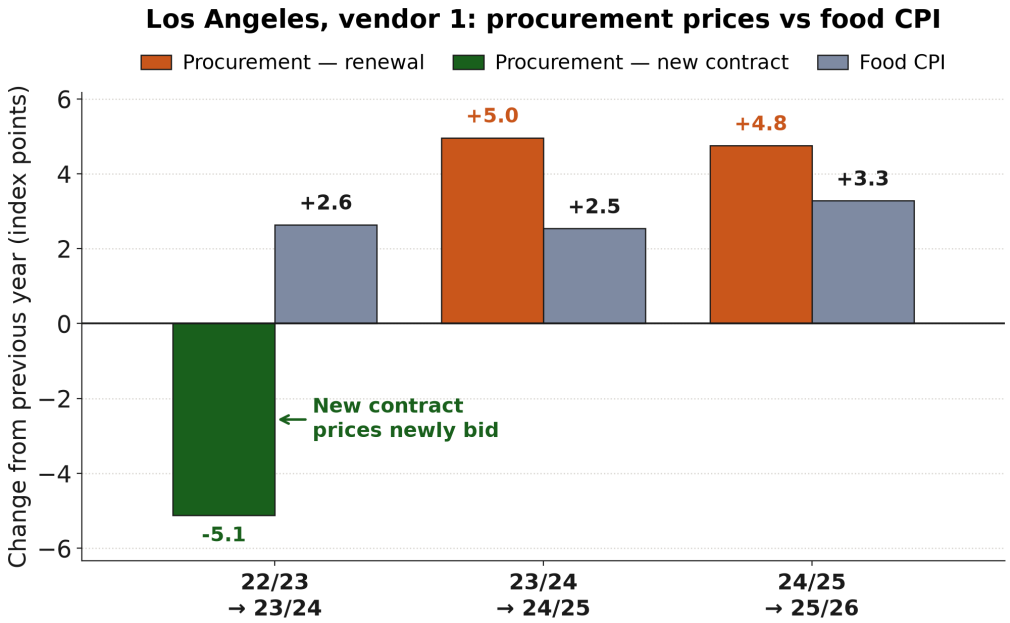


Figure 10: Backloading of Prices by the Main Vendor, Los Angeles MSA

Notes: The figure shows year-over-year changes (in index points) in procurement prices charged by the main vendor to school food authorities in the Los Angeles–Long Beach–Anaheim MSA, and in the Los Angeles food CPI. The green bar denotes the transition to a newly bid contract (from school year 2022/23 to 2023/24); orange bars denote subsequent contract renewals.

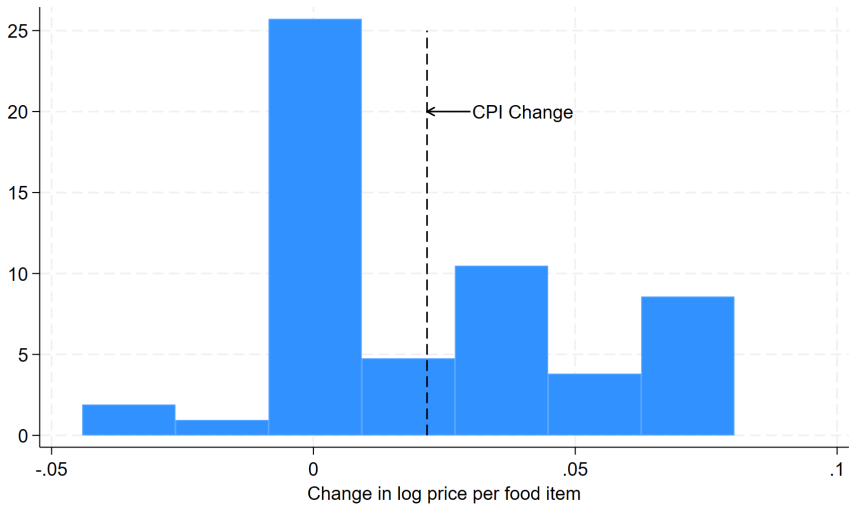


Figure 11: Price Changes at Contract Renewal, Main Competitor

Notes: The histogram summarizes the distribution of log changes in prices per case, $\log(p_{it}) - \log(p_{i,t-1})$, at a contract renewal of the main competitor for one school food authority. The vertical line denotes the annual change in the CPI, the stated benchmark for price changes at contract renewal.

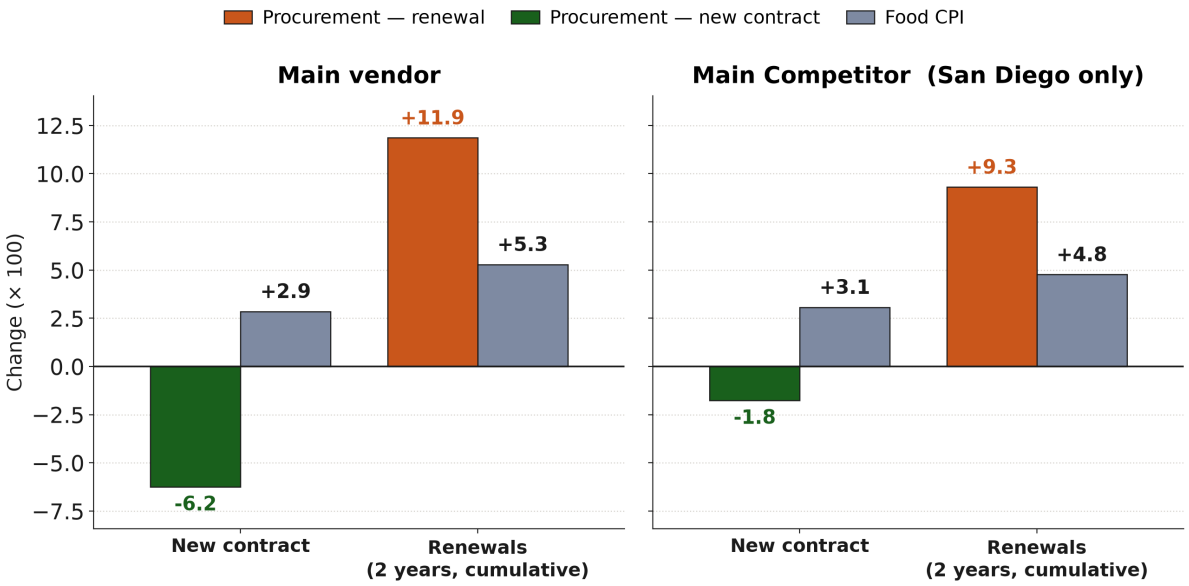


Figure 12: Price Changes over the Contract Cycle by Vendor

Notes: The figure compares changes in procurement prices (multiplied by 100) with changes in the food CPI for the main vendor (left) and its main competitor (right; San Diego MSA only). Green bars denote the transition to a newly bid contract; orange bars denote cumulative price changes over the two subsequent contract renewals.

Table 1: Price Variation by Market

Product group	Products	N ≥ 2 CV	N ≥ 2 Range	N ≥ 3 CV	N ≥ 3 Range	N ≥ 3 Share	N ≥ 4 CV	N ≥ 4 Range	N ≥ 4 Share
Panel A: Los Angeles–Long Beach–Anaheim									
Proteins	350	8.6	17.5	8.9	19.2	84.1	9.1	20.5	65.1
Dairy	62	7.0	14.6	8.6	19.4	78.0	7.8	19.0	65.5
Produce	385	9.0	14.2	7.4	15.8	57.2	7.0	15.4	48.1
Grains & Bakery	673	7.2	14.5	7.1	15.4	86.5	7.6	17.5	57.2
Fats, Condiments & Sweets	322	7.6	13.6	8.2	15.6	76.4	11.8	23.0	22.2
Beverages	60	3.2	5.5	2.4	5.1	43.7	2.0	4.5	5.2
Mixed/Prepared	329	5.5	10.6	6.6	13.5	76.2	6.4	14.3	42.8
Overall	2,181	7.3	14.3	7.6	16.2	80.1	7.9	17.9	54.3
Panel B: San Diego–Chula Vista–Carlsbad									
Proteins	138	6.7	10.4	14.2	26.4	18.1	15.9	36.2	4.5
Dairy	37	9.7	16.0	5.7	12.7	24.3	12.1	29.0	14.0
Produce	91	14.4	24.8	17.9	33.8	26.4	–	–	0.0
Grains & Bakery	271	7.1	11.1	7.0	14.0	40.5	10.5	22.9	9.7
Fats, Condiments & Sweets	154	12.2	19.6	21.8	41.2	24.2	15.9	35.7	1.5
Beverages	26	10.1	14.4	–	–	0.0	–	–	0.0
Mixed/Prepared	100	10.8	14.2	12.5	15.8	61.2	4.9	9.4	34.4
Overall	817	8.4	12.8	10.8	18.2	36.0	7.9	17.0	13.0
Panel C: San Francisco–Oakland–Fremont									
Proteins	252	11.8	17.5	8.2	16.7	–	4.7	10.7	–
Dairy	79	8.4	16.9	10.5	23.8	–	12.8	30.1	–
Produce	118	14.0	20.4	22.8	44.6	–	–	–	–
Grains & Bakery	367	6.6	9.9	8.5	15.7	–	–	–	–
Fats, Condiments & Sweets	270	5.5	7.5	14.7	27.5	–	9.2	18.6	–
Beverages	16	2.2	3.1	–	–	–	–	–	–
Mixed/Prepared	167	7.2	13.8	10.6	21.4	–	17.5	42.2	–
Overall	1,269	9.5	14.8	9.3	19.2	–	7.7	17.8	–

Table 2: Mandarin orange chicken: price per case, same product and vendor

	Avg. distance to distribution center	Price ($)	vs. LA mean (%)
Panel A: Across MSAs			
Los Angeles	34 mi	187.81	—
San Diego	102 mi	160.32	−14.6
Panel B: Districts within Los Angeles			
District A		195.59	+4.1
District B		194.29	+3.4
District C		191.09	+1.7
District D		187.24	−0.3
District E		159.82	−14.9
Max − min		35.77	19.0

Notes: Mean price of mandarin orange chicken (product ids 2053 and 596) bought from the same vendor. Panel A averages over districts in each MSA; Panel B reports each district in the Los Angeles MSA, sorted by price. Distance is the mean over each MSA's districts of the miles to the vendor's distribution center. The last column is the percentage difference from the Los Angeles MSA mean in Panel A.

Table 3: Average Markup of Bids over Marginal Costs, $\frac{b-c}{b}$, by Vendor

	All bids			Conditional on winning		
	A	*B*	All	*A*	*B*	Pooled
Bid homogenization:						
RE (BLUP)	23%	12%	17%	30%	19%	26%
RE (variance-matched)	25%	23%	24%	28%	32%	30%
Fixed effects	20%	10%	15%	27%	19%	24%
Food-group means only	50%	36%	43%	53%	39%	49%
Mean *(excl. row 4)*	**22.8%**	**14.8%**	**18.6%**	**28.2%**	**23.4%**	**26.6%**

Notes: The table reports estimated average markups of bids over marginal costs, $\frac{b-c}{b}$, following equation (6). The data come from 58 contested two-bidder first-price auctions held by one school food authority. Columns report averages over all bids and over winning bids only, separately for vendors *A* and *B* and pooled across vendors. Rows correspond to alternative approaches to removing common auction heterogeneity from log bids per pound: item random effects with BLUP shrinkage, item random effects with variance-matched shrinkage, item fixed effects, and food-group means only (see Appendix A.2). Bids with top-coded markup estimates are excluded. The last row averages the first three rows.

Table 4: Price changes at contract renewal and commodity cost changes

	Spending-weighted			Unweighted		
	(1)	(2)	(3)	(4)	(5)	(6)
Commodity cost change	0.888***	−0.169	−0.192*	0.637***	−0.197	−0.225
	(0.052)	(0.116)	(0.116)	(0.072)	(0.143)	(0.144)
Commodity cost change × Cost change > CPI		1.239***	1.489***		1.062***	1.323***
		(0.124)	(0.160)		(0.160)	(0.214)
Cost change > CPI			−0.021**			−0.020*
			(0.008)			(0.011)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	487	487	487	487	487	487
R^2	0.401	0.504	0.510	0.187	0.255	0.261
Adj. R^2	0.398	0.500	0.505	0.182	0.249	0.253

Notes: OLS of the change in log price at contract renewal on the change in commodity cost, main distributor only, with school-year fixed effects. "Cost change > CPI" indicates a commodity cost change above the CPI adjustment. Columns (1)–(3) weight by spending; columns (4)–(6) are unweighted. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A Appendix

A.1 Prices and Purchase Volume

Figure A1 complements the evidence on SFA size in Section 3. Rather than comparing average prices across SFAs ordered by enrollment, it relates the log price an SFA pays for an item to the log quantity of that item it purchases annually. Both variables are residualized from an item-by-SFA level regression that controls for market and product fixed effects, as well as vendor and SFA fixed effects. The binned scatter plot shows a small negative relationship overall, with a slope of -0.011 (s.e. 0.001). Doubling the quantity purchased is associated with a price that is less than 1% lower. Volume discounts therefore explain at most a small fraction of the price differences between SFAs documented in Section 2.2.

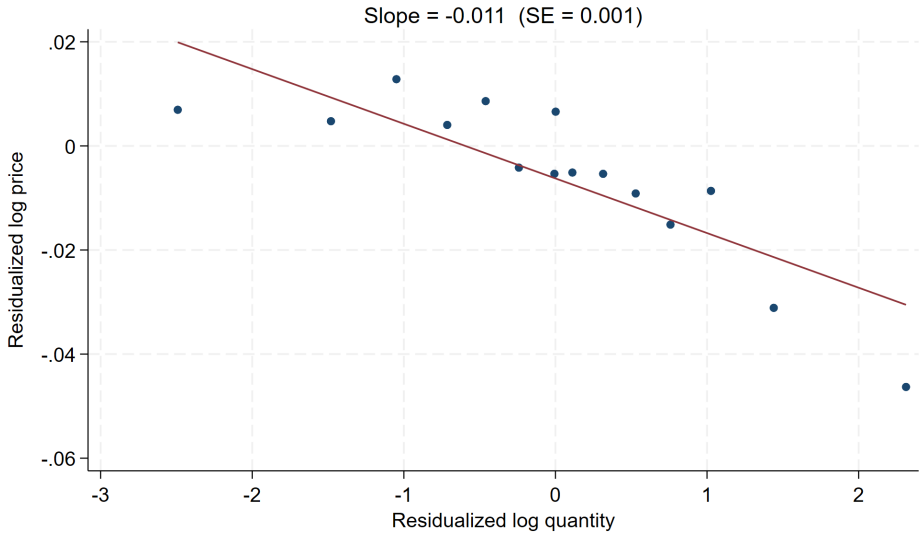


Figure A1: Log Price against Log Annual Volume by SFA

Notes: Binned scatter plot of residualized log prices against residualized log annual quantities, at the item-by-SFA level. Both variables are residualized on market and product fixed effects, as well as vendor and SFA fixed effects. The line shows the linear fit; its slope and standard error are reported above the plot. Data from school year 2025/2026.

A.2 Random-Effects Bid Homogenization

Let ℓ_{ia} denote bidder i's log bid per pound in auction (item) a. We decompose it into a food-group mean, an item effect, and a private shock,

$$\ell_{ia} = \bar{c}_{c(a)} + \eta_a + w_{ia}, \qquad \mathrm{Var}(\eta) = \sigma_\eta^2, \quad \mathrm{Var}(w) = \sigma_w^2, \tag{A1}$$

where $c(a)$ denotes the food group of item a. We construct residualized bids by shrinking toward the item mean $\bar{\ell}_a$ by a factor $\theta \in [0, 1]$,

$$\hat{w}_{ia}(\theta) = \ell_{ia} - \left[\bar{c}_{c(a)} + \theta(\bar{\ell}_a - \bar{c}_{c(a)})\right], \tag{A2}$$

so that $\theta = 0$ subtracts food-group means only and $\theta = 1$ corresponds to item fixed effects. With two bids per item, the variance of the residualized bids is

$$V(\theta) = (1-\theta)^2\sigma_\eta^2 + \sigma_w^2\left[\left(1 - \tfrac{\theta}{2}\right)^2 + \tfrac{\theta^2}{4}\right]. \tag{A3}$$

At the endpoints, $V(0) = \sigma_\eta^2 + \sigma_w^2$ overstates the dispersion of private costs, whereas $V(1) = \frac{1}{2}\sigma_w^2$ understates it. There is a unique interior value $\theta^\star$ with $V(\theta^\star) = \sigma_w^2$, which we refer to as the variance-matched specification. The best linear unbiased predictor uses $\theta_{\mathrm{BLUP}} = \sigma_\eta^2/(\sigma_\eta^2 + \sigma_w^2/2)$.

With two bids per item, the variance components have closed forms. Within an item, $\sum_{i \in a}(\ell_{ia} - \bar{\ell}_a)^2 = \Delta_a^2/2$, where Δ_a is the difference between the two log bids, so that over A items

$$\hat{\sigma}_w^2 = \frac{1}{A}\sum_a \frac{\Delta_a^2}{2}, \qquad \hat{\sigma}_\eta^2 = \frac{1}{A}\sum_a \left(\bar{\ell}_a - \bar{c}_{c(a)}\right)^2 - \frac{\hat{\sigma}_w^2}{2}. \tag{A4}$$

In our data, $\hat{\sigma}_w = 0.194$ and $\hat{\sigma}_\eta = 0.398$, implying $\theta_{\mathrm{BLUP}} = 0.89$ and $\theta^\star = 0.67$. Item heterogeneity accounts for 81% of the residual log-bid variance after removing

food-group means, which explains why the specification with food-group means only ($\theta = 0$) yields overdispersed bids and large markups.

A.3 Estimating the Bid Distribution

For each bid of vendor i, we pool the rival vendor j's residualized bids across auctions, $\mathcal{P}_i = \{\hat{w}_k : v(k) = j\}$. We estimate the probability of winning with the empirical distribution function,

$$1 - \hat{F}_j(\hat{w}_{ia}) = \frac{\#\{\hat{w}_k \in \mathcal{P}_i : \hat{w}_k > \hat{w}_{ia}\}}{|\mathcal{P}_i|}, \tag{A5}$$

and the density with a Gaussian kernel,

$$\hat{f}_j(\hat{w}_{ia}) = \frac{1}{|\mathcal{P}_i|} \sum_{k \in \mathcal{P}_i} \frac{1}{h} \phi\Big(\frac{\hat{w}_{ia} - \hat{w}_k}{h}\Big), \tag{A6}$$

with Silverman's bandwidth $h = 0.9 \min\{\hat{\sigma}, \text{IQR}/1.349\}\, n^{-1/5}$. The estimated markup is $\hat{m}_{ia} = \big(1 - \hat{F}_j(\hat{w}_{ia})\big) / \hat{f}_j(\hat{w}_{ia})$, see equation (6). Because bids are measured in logs, the change of variables $\widetilde{G}(\log b) = G(b)$ and $\widetilde{g}(\log b) = g(b)\, b$ implies that the inverse hazard of the log-bid distribution equals the proportional markup in equation (2) with $N = 2$,

$$\frac{b - c}{b} = \frac{1 - G(b)}{b\, g(b)} = \frac{1 - \widetilde{G}(\log b)}{\widetilde{g}(\log b)}. \tag{A7}$$

A.4 Falsification: Price Changes at Contract Award

Section 5 shows that price changes at contract renewal bunch at the CPI benchmark, with little mass below it. If price changes merely tracked vendors' cost growth, price changes should look similar when a contract is newly bid. Figure A2 tests this using the same school food authority as Figure 8, which rebid its contract for school year 2023/24.

The distribution looks very different from the one at renewal. There is no bunching: only about 1% of the 318 items have a price change within a quarter of a percentage point of the CPI change, compared with one third of items at renewal. Most of the mass lies *below* the benchmark. About 80% of items (84% of spending) have price changes below the CPI change, three quarters see outright price declines, and the median item becomes 5.7% cheaper. At renewal, by contrast, only 8% of items have price changes below the CPI, and the median price rises by 4.1%.

Intuitively, when the contract is rebid, competition between vendors reveals that the costs of many items grew more slowly than the CPI, and pushes their prices down. This supports our interpretation that the CPI acts as a price floor at renewal rather than as a measure of cost growth.

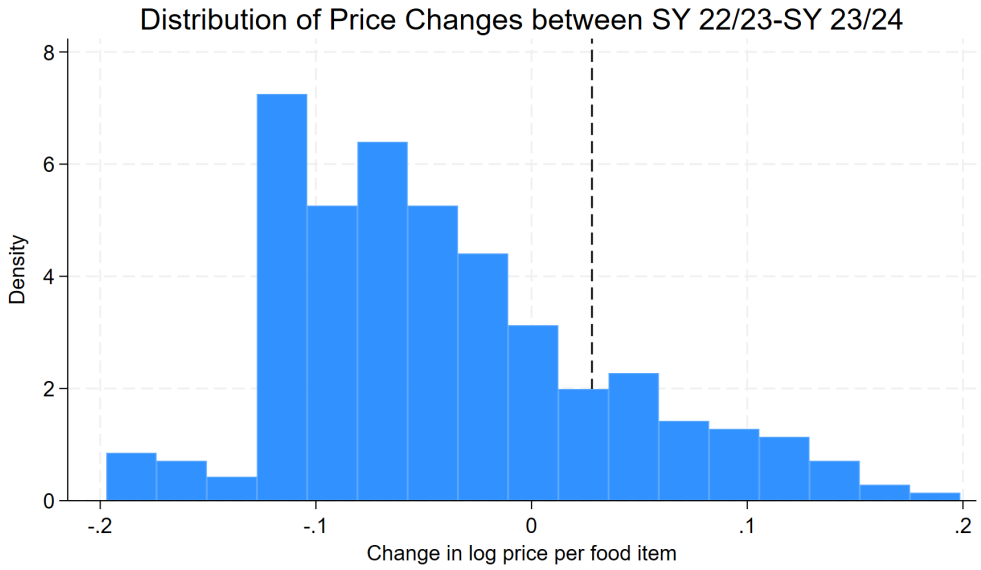


Figure A2: Falsification: Price Changes at Initial Contract Award

Notes: The histogram summarizes the distribution of log changes in prices per case, $\log(p_{it}) - \log(p_{i,t-1})$, for the same school food authority as in Figure 8, between school year 2022/23 and school year 2023/24, when the contract was newly bid.

A.5 Backloading by Vendor

Figure 12 in the main text averages the main vendor's price changes over its contracts in the Los Angeles and San Diego MSAs, whereas the main competitor is observed in San Diego only. Figure A3 restricts the comparison to San Diego, where we observe both vendors supplying the same school food authority over the same years. Both vendors renewed their contracts for school years 2023/24 and 2024/25 and were newly bid for 2025/26. The difference between the vendors becomes more pronounced within San Diego. When the contract was newly bid, the main vendor's prices fell by 8.8%, compared with a 3.1% increase in the food CPI, whereas the competitor's prices fell by only 1.8%. Over the two preceding renewals, the main vendor's prices rose by a cumulative 14.1%, nearly three times the 4.8% increase in the food CPI, compared with 9.3% for the competitor. Because both vendors serve the same buyer and face the same local cost conditions, these differences are unlikely to reflect differences in costs or in market. They are consistent with the main vendor backloading its prices more aggressively than its competitor: bidding low when the contract is up for competition and raising prices at subsequent renewals.

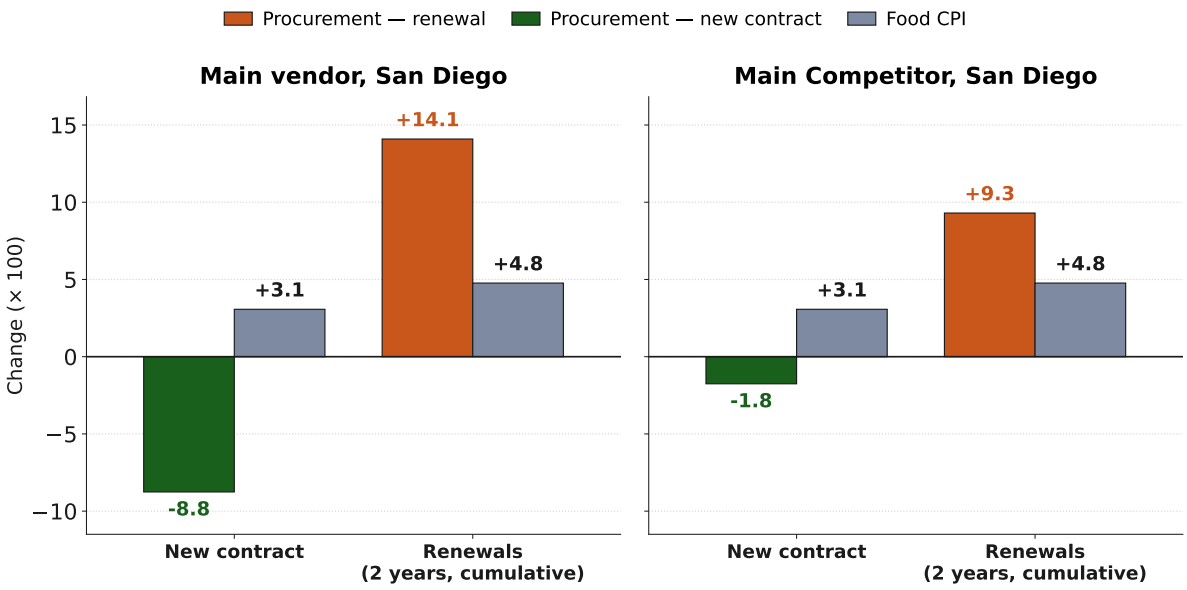


Figure A3: Price Changes over the Contract Cycle by Vendor

Notes: The figure compares changes in procurement prices (multiplied by 100) with changes in the food CPI for the main vendor (left) and its main competitor. Green bars denote the transition to a newly bid contract; orange bars denote cumulative price changes over the two subsequent contract renewals.