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# Price Variability Across Food Product and Vendor Type in Food Benefit Redemptions Under the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)

Patrick W. McLaughlin, Stacy Gleason, and Margaret Wilkin



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# **Price Variability Across Food Product and Vendor Type in Food Benefit Redemptions Under the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)**

Patrick W. McLaughlin, Stacy Gleason, and Margaret Wilkin

## **Abstract**

This report examines variability in WIC food transaction prices across store formats and four WIC State agencies in the Midwest, West, Southwest, and Mountain Plains using purchase-level data on 2014 Electronic Benefit Transfer (WIC EBT) transactions. While mass merchandisers and traditional grocers tended to have the lowest transaction prices in many product categories, prices vary greatly across States and store formats. Thus, the costliness of food baskets composed of various WIC food items varied significantly across the various store formats of WIC vendors, driven by prices in select product categories. State agencies may be able to reduce food costs in several key product categories, but potential savings may be outweighed by compromises to participant satisfaction or access to food benefits.

## **Acknowledgments**

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**Keywords:** WIC; Special Supplemental Nutrition Program for Women, Infants, and Children; WIC food prices; WIC redemptions; cost containment.

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# Price Variability Across Food Product and Vendor Type in Food Benefit Redemptions Under the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)

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## What Is the Issue?

USDA's Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides food assistance, healthcare referrals, and nutrition education to participating pregnant, post-partum, and breastfeeding women; infants; and children up to age 5. WIC serves 7.3 million participants annually and is the third largest USDA-administered food assistance program in terms of expenditures at \$5.6 billion in FY 2017. Cost containment to support the efficient use of discretionary funds is a longstanding priority in WIC. WIC State agencies (SAs) provide nutrition assistance to participants and manage a portfolio of authorized vendors who redeem benefits. WIC participants redeem benefits for approved food items at no personal cost—except for cash value vouchers for fruits and vegetables—so cost-containment efforts often address the prices of the food items chosen by WIC participants as well as the brands and variety of foods allowed.

This report uses 2014 WIC Electronic Benefit Transfer (EBT) transaction data to examine how prices of WIC foods purchased by participants with WIC benefits vary across four SAs—Midwest, Western, Southwest, and Mountain Plains—by product category and store format.

## What Did the Study Find?

This report studied price variability in WIC-approved *breakfast cereal, reduced-fat and whole milk, peanut butter, infant fruits/vegetables, bottled juice, and whole grains*. Price variability of WIC foods was observed across store formats with varying magnitudes after controlling for size and rurality of the store. Key findings are as follows.

- Approved items in the reduced-fat milk, breakfast cereal, bottled juice, and cheese categories ranked the highest in share of food costs in each SA, accounting for more than half of the value of all non-infant formula purchases. Breakfast cereal, bottled juice, and whole grains ranked the highest in price variability.
- While participants are theoretically price-insensitive when redeeming WIC benefits, only 14 to 23 percent of transactions in any SA were highest-priced (i.e., a transaction with a price in the top quartile of unique observed prices for WIC-approved food items in a given product

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category and SA). However, a few product categories, including whole grains, had over 40 percent of transactions deemed highest-price in some SAs.

- In general, WIC transactions at mass merchandisers (e.g., Walmart) and traditional grocers (i.e., national, regional, and local chains and independent grocery stores) had lower prices in most product categories compared to small and nontraditional food retailers (i.e., discount and limited-assortment chains, pharmacies, convenience-type stores, and other specialty stores). However, traditional grocers' prices tended to be higher in the juice category, but lower in milk, both by amounts as much as \$1 per 64-ounce bottle of juice or gallon of milk.
- We also examined average differences across store formats if participants hypothetically obtained at one store format all food items allowed by their respective WIC food package (e.g., a food basket). While mass merchandisers and traditional grocers tended to have lower average prices for these food baskets in general, prices at traditional grocers were often lowest due in part to lower milk prices.
- Transactions at small and nontraditional food retailers had significantly higher prices in most product categories. Furthermore, the costliness of WIC food baskets at smaller and nontraditional vendors tended to be significantly higher, especially for a food basket corresponding to an infant package providing 256 ounces of infant fruits and vegetables. For example, costs of this basket were roughly \$25 higher at convenience-type stores than at mass merchandisers in the Midwest SA. However, the inclusion of smaller retailers as authorized vendors may help ensure participant access to redeeming food benefits.
- Transaction prices at small and nontraditional food retailers authorized by the Southwest SA, however, were similar to those of their larger counterparts. This may be due to the extensive use of least-cost brand policies (or other policies affecting vendor reimbursements or participant choice) by that SA.

While significant price differences between store format types occur in some SAs, it remains unclear if food cost savings could be obtained without compromising participants' access to vendors for those lacking nearby large vendors. Nevertheless, this report provides an analytical framework that individual SAs can readily adopt using WIC EBT data in order to assess price variability by store format.

## **How Was the Study Conducted?**

This study examined two types of price variability in breakfast cereal, reduced-fat and whole milk, peanut butter, infant fruits/vegetables, bottled juice, and whole grains from WIC EBT transaction data in four SAs from May or June 2014 to August 2014. First, statistics summarizing the level and variation in transaction prices are presented for a select group of WIC product categories for each SA. Second, the relationship between the transaction prices and the store format of the transacting vendor is estimated for each studied product category. These results were used to simulate the average cost effect of a participant hypothetically redeeming at a given store format a food basket composed of the studied food categories in quantities allowed by the various WIC food packages.

# Price Variability Across Food Product and Vendor Type in Food Benefit Redemptions Under the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)

## Introduction

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides food assistance, healthcare referrals, and nutrition education for participating pregnant, post-partum, and breastfeeding women; infants; and children up to the age of 5. In FY 2017, the Federal budget for the WIC program totaled \$5.6 billion and served over 7.3 million participants nationwide during an average month.<sup>1</sup> WIC is the third largest food assistance program administered by the U.S. Department of Agriculture's (USDA) Food and Nutrition Service (FNS) in terms of budget, outranked only by the Supplemental Nutrition Assistance Program (SNAP) and the National School Lunch Program (NSLP). The WIC program supports early child development for many in the country, covering in recent years nearly half of all U.S. infants and over a quarter of all children ages 1 to 4 (USDA/FNS, 2017).

WIC food benefits are nutritionally targeted food packages issued to participants in monthly allotments. WIC food packages are defined by Federal regulations and include specific quantities of items conforming to nutritional criteria in prescribed product categories.<sup>2</sup> WIC food product categories include general staples such as low-fat milk, 100% whole-wheat bread and other whole-grain options, cheese, and breakfast cereal, as well as infant-targeted food such as infant formula, infant fruits and vegetables, and infant cereal. The prescribed quantity of items in each product category depends on the participant type (pregnant or postpartum mother, infant depending on age and breastfeeding status, or child) and, for a postpartum mother, whether she is fully breastfeeding, partially breastfeeding, or formula-feeding her infant.

Food packages comprise the majority of WIC program costs and thus receive the bulk of attention paid to cost containment in WIC. Spending on food totaled 65 percent of the WIC budget in FY 2017. Unlike the entitlement program SNAP, the WIC program budget is discretionary, with program spending fixed in a given fiscal year. Therefore, cost containment ensures that funds are sufficient so that all eligible individuals who apply can participate, in addition to ensuring efficient use of Federal discretionary funds. In general, cost containment is at the behest of the State agencies (SAs), which are charged with administering WIC benefits to participants. However, Federal regula-

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<sup>1</sup> These figures and all others covering the budget are available online on FNS's program data website.

<sup>2</sup> A final rule revising the food packages was published on March 4, 2014. This rule completes implementation of the first comprehensive revisions to the WIC food packages since 1980. With support from FNS, the National Academies of Sciences, Engineering, and Medicine (NASEM, formerly Institute of Medicine) convened an expert committee to review and assess the nutritional status and food/nutritional needs of the WIC-eligible population and provide recommendations based on its review and the most recently available science (Institute of Medicine, 2017). The Healthy Hunger-Free Kids Act requires that FNS scientifically evaluate WIC food packages every 10 years.

tions also require that cost-containment measures are in place.<sup>3</sup> For example, SAs may prohibit the purchase of products with features associated with higher prices (e.g., organic) or allow only the least expensive available brand to be purchased. Furthermore, SAs are instructed to authorize an appropriate number and distribution of vendors in order to achieve the lowest practicable food prices while ensuring adequate participant access.<sup>4</sup>

WIC food costs vary substantially across State agencies: the average monthly food cost per person (net of rebates) during FY 2014 ranged from \$29.27 in Texas to \$55.30 in New York. A variety of factors—including regional food prices, composition of the participant caseload, and cost-containment policies—are likely responsible (Kirlin et al., 2003). For instance, SAs with WIC food costs above the national average tend to have higher food prices overall (Davis and Leibtag, 2005). This same study also found at best a weak association between caseload composition and average WIC food costs, despite other research documenting differences in the value of the food package by participant type (Wilde et al., 2012). In addition, the real economic value of benefits such as the cash value voucher for fruit and vegetables, a fixed dollar amount, may vary according to regional food prices (Leibtag and Kumcu, 2011).

The makeup of a given SA's portfolio of authorized WIC vendors can impact food costs as well. For example, Saitone and colleagues (2014) found that prices at smaller vendors (e.g., convenience-type stores) were higher than those at larger vendors (e.g., supermarkets) for the California WIC program. California WIC, like many SAs, established higher levels of reimbursement for small authorized vendors than for large vendors, partly because smaller food retailers may charge higher prices for purely economic reasons, such as (lacking the) economies of scale or buying power afforded large retailers. The inclusion of smaller retailers as authorized WIC vendors may help ensure participant access to redeeming food benefits.

Participants' food choices may vary across retail contexts, with implications for WIC food costs. For instance, Zhang and colleagues (2017) find that participants' propensity to choose a costlier brand of some food items varied substantially between several supermarket chains. Thus, the choices participants make in small and nontraditional retailers (e.g., discount and limited-assortment chains, pharmacies, convenience-type stores, and other specialty stores) that are authorized vendors may have food cost implications as well. Nevertheless, the majority of WIC transactions take place at supermarkets and supercenters (Tiehen and Frazão, 2016), which limits the impact of smaller vendors on total food costs.

In light of the high variability in food costs, this report examines how prices charged for WIC foods vary across State agencies by product category and store format of the redeeming vendor. Identifying where high food prices are prevalent, if anywhere, and why may uncover areas for meaningful reductions in program spending. SAs likely prefer to target only those foods with the greatest potential for food cost savings, as cost-containment policies could arguably have unintended conse-

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<sup>3</sup> WIC is administered by 90 State agencies, through over 45,000 authorized retailers. WIC operates through 1,900 local agencies at 10,000 clinic sites in 50 State health departments, 34 Indian Tribal organizations, the District of Columbia, and 5 territories (Northern Mariana, American Samoa, Guam, Puerto Rico, and the Virgin Islands).

<sup>4</sup> Cost-containment policy can also include the system by which SAs reimburse vendors for redeeming benefits. FNS regulations stipulate that SAs must set maximum allowable redemption levels for benefits, and these rates are set according to SA-defined vendor peer groups. These peer groups, according to FNS regulations, should group vendors according to scope (e.g., size of the business, or extent of food business), geography, and whether or not WIC sales constitute more than 50 percent of all food sales (i.e., so called "A50" status). Saitone et al. (2014) study cost containment of this type for California WIC.



quences. For example, limiting the brands allowed for WIC purchase or where WIC consumers can redeem benefits may reduce participant satisfaction with the program or access to food benefits, and thus may present a disincentive to continued participation or enrollment, or to redeeming benefits altogether. This concern is especially pronounced in light of continued decreases in WIC participation rates (USDA, FNS 2017).

This report examines price variability in breakfast cereal, reduced-fat/whole milk, peanut butter, infant fruits and vegetables, bottled juice, and whole grains from WIC EBT transactions data in four State agencies from May/June 2014 to August 2014. This administrative data source provides the quantities and prices of specific items purchased by WIC participants with their benefits, which are typically not fully observable in previous studies.

# WIC Benefit Redemption Process and the Rationale for Cost Containment

The Child Nutrition Act of 1966 mandates that State agencies (SAs) establish and manage a food delivery system for recipients of assistance. While SAs' chosen food delivery systems are multivariied, virtually all SAs authorize private food retailers to exchange supplemental foods for participants' benefits and subsequently receive reimbursement from the SA for the value of the transaction.<sup>5</sup> WIC benefit regulations often create economic incentives for participants and authorized vendors that rationalize cost containment, namely the fact that food benefits are provided to participants at no cost.

## Participants' Incentives

Containing food costs in WIC is complicated due to recipients' lacking an explicit economic incentive to be cost conscious when making WIC food purchases. Virtually all SAs distribute food benefits by conferring to participants in monthly allotments either a paper voucher or EBT card that can be redeemed for a prescribed, fixed quantity of food items (except for the fruits/vegetables food category, which is set at a fixed dollar amount depending on the participant category).<sup>6</sup> The exact quantities of food items vary according to the seven broad food packages, defined in regulation; five that are most relevant to this study are detailed in Appendix A.<sup>7</sup> Participants then redeem their benefits in exchange for approved WIC food items from State-authorized vendors. WIC participants may select any food item regardless of price as long as it is approved by their SA. However, SAs reimburse vendors only up to a maximum level. Therefore, participants' economic demand for WIC food is (theoretically) perfectly price inelastic (i.e., the amount of a given item that the participant buys does not respond to changes in price).

While WIC participants may not always choose the most expensive food items available to them (Zhang et al., 2017), there is evidence that WIC participants are less price sensitive when using their benefits compared to paying out of pocket. For example, Dong and colleagues (2016) find that WIC participants using their food benefits pay 19 percent more for cereal compared to when they purchase cereal paying out of pocket (e.g., using their own funds or SNAP benefits). This finding is observed despite the fact that the authors also find that WIC-allowed cereal tends to have lower prices compared to all cereal products, on average.

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<sup>5</sup> In lieu of authorizing private vendors to redeem benefits, WIC SAs may also distribute benefits via either home delivery or a direct distribution system (e.g., participants receive WIC food items directly from the SA). As of 2016, only Mississippi and parts of Illinois use direct distribution (Tiehen and Frazão, 2016).

<sup>6</sup> Per the Healthy Hunger-Free Kids Act of 2010, all SAs must adopt an EBT system in lieu of the paper vouchers by 2020. As of 2017, 26 of 90 SAs had implemented WIC EBT, including the 4 SAs in this study (see the EBT/MIS page on the FNS website for more information). To clarify the caveat on fruits and vegetables, the WIC food package provides women and children participants with dollar quantities for fruits and vegetables.

<sup>7</sup> The five broad food packages include those for children, mothers fully formula-feeding their infants, mothers partially breastfeeding, mothers fully breastfeeding, and an infant food package received by fully breastfed infants at age 6-11 months. There are other infant packages for infants age 0-5 months that do not include any food items studied in this report, and other infant packages that offer studied food items in proportion to the aforementioned fully breastfed infant package.

## State-Approved WIC Food Items

In establishing the food benefit distribution system, State agencies determine the approved/authorized food items for their State in each WIC product category, provided all supplemental foods meet Federal nutritional requirements. Among products meeting these standards, SAs can further specify a mix of brand-specific (e.g., authorizing General Mills' Cheerios or allowing only specific Universal Product Codes (UPCs) for ready-to-eat breakfast cereals) and nonbrand-specific criteria (e.g., allowing only certain package sizes of cereal or disallowing the organic varieties in a product category). In fact, 67 percent of SAs excluded organic items of all food types (except fruits and vegetables) from their approved list as of 2015 (Thorn et al., 2015).

Thus, the SAs can first engage in cost containment by specifying the food items that are approved, although these decisions may also concern the ease of availability or participants' preferences for specific items (Kirlin et al., 2003). Some criteria tend to be driven more by cost than nutrition concerns. For example, smaller boxes of breakfast cereal tend to have higher per-ounce prices, so WIC participants purchasing many small boxes to meet their 36-ounce cereal allotment is uneconomical compared to participants buying two 18-ounce boxes. Hence, many SAs only allow cereal packages of a sufficiently large size. Such nonbrand criteria are used by 70 percent of SAs (Thorn et al., 2015).

Likewise, SAs authorize, in several ways, only those brands deemed to be sufficiently low priced. An SA might authorize General Mills' Cheerios or a similarly prominent brand, but decline to authorize brands deemed too expensive. SAs can also allow only the least expensive national or store brand for a given product category. For example, an SA may require a vendor to offer a traditionally least expensive brand in a product category and require participants to purchase that brand when patronizing the vendor. In contrast, other SAs require participants to purchase the least costly brand at the time of purchase, with the vendors responsible for ensuring this. This preferential brand can vary by vendor, or over time at a given vendor. The proportions of SAs using least-cost brand policies to contain costs in FY 2015 were 43 percent of SAs for milk, 35 percent for cheese, and 38 percent for eggs (Thorn et al., 2015).

While least-cost brand policies have reportedly been a source of significant savings to SAs, WIC participants and vendor staff have reported some confusion or dissatisfaction. Kirlin and colleagues (2003) report that California WIC discontinued its least-cost brand policies for milk in 2000 due to participant/vendor concerns. Thus, cost-containment policies may involve a tradeoff between the satisfaction of program stakeholders and food cost savings.

Another strategy to contain WIC costs is the use of single-supplier competitive contracts, especially for infant formula. Single-supplier competitive rebate contracts are allowed by Federal regulation for most WIC food product categories. To maximize the available food funds, most WIC SAs are required to establish competitively bid rebate contracts with infant formula manufacturers.<sup>8</sup> An SA awards an infant formula manufacturer a contract to be the sole provider of WIC formula, for which manufacturers compete on the basis of offering the largest wholesale rebate or lowest net price. The rebates provide substantial discounts averaging 92 percent of the total wholesale value (Oliveira et al., 2013). More than half of infant formula purchased in the United States is through WIC, although

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<sup>8</sup> All SAs are required to establish single-supplier competitive contracts for infant formula, except those using home delivery or direct distribution food delivery systems and Indian Tribal organization SAs with 1,000 or fewer participants.

the impact on wholesale formula prices is minimal (Davis, 2012). Some SAs use rebate bid contracts for other infant foods, but we are unaware of work detailing their effects.

## WIC Vendors

State WIC agencies authorize private food retailers to redeem benefits and develop maximum allowable reimbursement levels (MARLs). Again, SAs have latitude in this respect, much as they do in determining food eligibility, provided that certain cost-containment measures and program integrity requirements in Federal regulations are met. For instance, SAs must set competitive price criteria and minimum stocking requirements for WIC food items, to which all vendors must adhere.

The types of retailers authorized to redeem benefits are also determined by State agencies. Virtually all SAs authorize mass merchandisers (e.g., a Walmart with a grocery department), supermarkets (e.g., national chains such as Kroger or Safeway), and smaller grocery stores (e.g., local chains), and these types comprise the majority of authorized WIC vendors nationwide (Tiehen and Frazão, 2016). However, many SAs allow smaller and nontraditional vendors as well, like convenience stores, pharmacies, commissaries, other specialty stores, and a special class of vendors that derive 50 percent or more of their food sales from WIC sales (i.e., above-50 or A-50 vendors).<sup>9</sup>

Certain retailer categories may be able to impose higher food costs on WIC transactions, due in part to the various incentives and competitive pressures each vendor type faces. Because authorized vendors will request from the SA reimbursement for the value of the food items redeemed by participants, SAs are charged with ensuring that the reimbursements paid are not exceedingly high yet still fair and profitable for the participating vendor. In particular, SAs are required to establish “peer groups” of authorized vendors that each have their own MARLs, which act as price ceilings on requested prices. Characteristics defining vendor peer groups often include geography, size (e.g., the number of cash registers or WIC sales as a proxy), and A-50 status. The rationale is to group together vendors with similar economic incentives and conditions.

In general, the MARL for a given peer group is set at either the UPC, category, or subcategory level in SAs employing EBT systems and at the food instrument level for paper voucher systems. In all four of the SAs included in this study, which use EBT, the MARLs are computed at regular time intervals (e.g., monthly) as a function of the average redemption requested for a particular UPC within a peer group, plus a tolerance factor. The tolerance factor is either a fixed percentage of the aforementioned average or comes from the standard deviation of the peer group average redemption for the UPC. The MARLs are generally not known to authorized vendors. As seen in this study and past work, MARLs generally are not binding constraints on prices because WIC food items are also purchased by price-sensitive, non-WIC participants and therefore there is a clear economic incentive for vendors to be cost competitive. For example, Saitone and colleagues (2014) observe in California WIC that the vast majority of non-A50 vendors’ transactions are significantly below the MARL.

In addition to provisions on containing costs, Federal regulations also require SAs to ensure participants’ geographic access to authorized vendors. While there is no specific guidance on access, participants’ satisfaction with WIC—including the incentive to enroll or stay in the program—

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<sup>9</sup> SAs must seek approval from FNS to allow A-50 vendors to apply for authorization and must ensure that A-50 vendors’ MARLs do not exceed the average reimbursements issued SA-wide (74 FR 51725). No SA included in this study authorized A-50 vendors to redeem WIC benefits at the time of this study.



depends largely on vendor access. In particular, proximity to the local clinics that certify WIC participants was found to be a strong predictor of participation in the program (Rossin-Slater, 2013). Geographic access to authorized vendors may be of special concern because low-income (WIC) consumers tend to disproportionately reside in areas lacking a nearby supermarket (Rhone et al., 2017).

Therefore, in practice, SAs may face a difficult tradeoff between cost containment and participant satisfaction when determining their portfolio of authorized vendors, in addition to adhering to the Federal regulatory requirement to ensure participant access. Alleviating food access concerns if supermarket-type vendors are not plentiful may mean authorizing small and nontraditional vendors, which tend to have higher prices (and thus impose higher WIC costs). Adding more vendors can also significantly increase administrative costs for vendor management. Still, the higher average food costs of smaller vendors may be justified by expanding access to at least some participants. For example, a remote area of a State or Tribal organization may lack ready access to a mass merchandiser or traditional grocer, so WIC participants may have to redeem benefits at smaller authorized vendors.

## WIC Electronic Benefit Transfer (EBT) Redemptions and State Agency Data

The primary data source for this study was product and purchase information collected via WIC EBT redemption transactions from four SAs.<sup>10</sup> Vendor-specific variables are drawn either from the WIC EBT data or from auxiliary data on vendor characteristics provided by the SAs. The following is a brief description of each SA that provided study data:

- **Midwest SA** is located in the Midwest region (as determined by USDA's Food and Nutrition Service) and comprises both urban areas and large but less populated rural areas. Among the four SAs, it ranks second highest in total State population, number of WIC participants, and number of WIC vendors. The Midwest SA was in the top quartile of total WIC participants nationwide in 2014.
- **Western SA** is located in the Western region and comprises several urban areas and large but less populated rural areas. Among the four SAs, it ranks third in total population, number of WIC participants, and number of WIC vendors. The Western SA was in the third quartile of total WIC participants nationwide in 2014.
- **Southwest SA** is located in the Southwest region and comprises both urban areas and large rural areas. Among the four SAs, it ranks first in total population, number of WIC participants, and number of WIC vendors. The Southwest SA was in the top quartile of total WIC participants nationwide in 2014.
- **Mountain Plains SA** is located in the Mountain Plains region and comprises large but less populated rural areas and several smaller urban areas. Among the four SAs, it ranks fourth in total population, number of WIC participants, and number of WIC vendors. It was in the last quartile of number of WIC participants nationwide in 2014.

Electronic files obtained from the SAs contain redemption data on every WIC purchase made between May or June of 2014 (depending upon the SA) and August 2014. The EBT data contain the following variables used in the analysis:

- WIC vendor ID,
- WIC food item category and subcategory,
- Universal Product Code (UPC),
- Quantity of the food item purchased,
- Date benefit was redeemed,
- Claimed price (i.e., price or amount vendor requested), and
- Settled price (i.e., price or amount the SA paid the vendor).

The data were examined for completeness and implausible outliers in prices, which resulted in several adjustments to the records selected for analysis. In addition, claimed price was chosen to represent prices instead of settled price (with exceptions described herein) because claimed price

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<sup>10</sup> To abide by data sharing agreements, the State name of the SA was replaced with the FNS region to which the SA belongs. Withholding the names of the actual SAs emphasizes the differences in economic and policy features of each SA rather than promoting conclusions about one specific SA. In any case, none of the four SAs studied herein are representative of the FNS-defined region at large.

in most cases best represents the purchasing behavior of participants and the strategic behavior of vendors. Transactions for which the claimed price exceeded the settled price by at least fivefold were excluded from the analysis for a total of 58 transactions.<sup>11</sup> In addition, the settled redemption value replaced the claimed redemption value when the claimed value for a single item was greater than the maximum settled food price for the WIC food category in the given SA. This adjustment amounted to using settled price for 186,111 out of 13,954,569, or roughly 1.3 percent, of observed EBT purchases.

The product categories and standardized units included in the analysis were the following:

- Cereal, 1 ounce
- Cheese, 16 ounce
- Reduced fat milk, gallon
- Peanut butter, 1 16- to 18-ounce jar
- Whole milk, gallon
- Infant fruits and vegetables, 4 ounce
- Juice, 64-ounce bottle
- Whole grains, 16 ounce.

The standardized item units were chosen to allow for comparison of different items across SAs and vendors. Since the cereal allowance is 36 ounces and is purchased in a wide range of package sizes, the standardized unit used for analysis was 1 ounce. Infant fruits and vegetables also have multiple allowable sizes in some SAs; however, among the SAs included in this study, only 4-ounce containers of infant fruits and vegetables are allowed.<sup>12</sup> All other package sizes were the exclusive or most common package size prescribed by the Federal WIC food package for the respective product categories (e.g., 16 ounces of whole grains and 16 ounces of cheese). Descriptive statistics for the unit price of each category, by SA, can be found in Appendix B.

Several product categories prescribed in the WIC food package were excluded from our study either for having limited food cost implications or being outside the scope of considered cost containment policy. First, product categories or subcategories that were prescribed on the basis of dietary or medical needs (e.g., tofu, goat's milk, soy milk, evaporated milk, lactose-free milk) or were otherwise very rarely purchased (e.g., frozen juice, canned fish, infant cereal) were eliminated due to insufficient data on transactions. Second, fresh fruits and vegetables were excluded because WIC provides cash value benefits instead of quantity allowances. Hence, the maximum possible food costs in this category are fixed, and participants have a clear economic incentive to minimize the cost of their purchases. Third, several product categories with little to no variation in prices, such as eggs, were excluded. Finally, infant formula was eliminated due to the idiosyncratic nature of cost-containment policies (i.e., rebates) surrounding this category.

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<sup>11</sup> For example, if the claimed price of a given transaction was \$5.00 but the settled price was \$1.00, this transaction was excluded. Fifty-three redemptions were excluded in the Western SA and five redemptions were excluded in the Midwest SA.

<sup>12</sup> No studied SA had a rebate contract in place for infant foods at the time of this study.

## Vendor-Level Variables

Several vendor-level variables that may affect price variability were part of the data or were developed for the analysis. Even though the analysis was conducted at the transaction level, four variables were defined at the vendor level.

**WIC annual sales.** WIC annual sales are a proxy for a store's size. Stores with a higher volume of sales may have lower and less variable prices than stores with a lower volume of sales. However, non-WIC sales are unobservable in these data so we can only use WIC sales.

**Number of registers.** The number of registers in a store is another proxy for store size and is used by some SAs in our study to determine vendor peer groups. Authorized vendors were grouped into one of three size categories: small stores (1-3 registers), medium stores (4-19 registers), and large stores (20 or more registers). These cut points are obtained from Gleason and colleagues (2017), who used the same WIC EBT data to show food costs according to various peer group schemes.<sup>13</sup> Differences in WIC food costs between these three vendor groupings were statistically significant and the largest of any other considered groupings for the studied SAs. Furthermore, the number of registers may capture store size in a way that WIC annual sales does not: for example, a supermarket with 20 registers and \$100 million in annual total food sales—but a small share due to WIC—may not otherwise be well represented as “large” for our purposes.

**Rural/urban status of vendor.** Food benefit redemption prices may systematically vary between rural and urban vendors. On one hand, authorized vendors in rural areas may have higher prices than urban vendors for some product categories, due partly to relative distance from food distribution systems (Stewart and Dong, 2011; Zhang et al., 2017). On the other hand, higher costs of rental space in urban areas could mean higher food prices. In addition, rurality or urbanity could be a factor in a vendor's maximum reimbursement rate, as peer groups are mostly based on geography (although not all SAs use these or other definitions of rurality).<sup>14</sup>

The rural/urban status of a vendor was determined using WWAMI (Washington, Wyoming, Alaska, Montana, and Idaho) Rural Health Research Center Rural Urban Commuting Area (RUCA) codes, which use standardized definitions of urbanity in combination with employment commuting information to characterize all of the Nation's census tracts regarding their rural and urban status and relationships.<sup>15</sup> RUCA data, which are readily available online, were downloaded and merged with the analytic file based on vendor ZIP Code, and used to assign each vendor to one of four commonly used geographic classifications: urban, large rural, small rural, and isolated rural.<sup>16</sup> This classification was previously found to produce statistically significant differences in groups (Gleason et al., 2017).

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<sup>13</sup> These specific register cut points are not widely used by SAs and are not necessarily optimal.

<sup>14</sup> FNS may grant the SA an exemption from the requirement of basing peer groups, at least in part, on geography. Only one SA had such an exemption at the time of this study. However, the rural/urban variable still has relevance for price variability.

<sup>15</sup> WWAMI Rural Health Research Center. Rural Urban Commuting Areas.

<sup>16</sup> For this study, urban includes urbanized area cores with 50,000 or greater population; large rural includes large rural cities/towns with populations of 10,000-49,999; small rural includes small towns with populations of 2,500- 9,999; and isolated rural includes rural areas with populations less than 2,500.



**Store format of vendor.** Vendors are categorized according to the store formats used in Gleason and colleagues (2017), as described below:

“This model considers the variety and type of products offered, number of States in which the store owner operates, and the number of outlets operated by the owner.

...

For this study, information gleaned from the *Progressive Grocer’s Marketing Guidebook* (annual) was used to verify ownership, banners (specific store names), number of outlets, and States in which a vendor’s owner operates and to assign vendors to a business model store type category.”

Gleason and colleagues (2017) found this categorization scheme (table 1) to produce statistically significant differences in prices across store formats.

Table 1  
**Store formats of WIC-authorized vendors**

Format	Store names / criteria for categorizing stores
Mass merchandiser*	Retailer that sells a wide variety of merchandise, and also carries groceries, and has outlets in most or all States
Discount and limited-assortment chains†	Retailer that primarily sells a limited variety of low-cost merchandise and also carries a limited variety of food items
National grocery chain	Retailer that primarily sells groceries with outlets in most or all States (>30 States)
National drug chain‡	Pharmacy retailer that sells a limited variety of food items with outlets in most or all States (>30 States)
Regional grocery chain	Retailer that primarily sells groceries with at least 11 outlets and operates in 2 or more States
Local grocery chain	Retailer that primarily sells groceries with at least 11 outlets and operates in only 1 State
Independent grocery	Retailer that primarily sells groceries with less than 11 outlets
Regional or local drug	Pharmacy retailer that sells a limited variety of food and is not a national drug chain
Other	Island stores, remote-location stores, tribal-owned stores, general stores, specialty markets (meat, kosher, deli)
A50, WIC only	Store that derives more than 50 percent of its total annual food sales revenue from WIC food instruments
Commissary	Grocery store operated by the U.S. Defense Commissary Agency within the confines of a military installation; can qualify as any of the grocery formats
Convenience, liquor, gas stations	Retailer with a limited assortment of grocery items

Note: These store format categories and definitions are from Gleason et al. (2017). In some SAs, a pharmacy-type vendor may be authorized to transact infant formula only. WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

\* As of January 2016, only Target, K-Mart, and Walmart stores were included in this category.

†As of January 2016, only Dollar General and Dollar Tree stores were included in this category.

‡ As of January 2016, only CVS, Walgreens, Kroger Drug, and Rite Aid stores were included in this category.

## State Agency Characteristics

Table 2 describes some of the criteria governing WIC-eligible foods across SAs for several product categories. All four SAs implemented a least-cost-brand or store-brand-only policy for at least one product category, most frequently milk (three of the four SAs). The Southwest SA is perhaps the most restrictive, requiring participants to purchase the least cost brand of milk, cheese, whole grains, and juice. All four SAs allow more than whole-wheat bread loaves in the whole-grains categories, including tortillas, brown rice, and oatmeal (the Western SA accounts for oatmeal in the cereal category).

Table 2

### Select cost-containment policies governing WIC food product categories by State agency (SA)

	Midwest SA	Western SA	Southwest SA	Mountain Plains SA
Cereal		Includes oatmeal		
Milk		Least cost brand only	Least cost brand only	Store brand only
Cheese			Least cost brand only	Store brand only
Peanut butter	Store brand only			
Whole grains	Includes oatmeal, bread, tortillas, brown rice, buns	Includes bread, tortillas, brown rice	Least cost brand only, includes oatmeal, bread, tortillas, brown rice	Includes oatmeal, bread, tortillas, brown rice
Juice			Least cost brand only	

Note: Blank cells indicate multiple brands allowable. WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

Source: State agency WIC-approved food lists.

Vendors authorized by the SAs vary greatly both in terms of WIC annual sales and number of cash registers (table 3 and figure 1). While the average (May-August 2014) WIC sales per vendor was the same in the Western SA and the Southwest SA at nearly \$230,000, Midwest sales were roughly half at \$123,121. This difference reflects the large number of vendors per participant in the Midwest program—the Midwest SA has a high proportion of small vendors with one to three registers, whereas in the other three SAs, over 80 percent of vendors have more than three registers (figure 1). Average WIC sales per vendor was lowest in the Mountain Plains SA at only \$74,545, likely reflecting rurality (e.g., relatively few participants in a fixed geographic area).

Table 3

### Mean value of individual WIC-authorized vendors' WIC sales by State agency (SA), May-August 2014

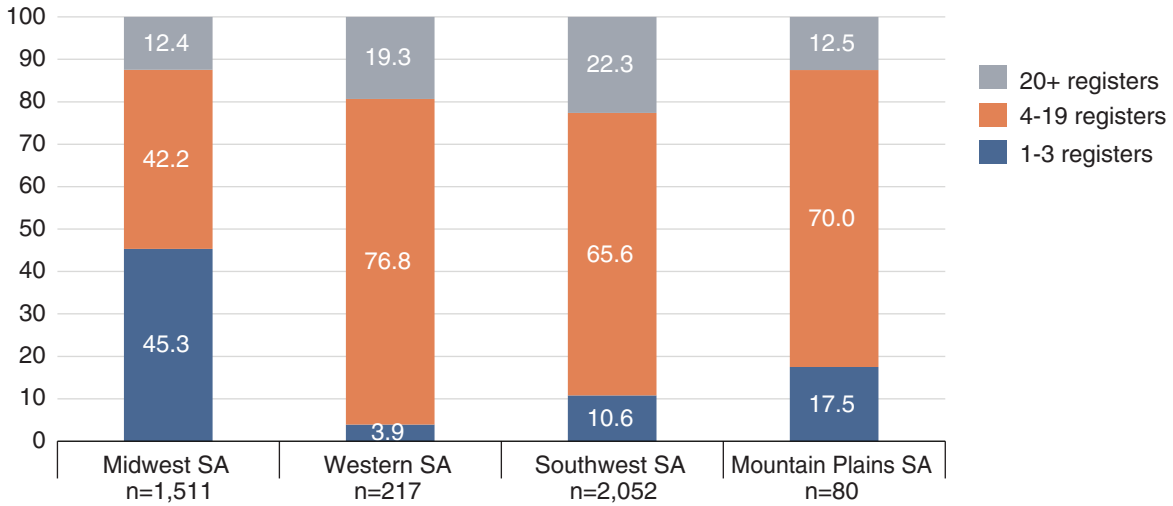
State agency (Vendors)	Mean WIC sales
Midwest SA (n=1,511)	\$123,121
Western SA (n=217)	\$227,485
Southwest SA (n=2,052)	\$229,138
Mountain Plains SA (n=80)	\$74,545

Source: State agency WIC electronic benefit redemption data.

Figure 1

**Register category (size) of WIC-authorized vendors by State agency, 2014**

Percent of vendors

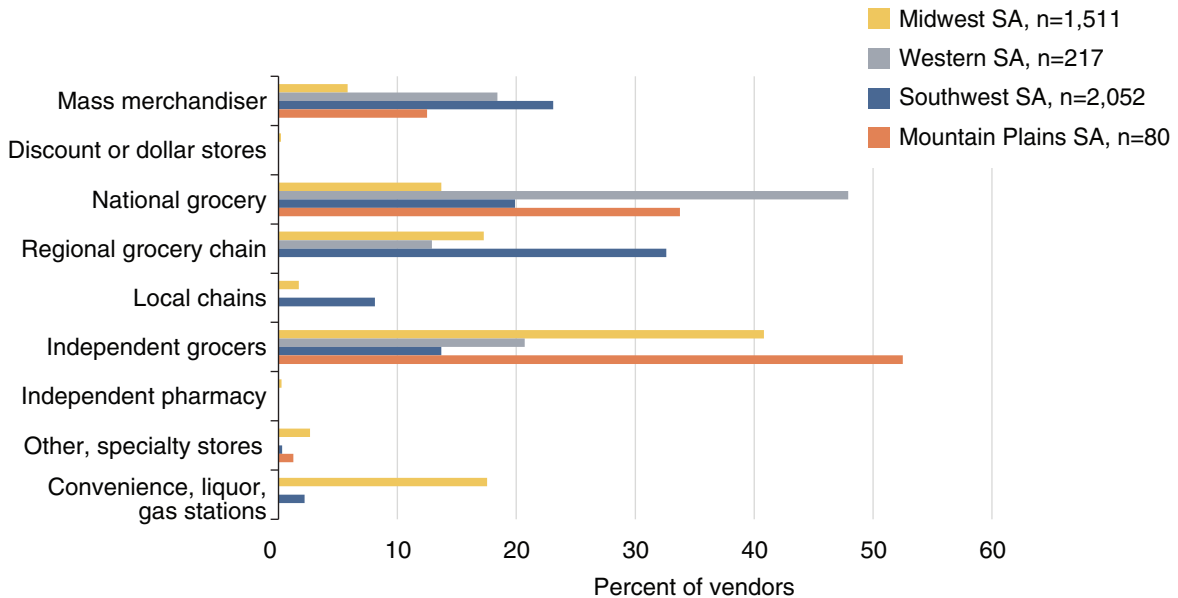


WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.  
 Source: State Agency WIC electronic benefit redemption data and authors' calculations

While most WIC vendors tend to be larger in terms of registers, there is considerable variation in terms of retail type. The Midwest SA has much more variety in terms of vendor type than the other three SAs. Only the Midwest SA has WIC-authorized independent pharmacies and discount/dollar stores, although these store types comprise a small proportion of its vendor population. Additionally, more than 15 percent of authorized vendors in the Midwest SA are convenience stores, whereas the Western and Mountain Plains SAs have no authorized convenience stores. Pharmacies, discount/dollar stores, and convenience stores generally have one to three registers, which helps to explain size differences observed between vendor populations in the Midwest SA and the other SAs.

Figure 2

**Retail type of WIC-authorized vendors by State agency (SA), 2014**



WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.  
 Source: State Agency WIC electronic benefit redemption data and authors' calculations

In contrast, the other SAs have a relatively homogeneous vendor portfolio. Nearly half of vendors authorized by the Western SA are part of national grocery chains; these vendors, along with independent/regional grocers and mass merchandisers, comprise the Western SA's vendor population. The Mountain Plains SA has the highest proportion of independent grocers.

By geographic location, more than 26 percent of vendors authorized by the Mountain Plains SA are in isolated areas, with 19 percent in urban areas (table 4). This is in stark contrast to the other three State agencies, where at least 75 percent of authorized vendors are in urban areas.

Table 4

**Geographic distribution of WIC vendors by State agency, 2014**

	Midwest SA n=1,511	Western SA n=217	Southwest SA n=2,052	Mountain Plains SA n=80
Urban	75.4%	86.2%	88.2%	18.8%
Large rural	9.5%	9.7%	5.0%	28.8%
Small rural	6.8%	3.2%	4.3%	26.3%
Isolated	8.3%	0.9%	2.5%	26.3%

SA = State agency. WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

Source: State Agency WIC electronic benefit redemption data and WWAMI (Washington, Wyoming, Alaska, Montana, and Idaho) Rural Health Research Center Rural Urban Commuting Area (RUCA) codes.



## Price Variability by State Agency and Product Category

To investigate potential reductions in WIC food costs, natural candidates for study include product categories with frequent purchases or a high share of WIC sales. However, frequently purchased items may represent a low share of food costs if their transaction prices are low. For most product categories, the share of WIC sales was similar to the (share of) number of redeemed items in terms of ranking, and this was consistent across SAs (table 5). For instance, reduced-fat milk comprised the highest percentage of sales (18.7-21.1 percent) and number of items redeemed (13.6-26.7 percent) in 2014. However, this characterization did not fully apply to all product categories. For example, infant fruits and vegetables ranked second or third in terms of the number of items redeemed across all SAs, but were among the least costly in terms of sales shares. WIC participants are allocated a large number of infant fruit/vegetable containers per month, but the price per unit is lower than for other food categories. Based on share of sales, the largest potential savings if any are to be found—across all four SAs—may come from reduced-fat milk, cereal, juice, and cheese.

Table 5

**Share of WIC sales (total dollars) and total items purchased of select WIC food product categories by State agency (SA), 2014**

	Midwest SA		Western SA		Southwest SA		Mountain Plains SA	
	% of total dollars	% of total items	% of total dollars	% of total items	% of total dollars	% of total items	% of total dollars	% of total items
Reduced-fat milk (gallon)	18.9	15.8	21.1	15.8	18.7	13.6	19.0	26.7
Cereal	15.2	11.8	16.2	12.8	15.7	12.1	15.2	10.7
Juice (bottle)	14.8	14.7	10.2	9.5	12.4	13.5	14.8	7.4
Cheese	14.3	8.4	11.9	8.4	13.1	8.5	14.3	3.8
Whole grains	8.4	8.6	9.9	8.2	5.2	8.0	8.4	5.8
Infant fruits and vegetables	7.2	13.2	6.5	13.8	7.7	13.0	7.2	11.7
Whole milk (gallon)	5.3	4.9	5.6	4.8	4.7	3.9	5.3	4.8
Peanut butter	3.9	4.6	3.0	3.5	1.9	2.3	3.9	4.2

Note: WIC = Special Supplemental Nutrition Program for Women, Infants, and Children. The grouping “select WIC food product categories” includes the top eight WIC food categories allowed by WIC except the following: infant formula and fruits and vegetables. Product categories outside of the top eight are not listed.

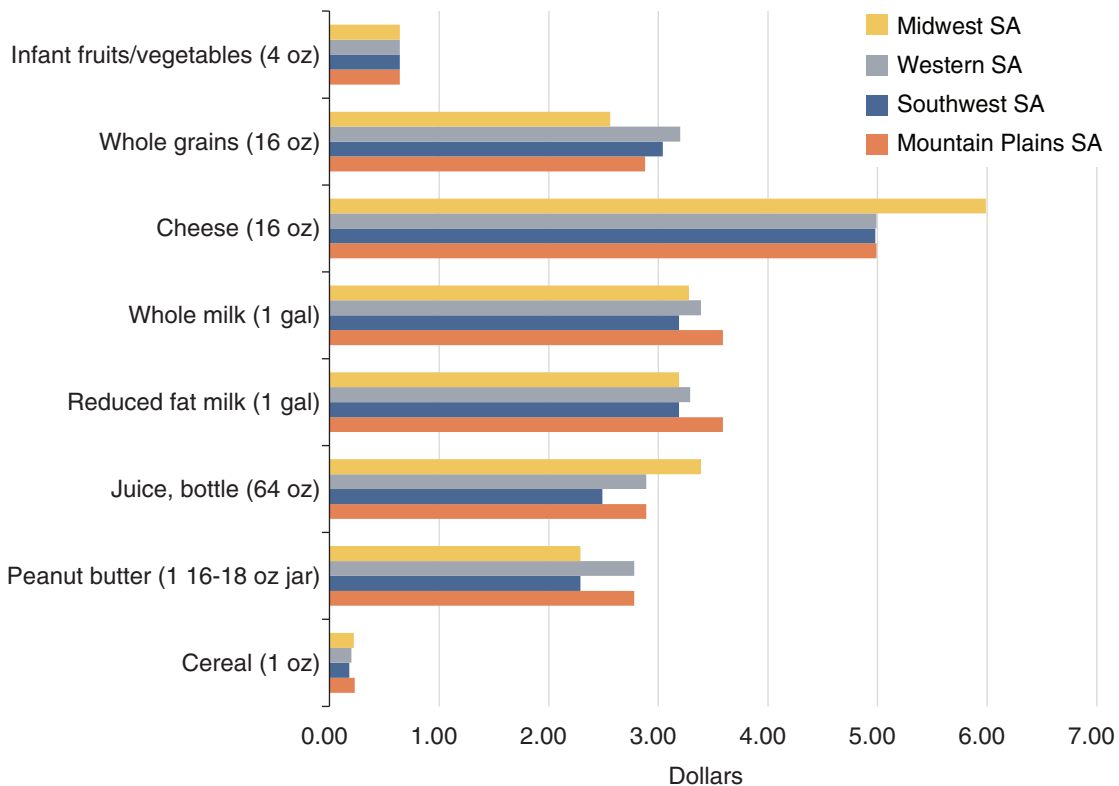
Source: State agency WIC electronic benefit redemption data.

Figure 3 presents the median transaction price by SA and product category; the median is chosen to guard against the potential influence of outliers on the mean. The median requested prices varied little across SAs for most categories, with several notable differences. For example, WIC transactions in the Midwest SA had slightly higher median cheese and bottled juice prices than in other SAs, and slightly lower whole-grain prices. Median milk transaction prices were slightly higher in the Mountain Plains SA. However, these data do not attribute differences to any specific factor (e.g., it could simply reflect regional food prices).

Nevertheless, the *variability* of prices—as measured by the interquartile range divided by the median (IQR/M; that is, the difference between the third and first quartile of observed prices divided by the median price for a given store format and SA, see box)—appears to differ substantially across SAs. Despite essentially identical median prices for infant fruit/vegetable redemptions, the Mountain Plains SA recorded much greater price variation than in other SAs (e.g., the IQR/M of the Mountain Plains SA was more than double that of all other SAs in 2014). Further, whole-grain transaction prices in the Southwest and Mountain Plains SAs were much more varied than in the Midwest and Western SAs. Some product categories appear to have more variation than others, as well, with ready-to-eat breakfast cereal having the highest IQR/M measures.

Figure 3

**Median offered price of WIC food items by product category and State agency (SA), 2014**



WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.  
 Source: State agency WIC electronic benefit redemption data.

The relationship between price variance and the types of food items SAs allow for WIC purchase is likely complex. On one hand, a high IQR/M may reflect an SA allowing a variety of choices—for example, a low-cost private labeled item (e.g., store brand) alongside costlier national brands—for a given product category. On the other hand, SAs imposing a “least-cost” brand restriction on a product category may also see high variation in prices. For example, the Southwest SA has a least-cost brand restriction for milk, yet it had the second highest IQR/M for this category among SAs. In another example, only the Midwest SA had a store-brand restriction for peanut butter, yet it had the highest IQR/M for peanut butter prices in 2014.

## Calculating the Interquartile Range Divided by the Median (IQR/M)

The IQR/M is a quartile coefficient of dispersion, calculated as follows:

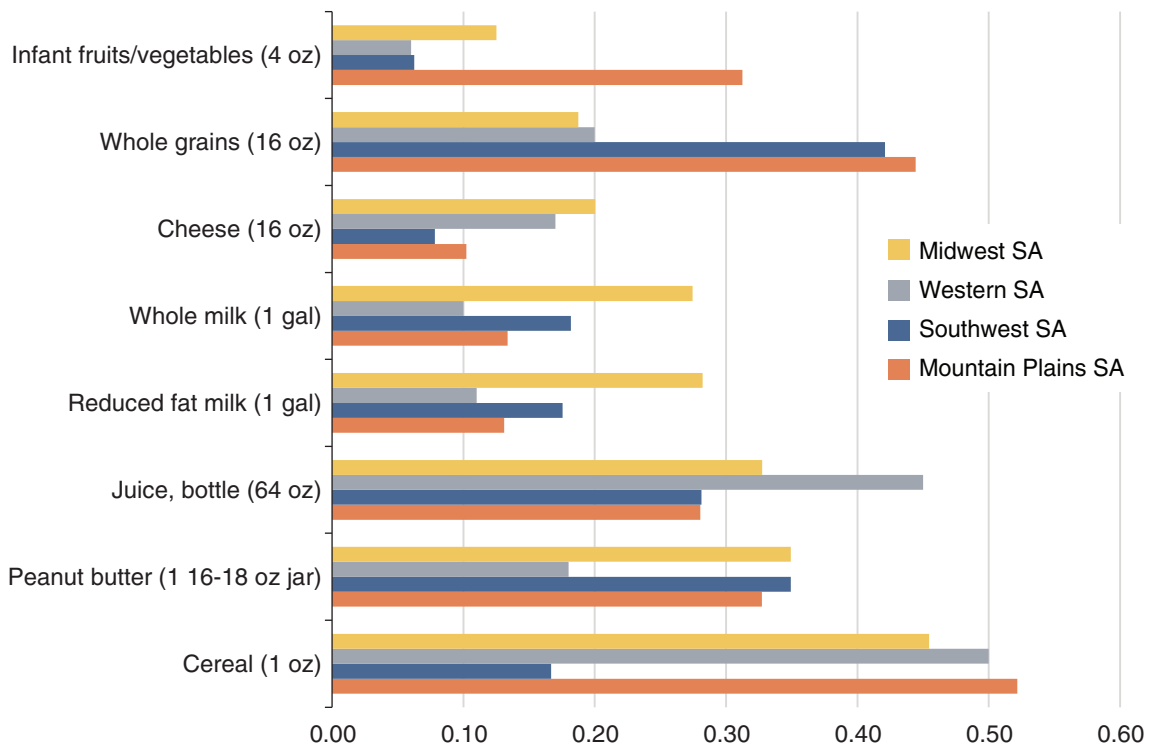
$$\text{IQR/M} = \frac{Q_3 - Q_1}{\text{Median}}$$

where  $Q_1$ ,  $Q_3$ , and *Median* refer to the 25<sup>th</sup> percentile (first quartile), 75<sup>th</sup> percentile (third quartile), and median of a set of requested transaction prices. For example, the IQR/M could be computed for the transaction prices of all vendors or supermarkets belonging to a given State agency.

This provides a unitless measure that allows comparisons of price variability across distributions with different means and/or units. In addition, it is consistent with our definition of “highest price” transactions in this report: that is, the price of the transaction is in the top quartile of unique prices among other vendors of the same store format and SA.

Figure 4

### Price variability (IQR/M) of WIC food items by product category and State agency (SA), 2014



The measure IQR/M is defined as the interquartile range divided by the median of food benefit prices for a given product category and SA. WIC = Special Supplemental Nutrition Program for Women, Infants, and Children. Source: State agency WIC electronic benefit redemption data.

## Highest-Price Eligible Items

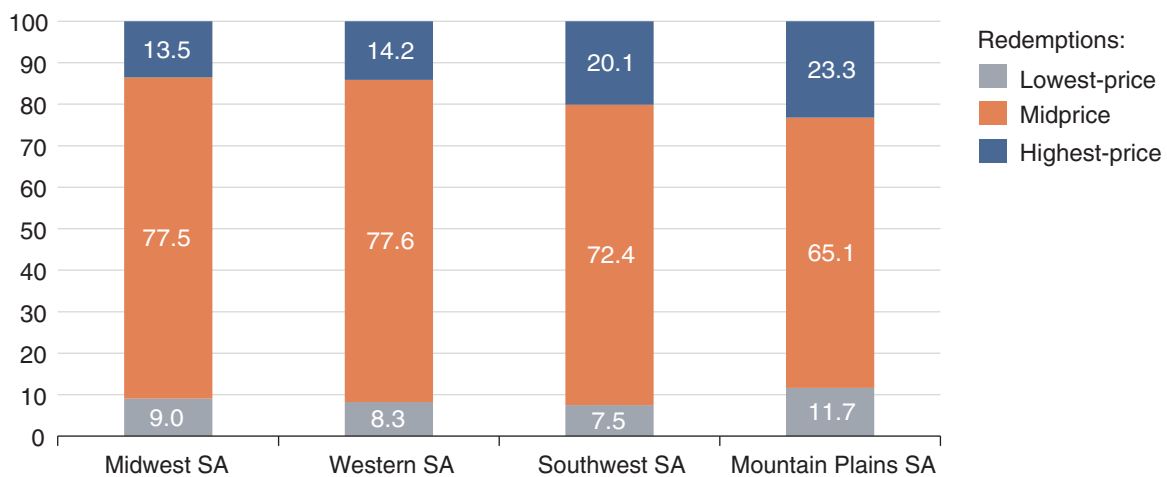
Without an explicit economic incentive to be cost conscious, we might expect WIC participants to choose the more expensive allowed items when redeeming their benefits (Dong et al., 2016). To determine the extent to which this happens, we characterized each WIC transaction as “highest-price,” “lowest-price,” or neither. A transaction is highest-price when the price at a given vendor is in the top quartile of unique prices among other vendors of the same store format and SA. Likewise, lowest-price transactions are in the bottom quartile of unique prices specific to store format and SA.

Figure 5 summarizes by SA the unadjusted frequencies with which transactions fell in the highest- and lowest-price delineations. Overall and across all WIC food categories, 65.1 to 77.6 percent of all transactions fell in the midrange. The Mountain Plains SA had the greatest proportion of both highest-price (23.3 percent) and lowest-price (11.7 percent) purchases. The Midwest SA had the smallest proportion of transactions identified as highest-price (13.5 percent) and the Southwest SA had the smallest proportion of lowest-price items purchased (7.5 percent).

Figure 5

### Share of WIC transactions in the highest-, mid-, and lowest-price ranges by State agency (SA), 2014

Percent of purchases



Note: A transaction value is deemed highest-price (lowest-price) if the value of the transaction made by a given vendor is in the top (bottom) quartile of prices among other vendors of the same store format and SA.

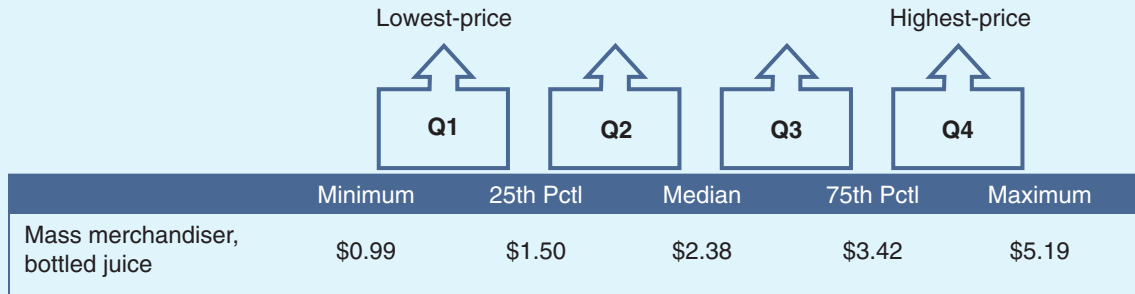
WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

Source: State Agency WIC electronic benefit redemption data.



## Determination of Highest- or Lowest-Price Status of a Transaction

**Example:** If a participant is shopping in a mass merchandiser (e.g., Target) and purchases a bottle of juice for \$3.75, he or she has selected an item that is in the most expensive quartile of available prices since it is between \$3.42 and \$5.19; hence, this item will be categorized as “highest-price.”

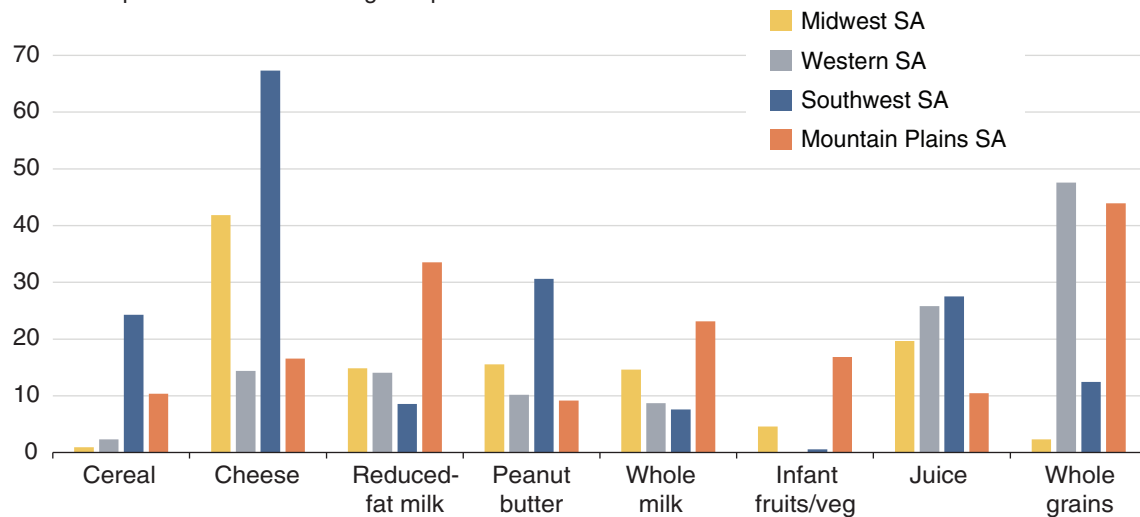


When examined separately for each WIC food category, the frequency of highest-price transactions varied substantially, although it was a relatively infrequent occurrence in most cases (figure 6). The Southwest SA had a higher frequency of highest-price redemptions in many product categories compared to all other SAs. For example, nearly 70 percent of transactions in the cheese category were identified as highest-price in 2014. This likely reflects limited variation in the minimum prices of cheese in authorized WIC vendors in combination with the use of least-cost brand policies for cheese by the Southwest SA. That is, if most prices of cheese are roughly the same, then a substantial portion of them being “highest-price” is expected.

Figure 6

### Share of purchases that were highest-price by food product category and State agency (SA), 2014

Percent of purchases that were highest-price\*



Note: A transaction value is deemed highest-price if the value of the redemption transaction made by a given vendor is in the top quartile of prices among other vendors of the same store format and SA. WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

Source: State agency WIC electronic benefit redemption data.

## Price Variability by Store Format

Transaction prices were expected to systematically vary by type of WIC vendor as a result of differing incentives across store formats in stocking WIC-eligible items and pricing. In many product categories, mass merchandisers and national chains are likely to charge lower prices than do smaller retailers for the same WIC-eligible item, regardless of whether they are authorized to accept WIC. Larger retailers tend to have preferential buying agreements with wholesalers and advanced inventory/procurement networks, conferring cost advantages. Smaller WIC vendors lacking such advantages are often allowed to request higher reimbursements from the State agency. Supermarkets (e.g., national, regional, and local chains) carry, on average, nearly 40,000 unique products (Food Marketing Institute, 2017), which likely include multiple WIC-eligible items for a given product category (when allowed). By contrast, smaller vendors with scarce shelf space may choose to stock only those products yielding the most WIC customers at the highest profit margin. This would account for higher average prices among smaller vendors. However, the incentives faced within specific product categories may be highly complex, and prices may vary by retail product category in surprising ways.

To examine the relationship between prices and store format, we estimated the following regression model for a given product category:

$$R_{ijk}^s = a_s + \sum_{l=2}^{L^s} b_k^l retail_{il}^s + X_i^s + e_{ijk}^s \quad (1)$$

where  $R_{ijk}^s$  is the price of the  $j^{\text{th}}$  observed WIC benefit transaction of a food item in product category  $k$  at vendor  $i$  authorized in a given SA denoted by  $s$ . The core variables of interest are  $retail_{il}^s$ , which are binary variables indicating vendor  $i$ 's store format. In general, these store formats include subchannels of traditional grocers and different subchannels of smaller and nontraditional vendors (see table 1). Mass merchandisers are excluded from the channels represented in  $retail_{il}^s$  to avoid perfect multicollinearity. Thus,  $b_{kl}^s$  is interpreted as the SA-specific estimated average difference in transaction price in product category  $k$  (taking place at vendors belonging to store format  $l$ ) compared to mass merchandisers' redemption prices.

In addition, equation 1 includes several control variables (represented by the vector  $X_i$ ) that may be related to the reimbursements paid to vendors and are likely to be correlated with store format. The choice of control variables follows modelling choices that were shown to have statistically significant relationships with WIC prices in related work. For example, we include a variable representing the number of cash registers a vendor has; Saitone and colleagues (2014) demonstrated that the price of a food bundle varies with the number of cash registers owned by a vendor in one SA. Similarly, we include the level of annual WIC sales by a vendor since this likely correlates with the number of registers, which is itself a proxy for total (WIC and non-WIC) sales. At least one SA in this study uses annual WIC sales to determine vendors' reimbursement peer groups. The last control variable we include is a binary variable indicating whether the census tract of the vendor is rural or urban. Zhang and colleagues (2017) demonstrate that the sign of the difference in WIC prices between rural and urban areas may depend on the WIC product category. Finally,  $e_{ijk}^s$  is an idiosyncratic error term that represents deviations in  $R_{ijk}^s$  that are unexplained by store format or controls.

While the transaction prices of various product categories differ by store format, the net impact of vendor type on food costs depends on the total value of the WIC foods redeemed. To examine the

differences in overall food costs by store format, we used the coefficient estimates of equation 1 to simulate average differences (by store format) in the cost of a participant redeeming a food basket made up of the studied food categories (see appendix 1) in quantities allowed by the various WIC food packages (see box, “Example of Calculating Food Basket Average Price Difference Compared to Mass Merchandisers”). In particular, we use the estimated coefficients to compute the average difference in food basket cost compared to mass merchandisers across vendor types, hypothetically assuming that all prescribed items in the basket were redeemed at the given store format.

### Example of Calculating Food Basket Average Price Difference Compared to Mass Merchandisers

Consider the child package, which provides 128 fluid ounces of juice, 16 quarts of reduced-fat milk, 36 ounces of breakfast cereal, 2 pounds of whole wheat bread, and 1 16-18 ounce jar of peanut butter. The average price difference compared to mass merchandisers is calculated as

$$\bar{R}_{\text{supermarket}}^s = 128 \times \hat{\beta}_{\text{juice}}^{\text{supermarket}} + 4 \times \hat{\beta}_{\text{rf-milk}}^{\text{supermarket}} + 36 \times \hat{\beta}_{\text{cereal}}^{\text{supermarket}} + 2 \times \hat{\beta}_{\text{bread}}^{\text{supermarket}} + 1 \times \hat{\beta}_{\text{pb}}^{\text{supermarket}}$$

where each  $\hat{\beta}_k^{\text{supermarket}}$  is the estimated average difference in price of product category  $k$  for supermarkets compared to mass merchandisers. Note that each of these estimated coefficients comes from each individually estimated regression model specific to each product category.

Standard errors for  $\bar{R}_{\text{supermarket}}^s$  are computed as  $[V\{\bar{R}_{\text{supermarket}}^s\}]^{\frac{1}{2}}$ , where  $V\{\bar{R}_{\text{supermarket}}^s\}$  is computed using the following equation:

$$V\{\bar{R}_{\text{supermarket}}^s\} = 16384 \times V\{\hat{\beta}_{\text{juice}}^{\text{supermarket}}\} + 16 \times V\{\hat{\beta}_{\text{rf-milk}}^{\text{supermarket}}\} + 1296 \times V\{\hat{\beta}_{\text{cereal}}^{\text{supermarket}}\} \\ + 4 \times V\{\hat{\beta}_{\text{bread}}^{\text{supermarket}}\} + 1 \times V\{\hat{\beta}_{\text{pb}}^{\text{supermarket}}\}.$$

Note that zero covariance between estimated coefficients is implicitly assumed by the modeling approach that estimates equation 1 for each product category.

### Traditional Grocers

For traditional grocer vendors, transaction prices in many individual product categories were no greater than those of mass merchandisers in three of the four State agencies (table 6). For example, among these three SAs (all but Mountain Plains), the largest difference in cereal price compared to mass merchandisers was \$0.05 per ounce, amounting to roughly 22 percent of the respective SA mean (i.e., \$0.23 per ounce in the Southwest SA). Many of the other differences in cereal prices among traditional grocers were smaller, at 5 percent or less of the mean. This is also true of cheese, peanut butter, infant fruits and vegetables, and whole grains, with several exceptions occurring for smaller vendors (e.g., for independent grocers’ peanut butter in the Midwest SA).

However, traditional grocers appear to differ from mass merchandisers in several key ways. First, traditional grocers’ reduced-fat milk transaction prices were substantially (up to 91 cents/gallon) lower; this is similarly observed for whole milk. One explanation is that traditional grocers more often engage in “loss-leading” (i.e., selling at reduced profit margins or even below cost) for milk products in order to attract customers (Maynard, 2000).

Table 6

**Traditional grocers' estimated average difference in price (compared with mass merchandisers) for WIC product categories by vendor type and State agency (SA), 2014**

		Cereal, 1 oz	Cheese, 1 lb.	RF milk, gallon	Peanut butter	Whole milk, gallon	Infant F/V, 4 oz	Bottled Juice	Whole grains, 16 oz
Midwest SA	Store type								
	National chains	-\$0.01*	\$0.58*	-\$0.79*	-\$0.07*	-\$0.95*	-\$0.05*	-\$0.29*	-\$0.27*
	Regional chains	\$0.00*	\$0.35*	-\$0.46*	\$0.11*	-\$0.53*	\$0.01*	-\$0.02*	\$0.02*
	Local chains	-\$0.01*	\$0.31*	-\$0.76*	\$0.05*	-\$0.97*	\$0.01*	-\$0.06*	-\$0.16*
	Independent grocers	\$0.05*	\$0.45*	-\$0.05*	\$0.62*	-\$0.14*	\$0.18*	\$0.65*	\$0.17*
Western SA	Store type								
	National chains	-\$0.03*	-\$0.56*	-\$0.91*	-\$0.28*	-\$0.85*	-\$0.11*	-\$1.31*	-\$0.43*
	Regional chains	-\$0.02*	-\$0.82*	-\$0.38*	-\$0.08*	-\$0.32*	-\$0.03*	-\$0.31*	-\$0.51*
	Independent grocer	< -\$0.01	-\$0.76*	-\$0.55*	\$0.16*	-\$0.45*	\$0.02*	-\$0.53*	-\$0.39*
Southwest SA	Store type								
	National chains	\$0.02*	-\$0.37*	-\$0.42*	\$0.19*	-\$0.42*	-\$0.01*	\$0.27*	\$0.52*
	Regional chains	< \$0.01	-\$0.11*	-\$0.43*	-\$0.03*	-\$0.41*	-\$0.02*	\$0.11*	-\$0.16*
	Local chains	\$0.03*	-\$0.43*	-\$0.35*	\$0.27*	-\$0.35*	\$0.05*	\$0.16*	\$0.63*
	Independent grocers	\$0.02*	-\$0.32*	\$0.11*	\$0.20*	\$0.11*	\$0.07*	\$0.31*	\$0.06*
Mountain Plains SA	Store type								
	National chains	\$0.06*	\$0.26*	\$0.36*	\$0.70*	\$0.31*	\$0.07*	\$0.29*	\$0.07*
	Independent grocer	\$0.08*	\$0.56*	\$0.48*	\$0.60*	\$0.66*	\$0.12*	\$0.60*	\$0.03

Note: WIC = Special Supplemental Nutrition Program for Women, Infants, and Children. RF = reduced fat. F/V = fruits/vegetables. \* = statistical significance at the 95% confidence level. Coefficient estimates are from a series of multivariate linear regression models with food category as the dependent variable (mass merchandisers serve as the reference category) and adjusted for WIC annual sales, number of registers, and geographic location (rural versus urban).

Source: State agency WIC electronic benefit redemption data and WWAMI Rural Health Research Center Rural Urban Commuting Area (RUCA) codes.

Second, the bottled juice category exhibited substantial variability. For example, mean transaction prices differed by as much as \$1 among traditional grocers in the Midwest SA, where juice transactions averaged \$3.52 per 64-ounce bottle SA-wide. The Western and Mountain Plains SAs also exhibited wide variance in juice prices among traditional grocers. In contrast, variation in juice prices was relatively low in the Southwest SA, although these values are higher than the mass merchandisers' prices by 5-10 percent on average. The Southwest was the only SA to require WIC recipients to buy the least-cost juice brand. While the effect of this policy on juice stocking and pricing decisions among traditional vendors in the Southwest is unclear, participants in the other SAs tended to choose more expensive allowed brands of juice.

Finally, traditional grocers in the Mountain Plains SA tended to have higher transaction prices compared to mass merchandisers, in contrast to observed relationships for all other SAs. For

example, cereal prices were \$0.06-\$0.08 higher per ounce at traditional grocers, or 25 to 33 percent more than the SA-wide mean. Similar differences were found across most product categories, including reduced-fat milk, the product category for which traditional grocers had substantially lower transaction prices in all other SAs. An immediate explanation for this discrepancy is not clear. On one hand, the Mountain Plains SA set MARLs at one standard deviation above the peer group average, where each store format effectively comprises its own peer group. Therefore, traditional grocers may have been subjected to higher MARLs because their prices likely varied more, partly because they are more likely to engage in price promotions than are mass merchandisers (Hoch et al., 1994). On the other hand, grocers that likely had a significant non-WIC (i.e., price-sensitive) customer base lack a clear incentive to charge higher prices for WIC-eligible items. However, such an incentive would exist if WIC participants were the primary purchasers of specific brands.<sup>17</sup>

In many cases, traditional grocers have lower prices for WIC-approved food baskets (table 7). This may be explained by variation across store formats in the transaction price of milk, which was significantly lower at traditional grocers (table 6). Reduced-fat milk is allotted in large quantities in the WIC food packages for women and children; as such, it was the most widely purchased product category among those studied (table 5). Therefore, significant differences in milk prices are likely to correspond to large differences in the prices of food baskets when all other prices are similar. As further evidence, differences in the prices charged by traditional grocers and mass merchandisers for the infant-tailored food basket (II-BF) are statistically insignificant in most cases. This food basket is largely composed of infant fruits and vegetables, for which traditional grocers and mass merchandisers charge similar prices.

Table 7

**Traditional grocers' estimated average difference in price of WIC food baskets (compared to mass merchandiser) by State agency (SA)**

		Food package types				
		Infant II-BF	Child IV	Women V	Women VI	Women VII
Midwest SA	<b>Store type</b>	Average partial package differential relative to mass merchandisers				
	National chains	-\$3.20*	-\$4.71*	-\$5.70*	-\$4.03*	-\$5.51*
	Regional chains	\$0.64	-\$1.73*	-\$2.45*	-\$1.76*	-\$2.33*
	Local chains	\$0.64	-\$3.79*	-\$4.79*	-\$3.44*	-\$4.86*
	Independent grocers	\$11.52*	\$3.86*	\$3.78*	\$3.20*	\$4.20*
	SA-wide partial package value					
	Mean	\$42.24	\$37.38	\$40.80	\$30.14	\$48.58

—continued

<sup>17</sup> Another consideration may be the rurality of the Mountain Plains SA: over 80 percent of vendors are in rural or isolated areas whereas the overwhelming majority of vendors in the other SAs are urban. However, we observe no clear differences in rurality by store format in the Mountain Plains SA.

Table 7

**Traditional grocers' estimated average difference in price of WIC food baskets (compared to mass merchandiser) by State agency (SA)—continued**

	Store type	Average partial package differential relative to mass merchandisers				
Western SA	National chains	-\$1.92	-\$7.68*	-\$9.34*	-\$6.97*	-\$10.36*
	Regional chains	-\$0.64	-\$3.00*	-\$3.62*	-\$2.79*	-\$4.63*
	Independent grocer	\$0.64	-\$3.14*	-\$4.08*	-\$2.84*	-\$5.11*
	SA-wide partial package value					
	Mean	\$40.96	\$36.98	\$39.80	\$29.20	\$46.53
Southwest SA	Store type	Average partial package differential relative to mass merchandisers				
	National chains	-\$0.64	\$0.81*	-\$0.27	-\$0.37*	-\$0.85*
	Regional chains	-\$1.28*	-\$1.85*	-\$2.31*	-\$1.59*	-\$2.63*
	Local chains	\$3.20*	\$1.53*	\$0.42*	\$0.19	-\$0.19
	Independent grocers	\$4.48*	\$2.10*	\$2.28*	\$1.83*	\$2.02*
	SA-wide partial package value					
	Mean	\$39.68	\$33.40	\$35.82	\$25.85	\$42.16
Mountain Plains SA	Store type	Average partial package differential relative to mass merchandisers				
	National chains	\$4.48*	\$5.02*	\$5.56*	\$4.74*	\$6.00*
	Independent grocer	\$7.68*	\$6.60*	\$7.47*	\$6.30*	\$8.27*
	SA-wide partial package value					
	Mean	\$44.80	\$38.12	\$41.59	\$30.93	\$48.67

Note: WIC = Special Supplemental Nutrition Program for Women, Infants, and Children. \* = statistical significance at the 95% confidence level. The average partial package differential value relative to mass merchandisers is computed using the regression estimates of table 6, where the total quantities per standardized unit allocated by the Federal WIC food package are multiplied by the respective estimated coefficients. Infant (II-BF) refers to the fully breastfed infant package conferred to the infant at ages 6-11 months. See Appendix A for prescribed food items under the other package types.

Source: Estimated coefficients of average differences in transaction prices compared to mass merchandisers (see table 6).

## Small and Nontraditional Food Retailers

Small and nontraditional retailers (e.g., convenience/liquor/gas stations, other/specialty stores, independent pharmacies) were authorized to redeem WIC benefits in all but the Western SA. As expected, this grouping of vendors tended to have higher transaction prices, although the extent varied by product category and SA (table 8). For example, 1 pound of cheese was roughly \$1 more costly at small and nontraditional food retailers compared to mass merchandisers in the Midwestern SA, but \$0.28-0.50 cheaper in the Southwest SAs.<sup>18</sup>

<sup>18</sup> Insufficient cheese redemptions were observed for other/specialty stores in the Mountain Plains SA.



Table 8

**Small and nontraditional vendors' estimated average difference in prices for WIC product categories (compared to mass merchandisers) by store format and State agency (SA), 2014**

		Cereal, 1 oz	Cheese, 1 lb.	RF milk, gallon	Peanut butter	Whole milk, gallon	Infant F/V, 4 oz	Bottled Juice	Whole grains, 16 oz
Midwest SA	<b>Store type</b>								
	Discount stores	\$0.07*	\$1.35*	-\$0.21*	\$1.03*	-\$0.48*	\$0.35*	\$0.94*	\$0.19*
	Independent pharmacy	\$0.06*	-\$0.80*	-\$0.23*	\$0.27*	\$0.13*	\$0.31*	\$0.81*	\$0.34*
	Other/Specialty stores	\$0.09*	\$0.94*	\$0.63*	\$0.92*	\$0.51*	\$0.31*	\$1.03*	\$0.09*
	Convenience/Liquor/ Gas stations	\$0.10*	\$1.02*	\$0.20*	\$1.32*	\$0.12*	\$0.39*	\$1.14*	\$0.36*
Southwest SA	<b>Store type</b>								
	Other/Specialty stores	\$0.02*	-\$0.50*	\$0.21*	\$0.43*	\$0.21*	\$0.08*	\$0.39*	\$0.07*
	Convenience/Liquor/ Gas stations	-\$0.01*	-\$0.28*	\$0.15*	\$0.10*	\$0.19*	\$0.05*	\$0.29*	-\$0.28*
Mountain Plains SA	<b>Store type</b>								
	Other/Specialty stores	-	-	\$0.77*	-	\$0.90*	-\$0.03	-\$1.25	-

Note: WIC = Special Supplemental Nutrition Program for Women, Infants, and Children. \* = statistical significance at the 95% confidence level. RF = reduced fat. F/V = fruits/vegetables. Coefficients from a series of multivariate linear regression models with food category as the dependent variable and adjusted for WIC annual sales, number of registers, and geographic location. Cells with a "-" indicate insufficient data in the category for analysis. Only the Midwest, Southwest, and Mountain Plains SAs authorized small and nontraditional vendors to redeem WIC benefits in 2014.

Source: State Agency WIC electronic benefit redemption data and WWAMI Rural Health Research Center Rural Urban Commuting Area (RUCA) codes.

Cereal transactions had significantly higher prices at these smaller vendors in the Midwest SA compared to mass merchandisers (\$0.06-0.10 more per ounce). However, cereal prices among small/nontraditional food retailers and mass merchandisers were similar in the Southwest SA. One explanation for this apparent discrepancy may be that the Southwest SA requires WIC participants to buy 18-ounce boxes, while the Midwest SA allows smaller boxes that may cost more per ounce.

Prices of reduced-fat milk were only modestly higher at convenience-type retailers (i.e., convenience/liquor/gas stations) than mass merchandisers. Many Americans may actually purchase milk at convenience-type retailers on a regular basis and thus prices may be more competitive than otherwise expected. For example, Dong and Stewart (2012) found that households headed by employed women had a high likelihood of patronizing convenience-type stores as their primary store for acquiring milk. This demographic may encompass some women participating in WIC, who may prefer to purchase milk at nontraditional vendors. In contrast, reduced-fat milk was significantly more expensive at other small and nontraditional retailers than at mass merchandisers in the Midwest SA.

Small and nontraditional food retailers tended to have the highest WIC food basket costs (table 9), although the degree to which they did varied by SA and food basket. Some price differences

were large; transactions by Midwest SA convenience/liquor/gas stations in the partial infant (II-BF) package averaged \$25 more than at mass merchandisers. This differential is nearly 60 percent of the mean redemption value of this food bundle (\$42.24). These high costs were driven by the predominance of infant fruits and vegetables in the infant basket, as convenience/liquor/gas stations had the highest cost in their SA for these items. The food basket price differentials of small and nontraditional vendors for other product categories, though positive, were not as large as for infant fruits/vegetables.

Table 9

**Small and nontraditional vendors' estimated average difference in price for WIC food baskets (compared to mass merchandisers) by store format and State agency (SA), 2014**

		Food package types				
		Infant II-BF	Child IV	Women V	Women VI	Women VII
Midwest SA	Store type	Average partial package differential relative to mass merchandisers				
	Discount stores	\$22.40*	\$4.97*	\$4.70*	\$4.12*	\$5.95*
	Independent pharmacy	\$19.84*	\$3.81*	\$3.33*	\$2.73*	\$2.41*
	Other/Specialty stores	\$19.84*	\$8.92*	\$10.03*	\$8.23*	\$11.29*
	Convenience/Liquor/Gas stations	\$24.96*	\$8.72*	\$8.95*	\$7.43*	\$10.07*
	SA-wide partial package value					
	Mean	\$42.24	\$37.38	\$40.80	\$30.14	\$48.58
Southwest SA	Store type	Average partial package differential relative to mass merchandisers				
	Other/Specialty stores	\$5.12*	\$2.91*	\$3.25*	\$2.58*	\$2.86*
	Convenience/Liquor/Gas stations	\$3.20*	\$0.36	\$0.94*	\$0.78*	\$0.73*
	SA-wide partial package value					
	Mean	\$39.68	\$33.40	\$35.82	\$25.85	\$42.16

Note: \*indicates statistical significance at the 95% confidence level. The average partial package differential value relative to mass merchandisers is computed using the regression estimates of table 8, where the total quantities per standardized unit allocated by the Federal WIC food package are multiplied by the respective estimated coefficients. Note that Infant (II-BF) refers to the fully breastfed infant package conferred to the infant at age 6-11 months. Only the Midwest and Southwest SAs authorized small and nontraditional vendors where such vendors had a significant number of redemptions in all studied product categories.

Source: Estimated coefficients of average differences in transaction prices compared to mass merchandisers (see table 8).

Small and nontraditional food retailers in the Southwest SA, on the other hand, did not appear to have significantly higher food basket costs when compared to those in the Midwest SA. The highest average food basket differential of any small and nontraditional vendor authorized by the Southwest SA was slightly over \$5 (other/specialty stores for the infant (II-BF) package), whereas the highest average differential in the Midwest SA was \$25. This discrepancy is large, especially since the mean price of this food basket cost in the Midwest SA was only \$2 higher.

In other cases, small and nontraditional vendors authorized by the Southwest SA are among the most cost competitive. For example, the average cost differentials (compared with mass merchandisers) for convenience/liquor/gas stations in all food baskets except for the infant (II-BF) ranged from \$0.36 to \$0.94. Yet the average food basket cost differentials of mass merchandisers compared to regional chains (i.e., the differentials reported in table 7 multiplied by -1) ranged from \$1.59 to \$2.63. In other words, mass merchandisers' prices were more similar to costlier convenience-type stores than to regional grocery chains.

*In Short...*

In line with conventional economic wisdom, WIC vendors in larger store formats (e.g., mass merchandisers) tended to have lower prices per unit compared to small and nontraditional food retailers (e.g., convenience/liquor/gas stations) for multiple product categories. However, the strength of this relationship was highly variable across product categories and store formats. Traditional grocers and mass merchandisers had similar transaction prices in most product categories. However, some product categories, such as milk, had lower price transactions at traditional grocers. Thus, simulated food basket purchases corresponding to WIC food packages that prescribe lowfat milk were significantly less costly at traditional grocers in most State agencies.

Furthermore, small and nontraditional retailers often had the highest transaction prices in individual product categories among all store formats in the Midwest SA, one of two SAs examined that authorize such vendors for significant WIC transactions. The largest differences in price were in the infant fruits and vegetable category, which raised costs of the simulated food basket—composed of the infant fruits and vegetables offered by WIC's infant (II-BF) food package—to be substantially higher than the cost at mass merchandisers. However, the price differentials at small and nontraditional retailers did not apply in the Southwest SA, where variation in WIC transaction prices was more muted.

## Conclusion

This report examined variability in the prices of items purchased by WIC participants in select product categories and four State agencies: Midwest, West, Southwest, and Mountain Plains. Product categories studied include breakfast cereal, cheese, reduced-fat and whole milk, peanut butter, infant fruits and vegetables, juice, and whole grains. Data on prices of food items purchased (i.e., requested prices) using WIC benefits came from EBT transaction records from all four SAs from May or June 2014 to August 2014.

Among the subset of WIC product categories studied, reduced-fat milk, breakfast cereal, juice, and cheese were the highest ranking in terms of share of food costs in each SA. In total, these product categories accounted for more than half the value of all non-infant formula redemptions. In many cases, median prices of a given product category were similar across SAs. However, *variability* in prices differed by SA. For example, price variability for reduced-fat milk in the Midwest SA was roughly twice that in the Western or Mountain Plains SAs. The prices for breakfast cereal, juice, and whole grains were most variable across regions. While excessive variability in prices could lead to many costly redemptions, only 14 to 23 percent of redemptions in any SA were found to be highest-price among all benefit redemptions. However, the rate of highest-price redemptions varied by product category. For example, over 40 percent of whole-grain purchases in some SAs were highest-price, while less than 20 percent of infant fruit/vegetable purchases were highest-price in all SAs. In short, the majority of WIC transactions are more likely to be in the middle or lowest quartiles of observed market prices, consistent with vendors' management systems ensuring that WIC transactions are generally cost competitive.

In general, mass merchandisers and traditional grocers, such as supermarkets and grocery stores, tended to have lower WIC transaction prices compared to all other store formats. Furthermore, mass merchandisers and supermarkets had similar prices in most product categories. However, supermarkets' prices were often higher for juice and lower for milk (by as much as \$1, on average) compared to mass merchandisers. And because milk is much prescribed in WIC baskets, traditional grocers redeeming a food basket (comprising many of the food items allotted to participants in quantities allowed by the food packages) would do so at a lower average cost than other WIC vendors. In contrast, traditional grocers in the Mountain Plains SA have significantly higher prices than mass merchandisers.

Small and nontraditional vendors (e.g., convenience/liquor/gas stations, other/specialty stores, independent pharmacies) had significantly higher prices in many but not all WIC product categories. Prices for infant fruits/vegetables and breakfast cereals were substantially higher. For instance, the estimated average redemption value of a food basket made to comprise a portion of the infant with breastfeeding mother package (Infant-II) was nearly \$25 higher than a comparable basket at mass merchandisers. In contrast, small and nontraditional food retailers had only slightly higher prices for reduced-fat milk compared to mass merchandisers. Therefore, milk transactions at these smaller vendor types are roughly cost competitive with larger vendors. In fact, simulated food basket costs in the Southwest SA at small and nontraditional food retailers were often no higher than at mass merchandisers and some grocery store types. Therefore, transactions made by participants at smaller and nontraditional vendors—at least under some circumstances and in some product categories—are likely cost competitive.

While exact causes are difficult to pinpoint, the observed variability in WIC product prices is likely due to a confluence of factors, including SA-specific policies guiding cost containment and incentives faced by food retailers when setting prices that are unrelated to WIC. For example, the minimal variation in transaction prices across store formats in the Southwest SA may be influenced by the extensive use of least-cost brand policies there that reduce the likelihood of expensive redemptions at any vendor of any kind.

This study provides several takeaways for future research examining cost containment in the WIC program. First, it appears that product categories such as infant fruits/vegetables and milk experience more price variability across all store formats than any other product categories. Work to explain factors influencing price variability, such as regional food prices or WIC-specific policies, may be best targeted to these categories over others. Second, future research might consider the feasibility and potential impact of using manufacturer rebates in product categories other than infant formula, which has been very successful. Replicating the success of infant formula rebates is uncertain as soliciting single-source competitive contracts has associated administrative costs, and the potential size of rebates is unclear. The infant formula market is well suited to single-sourcing in that there are few producers. The transaction costs of coordinating with numerous parties in food industries with many suppliers, on the other hand, may be exceedingly high.

Third, based on observations in the Southwest SA compared to all other studied SAs, least-cost brand policies may be associated with lower price variability across store formats, although other factors such as the non-WIC market for food may be at play. While this may be beneficial from a cost-containment perspective, least-cost brand policies may diminish participant satisfaction with food benefits. Increased cost-containment measures may compromise participant satisfaction or access to food benefits. Finally, while this study focuses on four SAs only and thus findings may not be generalizable to the Nation broadly, the analytical framework may prove useful to individual SAs in uncovering specific areas of price variability in their WIC programs.

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# Appendix A: WIC Food Packages and Included and Excluded Goods for Partial Package Value Analysis

Appendix table A1

## Select WIC food packages and prescribed items included in and excluded from the study analysis

Food packages	Prescribed food items	
	Included for analysis	Excluded from analysis
Infant (II-BF)*	<ul style="list-style-type: none"> <li>• 256 ounces of infant fruits and vegetables</li> </ul>	<ul style="list-style-type: none"> <li>• 24 ounces of infant cereal</li> <li>• 77.5 ounces of infant food meat</li> </ul>
Child (IV)	<ul style="list-style-type: none"> <li>• 128 fluid ounces of juice</li> <li>• 16 quarts of reduced-fat milk</li> <li>• 36 ounces of breakfast cereal</li> <li>• 2 pounds of whole wheat bread</li> <li>• 18 ounces of peanut butter</li> </ul>	<ul style="list-style-type: none"> <li>• 1 dozen eggs</li> <li>• \$8 in cash value vouchers for fruits and vegetables</li> <li>• 1 pound (dry) or 64 ounces (canned) legumes</li> </ul>
Woman (V)	<ul style="list-style-type: none"> <li>• 144 fluid ounces of juice</li> <li>• 22 quarts of reduced-fat milk</li> <li>• 36 ounces of breakfast cereal</li> <li>• 1 pound of whole wheat bread</li> <li>• 18 ounces of peanut butter</li> </ul>	<ul style="list-style-type: none"> <li>• 1 dozen eggs</li> <li>• \$11 in cash value vouchers for fruits and vegetables</li> <li>• 1 pound (dry) or 64 ounces (canned) legumes</li> </ul>
Woman (VI)	<ul style="list-style-type: none"> <li>• 96 fluid ounces of juice</li> <li>• 16 quarts of reduced-fat milk</li> <li>• 36 ounces of breakfast cereal</li> <li>• 1 pound of whole wheat bread</li> <li>• 18 ounces of peanut butter</li> </ul>	<ul style="list-style-type: none"> <li>• 1 dozen eggs</li> <li>• \$11 in cash value vouchers for fruits and vegetables</li> <li>• 1 pound (dry) or 64 ounces (canned) legumes</li> </ul>
Woman (VII)	<ul style="list-style-type: none"> <li>• 128 fluid ounces of juice</li> <li>• 16 quarts of reduced-fat milk</li> <li>• 36 ounces of breakfast cereal</li> <li>• 1 pound of cheese</li> <li>• 1 pound of whole-wheat bread</li> <li>• 18 ounces of peanut butter*</li> </ul>	<ul style="list-style-type: none"> <li>• 2 dozen eggs</li> <li>• \$11 in cash value vouchers for fruits and vegetables</li> <li>• 1 pound (dry) or 64 ounces (canned) legumes</li> </ul>

Note: WIC = Special Supplemental Nutrition Program for Women, Infants, and Children. Monthly maximum food packages can be found on USDA, FNS website.

\*Infant II-BF refers to the maximum monthly allowances for a fully breastfed infant received during 6-11 months. In addition, fully formula-fed and partially breastfed infants receive 24 ounces of infant cereal (excluded category) and 128 ounces of infant fruits and vegetables (included category) in addition to a certain volume of liquid concentrate infant formula (excluded category) through food packages II-FF, III-FF, II-BF/FF, and III BF/FF. These food packages are similarly subject to the same study implications found for II-BF, as the only difference in studied product categories is the quantity of infant fruits and vegetables. Infant food packages I-FF, III-FF, I-BF/FF, and III-BF/BF provide only infant formula in the first 6 months and therefore are not relevant to this study because this product category is excluded from the analysis.

## Appendix B: Requested Redemption Value by Food Product Category and State Agency

Appendix table B1

### Summary statistics of prices by product category and State agency (SA)

MIDWEST SA					
	Number of purchases	Mean	Median	Minimum	Maximum
Cereal, 1 oz	259,236	\$0.23	\$0.22	\$0.05	\$0.60
Cheese, 16 oz	185,461	\$6.02	\$5.99	\$0.99	\$8.00
Reduced-fat milk, gallon	346,891	\$3.52	\$3.19	\$0.59	\$5.99
Peanut butter	101,103	\$2.50	\$2.29	\$0.89	\$4.99
Whole milk, gallon	107,086	\$3.59	\$3.28	\$0.09	\$5.99
Infant fruits and vegetables, 4 oz	291,490	\$0.66	\$0.64	\$0.04	\$1.32
Juice, bottled	323,761	\$3.52	\$3.39	\$0.50	\$6.76
Whole grains, 16 oz	189,404	\$2.74	\$2.56	\$0.32	\$4.96
WESTERN SA					
	Number of purchases	Mean	Median	Minimum	Maximum
Cereal, 1 oz	181,937	\$0.22	\$0.20	\$0.02	\$0.69
Cheese, 16 oz	119,093	\$5.02	\$4.99	\$0.20	\$9.80
Reduced-fat milk, gallon	224,833	\$3.42	\$3.29	\$1.49	\$5.83
Peanut butter	49,580	\$2.86	\$2.78	\$0.16	\$4.72
Whole milk, gallon	67,401	\$3.49	\$3.39	\$1.58	\$5.69
Infant fruits and vegetables, 4 oz	195,724	\$0.64	\$0.64	\$0.12	\$1.56
Juice, bottled	134,889	\$3.16	\$2.89	\$1.00	\$9.90
Whole grains, 16 oz	116,799	\$3.10	\$3.20	\$0.32	\$4.00
SOUTHWEST SA					
	Number of purchases	Mean	Median	Minimum	Maximum
Cereal, 1 oz	1,649,632	\$0.18	\$0.18	\$0.01	\$0.25
Cheese, 16 oz	1,174,378	\$4.70	\$4.98	\$0.50	\$5.00
Reduced-fat milk, gallon	2,217,767	\$3.28	\$3.19	\$0.99	\$5.50
Peanut butter	317,730	\$2.42	\$2.29	\$0.50	\$3.30
Whole milk, gallon	634,298	\$3.29	\$3.19	\$0.98	\$5.50
Infant fruits and vegetables, 4 oz	1,929,731	\$0.62	\$0.64	\$0.12	\$1.00
Juice, bottled	1,839,263	\$2.55	\$2.49	\$0.17	\$3.33
Whole grains, 16 oz	1,043,801	\$3.14	\$3.04	\$0.48	\$6.08

—continued

**Summary statistics of prices by product category and State agency (SA)—continued**

MOUNTAIN PLAINS SA					
	Number of purchases	Mean	Median	Minimum	Maximum
Cereal, 1 oz	36,104	\$0.24	\$0.23	\$0.03	\$0.49
Cheese, 16 oz	12,764	\$5.25	\$4.99	\$2.48	\$9.00
Reduced-fat milk, gallon	90,008	\$3.66	\$3.59	\$0.25	\$6.35
Peanut butter	14,258	\$2.94	\$2.78	\$1.09	\$5.95
Whole milk, gallon	16,159	\$3.72	\$3.59	\$0.81	\$6.85
Infant fruits and vegetables, 4 oz	39,534	\$0.70	\$0.64	\$0.40	\$1.52
Juice, bottled	24,983	\$3.14	\$2.89	\$1.25	\$6.00
Whole grains, 16 oz	19,454	\$2.81	\$2.88	\$0.80	\$4.64

WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

Source: State agency WIC electronic benefit redemption data.

## Appendix C: Prices of WIC Food Product Categories by Retail Channel and State Agency

Appendix table C1

**Summary statistics of prices in the Midwest State agency (SA) by store format and product category**

MIDWEST SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
01: Mass merchandiser	Cereal, 1 oz	\$0.05	\$0.17	\$0.27	\$0.28	\$0.48	\$0.41
	Cheese, 16 oz	\$1.99	\$4.65	\$5.19	\$5.39	\$6.98	\$0.14
	Reduced-fat milk, gallon	\$1.69	\$2.62	\$3.12	\$3.98	\$4.88	\$0.44
	Peanut butter	\$1.50	\$1.68	\$1.90	\$2.19	\$2.79	\$0.27
	Whole milk, gallon	\$0.19	\$2.67	\$2.99	\$3.49	\$4.98	\$0.27
	Infant fruits/veg, 4 oz	\$0.24	\$0.46	\$0.62	\$0.74	\$0.88	\$0.45
	Juice, bottled	\$0.99	\$1.50	\$2.38	\$3.42	\$5.19	\$0.81
	Whole grains, 16 oz	\$0.80	\$1.44	\$2.24	\$3.04	\$3.84	\$0.71
02: Discount and limited assortment chains	Cereal, 1 oz	\$0.22	\$0.31	\$0.31	\$0.33	\$0.54	\$0.06
	Cheese, 16 oz	\$4.59	\$4.99	\$6.64	\$7.99	\$7.99	\$0.45
	Reduced-fat milk, gallon	\$3.49	\$3.49	\$3.59	\$3.99	\$3.99	\$0.14
	Peanut butter	\$3.19	\$3.29	\$3.64	\$3.94	\$3.99	\$0.18
	Whole milk, gallon	\$3.49	\$3.49	\$3.59	\$3.99	\$3.99	\$0.14
	Infant fruits/veg, 4 oz	\$0.88	\$0.88	\$0.94	\$1.00	\$1.00	\$0.13
	Juice, bottled	\$1.99	\$2.99	\$4.19	\$5.32	\$5.99	\$0.56
	Whole grains, 16 oz	\$2.24	\$2.88	\$3.20	\$3.52	\$3.84	\$0.20

—continued

**Summary statistics of prices in the Midwest State agency (SA) by store format and product category—continued**

MIDWEST SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
03: National grocery	Cereal, 1 oz	\$0.07	\$0.19	\$0.23	\$0.36	\$0.50	\$0.74
	Cheese, 16 oz	\$3.49	\$4.49	\$5.49	\$6.29	\$8.00	\$0.33
	Reduced-fat milk, gallon	\$1.99	\$2.88	\$3.29	\$3.69	\$4.49	\$0.25
	Peanut butter	\$1.53	\$1.88	\$2.50	\$2.99	\$4.49	\$0.44
	Whole milk, gallon	\$1.99	\$2.89	\$3.34	\$3.67	\$4.49	\$0.23
	Infant fruits/veg, 4 oz	\$0.28	\$0.56	\$0.66	\$0.80	\$1.00	\$0.36
	Juice, bottled	\$0.99	\$2.44	\$3.54	\$4.62	\$5.99	\$0.62
	Whole grains, 16 oz	\$0.64	\$1.76	\$2.64	\$3.52	\$4.96	\$0.67
05: Regional grocery chain	Cereal, 1 oz	\$0.05	\$0.19	\$0.23	\$0.36	\$0.58	\$0.74
	Cheese, 16 oz	\$2.49	\$4.67	\$5.68	\$6.32	\$8.00	\$0.29
	Reduced-fat milk, gallon	\$1.15	\$2.65	\$3.13	\$3.82	\$4.95	\$0.37
	Peanut butter	\$1.29	\$1.95	\$2.39	\$2.80	\$4.49	\$0.36
	Whole milk, gallon	\$0.09	\$2.58	\$3.17	\$3.99	\$5.29	\$0.44
	Infant fruits/veg, 4 oz	\$0.28	\$0.44	\$0.62	\$0.78	\$1.00	\$0.55
	Juice, bottled	\$0.99	\$2.45	\$3.16	\$3.93	\$5.79	\$0.47
	Whole grains, 16 oz	\$0.64	\$1.60	\$2.72	\$3.84	\$4.96	\$0.82

—continued



**Summary statistics of prices in the Midwest State agency (SA) by store format and product category—continued**

MIDWEST SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
06: Local chains	Cereal, 1 oz	\$0.11	\$0.19	\$0.24	\$0.27	\$0.42	\$0.33
	Cheese, 16 oz	\$3.49	\$4.83	\$5.38	\$6.08	\$8.00	\$0.23
	Reduced-fat milk, gallon	\$2.00	\$2.49	\$2.84	\$3.19	\$3.99	\$0.25
	Peanut butter	\$1.69	\$1.99	\$2.39	\$2.79	\$4.49	\$0.33
	Whole milk, gallon	\$2.28	\$2.54	\$2.84	\$3.34	\$3.99	\$0.28
	Infant fruits/veg, 4 oz	\$0.04	\$0.52	\$0.58	\$0.64	\$0.68	\$0.21
	Juice, bottled	\$1.17	\$2.43	\$2.85	\$3.59	\$5.49	\$0.41
	Whole grains, 16 oz	\$1.28	\$1.92	\$2.64	\$3.36	\$4.00	\$0.55
07: Independent grocers	Cereal, 1 oz	\$0.05	\$0.21	\$0.28	\$0.44	\$0.60	\$0.82
	Cheese, 16 oz	\$1.99	\$4.58	\$5.50	\$6.26	\$8.00	\$0.31
	Reduced-fat milk, gallon	\$0.59	\$2.97	\$3.68	\$4.45	\$5.99	\$0.40
	Peanut butter	\$0.89	\$1.99	\$2.56	\$3.17	\$4.99	\$0.46
	Whole milk, gallon	\$0.50	\$3.29	\$3.98	\$4.52	\$5.99	\$0.31
	Infant fruits/veg, 4 oz	\$0.04	\$0.52	\$0.80	\$1.08	\$1.32	\$0.70
	Juice, bottled	\$0.50	\$2.88	\$3.78	\$4.79	\$6.72	\$0.51
	Whole grains, 16 oz	\$0.32	\$1.60	\$2.72	\$3.84	\$4.96	\$0.82

—continued

**Summary statistics of prices in the Midwest State agency (SA) by store format and product category—continued**

MIDWEST SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
08: Independent pharmacy	Cereal, 1 oz	\$0.14	\$0.27	\$0.28	\$0.32	\$0.47	\$0.18
	Cheese, 16 oz	\$3.99	\$3.99	\$4.29	\$4.69	\$5.99	\$0.16
	Reduced-fat milk, gallon	\$2.99	\$3.49	\$3.74	\$3.99	\$4.29	\$0.13
	Peanut butter	\$2.19	\$2.19	\$2.99	\$3.99	\$3.99	\$0.60
	Whole milk, gallon	\$3.69	\$3.84	\$4.14	\$4.39	\$4.49	\$0.13
	Infant fruits/ veg, 4 oz	\$0.84	\$0.84	\$0.88	\$1.00	\$1.00	\$0.18
	Juice, bottled	\$2.50	\$4.04	\$4.59	\$5.51	\$5.99	\$0.32
	Whole grains, 16 oz	\$3.04	\$3.04	\$3.20	\$3.36	\$3.36	\$0.10
09: Other, Specialty stores	Cereal, 1 oz	\$0.13	\$0.25	\$0.28	\$0.40	\$0.58	\$0.54
	Cheese, 16 oz	\$0.99	\$4.93	\$5.58	\$6.49	\$8.00	\$0.28
	Reduced-fat milk, gallon	\$2.50	\$3.44	\$4.14	\$4.77	\$5.99	\$0.32
	Peanut butter	\$1.77	\$2.14	\$2.89	\$3.69	\$4.99	\$0.54
	Whole milk, gallon	\$2.79	\$3.89	\$4.27	\$4.90	\$5.99	\$0.24
	Infant fruits/ veg, 4 oz	\$0.64	\$0.78	\$0.94	\$1.18	\$1.28	\$0.43
	Juice, bottled	\$1.67	\$3.23	\$4.21	\$4.99	\$6.69	\$0.42
	Whole grains, 16 oz	\$1.12	\$1.92	\$2.56	\$3.20	\$3.84	\$0.50

—continued

Appendix table C1

**Summary statistics of prices in the Midwest State agency (SA) by store format and product category**

MIDWEST SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
12: Convenience, liquor, gas stations	Cereal, 1 oz	\$0.13	\$0.27	\$0.31	\$0.44	\$0.60	\$0.55
	Cheese, 16 oz	\$1.08	\$4.99	\$5.99	\$7.09	\$8.00	\$0.35
	Reduced-fat milk, gallon	\$2.79	\$3.50	\$4.10	\$4.69	\$5.99	\$0.29
	Peanut butter	\$1.99	\$2.84	\$3.65	\$4.31	\$4.99	\$0.40
	Whole milk, gallon	\$2.79	\$3.69	\$4.19	\$4.76	\$5.59	\$0.26
	Infant fruits/veg, 4 oz	\$0.68	\$0.88	\$1.04	\$1.16	\$1.28	\$0.27
	Juice, bottled	\$1.79	\$3.95	\$4.94	\$5.64	\$6.76	\$0.34
	Whole grains, 16 oz	\$0.96	\$2.40	\$3.04	\$3.68	\$4.96	\$0.42

Note: IQR/M is the interquartile range divided by the median of the respective category of redemptions.

Source: State agency WIC electronic benefit redemption data.

Appendix table C2

**Summary statistics of prices in the Western State agency (SA) by store format and product category**

WESTERN SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
01: Mass merchandise	Cereal, 1 oz	\$0.04	\$0.09	\$0.19	\$0.31	\$0.45	\$1.16
	Cheese, 16 oz	\$1.49	\$2.78	\$3.98	\$4.98	\$6.28	\$0.55
	Reduced-fat milk, gallon	\$1.89	\$2.89	\$3.35	\$4.48	\$5.65	\$0.47
	Peanut butter	\$1.00	\$1.89	\$2.19	\$2.78	\$3.38	\$0.41
	Whole milk, gallon	\$1.58	\$2.79	\$3.38	\$3.88	\$4.98	\$0.32
	Infant fruits/veg, 4 oz	\$0.24	\$0.48	\$0.60	\$0.80	\$1.08	\$0.53
	Juice, bottled	\$1.00	\$1.67	\$2.13	\$2.88	\$3.98	\$0.57
	Whole grains, 16 oz	\$0.80	\$1.36	\$2.00	\$2.80	\$3.52	\$0.72

—continued

**Summary statistics of prices in the Western State agency (SA) by store format and product category—continued**

WESTERN SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
03: National grocery	Cereal, 1 oz	\$0.04	\$0.18	\$0.23	\$0.37	\$0.56	\$0.83
	Cheese, 16 oz	\$2.99	\$4.51	\$5.29	\$6.49	\$8.99	\$0.37
	Reduced-fat milk, gallon	\$2.00	\$2.78	\$3.00	\$3.69	\$5.29	\$0.30
	Peanut butter	\$1.48	\$2.21	\$2.74	\$3.54	\$4.72	\$0.49
	Whole milk, gallon	\$2.49	\$2.87	\$3.27	\$3.99	\$5.29	\$0.34
	Infant fruits/veg, 4 oz	\$0.24	\$0.44	\$0.68	\$0.96	\$1.28	\$0.76
	Juice, bottled	\$1.00	\$2.37	\$3.19	\$3.80	\$9.90	\$0.45
	Whole grains, 16 oz	\$0.48	\$1.60	\$2.40	\$3.20	\$4.00	\$0.67
05: Regional grocery chain	Cereal, 1 oz	\$0.02	\$0.09	\$0.24	\$0.38	\$0.61	\$1.21
	Cheese, 16 oz	\$2.50	\$3.89	\$4.49	\$5.41	\$8.99	\$0.34
	Reduced-fat milk, gallon	\$1.69	\$3.06	\$3.32	\$3.58	\$5.49	\$0.16
	Peanut butter	\$0.22	\$2.23	\$2.81	\$3.64	\$4.19	\$0.50
	Whole milk, gallon	\$3.12	\$3.39	\$3.52	\$3.98	\$5.49	\$0.17
	Infant fruits/veg, 4 oz	\$0.16	\$0.56	\$0.72	\$1.08	\$1.40	\$0.72
	Juice, bottled	\$1.33	\$2.24	\$2.99	\$3.79	\$7.69	\$0.52
	Whole grains, 16 oz	\$0.32	\$1.44	\$2.32	\$3.20	\$4.00	\$0.76

—continued

Appendix table C2

**Summary statistics of prices in the Western State agency (SA) by store format and product category—continued**

WESTERN SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
07: Independent grocers	Cereal, 1 oz	\$0.02	\$0.12	\$0.28	\$0.45	\$0.69	\$1.18
	Cheese, 16 oz	\$0.20	\$4.00	\$5.19	\$6.18	\$9.80	\$0.42
	Reduced-fat milk, gallon	\$1.49	\$3.08	\$3.48	\$3.95	\$5.83	\$0.25
	Peanut butter	\$0.16	\$2.45	\$3.21	\$3.69	\$4.69	\$0.39
	Whole milk, gallon	\$1.99	\$3.34	\$3.73	\$4.44	\$5.69	\$0.29
	Infant fruits/veg, 4 oz	\$0.12	\$0.60	\$0.88	\$1.16	\$1.56	\$0.64
	Juice, bottled	\$1.33	\$2.60	\$3.56	\$4.30	\$8.58	\$0.48
	Whole grains, 16 oz	\$0.48	\$1.44	\$2.32	\$3.20	\$4.00	\$0.76

Note: WIC = Special Supplemental Nutrition Program for Women, Infants, and Children. IQR/M is the interquartile range divided by the median of the respective category of redemptions.

Source: State agency WIC electronic benefit redemption data.

Appendix table C3

**Summary statistics of prices in the Southwest State agency (SA) by store format and product category**

SOUTHWEST SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
01: Mass merchandise	Cereal, 1 oz	\$0.03	\$0.11	\$0.18	\$0.18	\$0.25	\$0.39
	Cheese, 16 oz	\$0.79	\$3.50	\$4.29	\$4.70	\$5.00	\$0.28
	Reduced-fat milk, gallon	\$0.99	\$2.38	\$3.10	\$3.70	\$5.50	\$0.43
	Peanut butter	\$0.76	\$1.79	\$2.20	\$2.64	\$3.30	\$0.39
	Whole milk, gallon	\$1.29	\$2.75	\$3.28	\$3.78	\$5.50	\$0.31
	Infant fruits/veg, 4 oz	\$0.12	\$0.32	\$0.52	\$0.72	\$1.00	\$0.77
	Juice, bottled	\$0.26	\$1.64	\$2.25	\$2.59	\$3.33	\$0.42
	Whole grains, 16 oz	\$0.80	\$2.32	\$3.60	\$4.88	\$6.08	\$0.71

—continued

**Summary statistics of prices in the Southwest State agency (SA) by store format and product category—continued**

WESTERN SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
03: National grocery	Cereal, 1 oz	\$0.05	\$0.14	\$0.18	\$0.19	\$0.25	\$0.28
	Cheese, 16 oz	\$1.50	\$3.79	\$4.20	\$4.75	\$5.00	\$0.23
	Reduced-fat milk, gallon	\$0.99	\$2.69	\$3.09	\$3.69	\$5.50	\$0.32
	Peanut butter	\$0.50	\$1.78	\$2.32	\$2.80	\$3.30	\$0.44
	Whole milk, gallon	\$1.50	\$2.69	\$3.19	\$3.77	\$5.50	\$0.34
	Infant fruits/veg, 4 oz	\$0.20	\$0.32	\$0.58	\$0.72	\$0.84	\$0.69
	Juice, bottled	\$0.79	\$1.94	\$2.50	\$2.92	\$3.33	\$0.39
	Whole grains, 16 oz	\$1.28	\$2.40	\$3.52	\$4.80	\$6.08	\$0.68
05: Regional grocery chain	Cereal, 1 oz	\$0.01	\$0.10	\$0.18	\$0.18	\$0.25	\$0.44
	Cheese, 16 oz	\$0.50	\$3.75	\$4.05	\$4.46	\$5.00	\$0.18
	Reduced-fat milk, gallon	\$0.99	\$2.82	\$3.32	\$3.91	\$5.50	\$0.33
	Peanut butter	\$0.50	\$1.85	\$2.29	\$2.73	\$3.30	\$0.38
	Whole milk, gallon	\$0.99	\$2.90	\$3.38	\$3.96	\$5.50	\$0.31
	Infant fruits/veg, 4 oz	\$0.12	\$0.34	\$0.54	\$0.74	\$1.00	\$0.74
	Juice, bottled	\$0.17	\$1.89	\$2.44	\$2.84	\$3.33	\$0.39
	Whole grains, 16 oz	\$0.48	\$1.76	\$3.12	\$4.48	\$6.08	\$0.87

—continued



Appendix table C3

**Summary statistics of prices in the Southwest State agency (SA) by store format and product category**

SOUTHWEST SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
07: Independent grocers	Cereal, 1 oz	\$0.07	\$0.14	\$0.21	\$0.24	\$0.25	\$0.48
	Cheese, 16 oz	\$2.50	\$3.85	\$4.30	\$4.69	\$5.00	\$0.20
	Reduced-fat milk, gallon	\$2.50	\$2.77	\$3.19	\$3.85	\$5.50	\$0.34
	Peanut butter	\$1.44	\$2.09	\$2.59	\$2.79	\$3.30	\$0.27
	Whole milk, gallon	\$0.98	\$2.68	\$3.19	\$3.88	\$5.50	\$0.38
	Infant fruits/veg, 4 oz	\$0.28	\$0.58	\$0.70	\$0.82	\$1.00	\$0.34
	Juice, bottled	\$1.16	\$2.13	\$2.54	\$2.94	\$3.33	\$0.32
	Whole grains, 16 oz	\$0.96	\$1.92	\$2.96	\$4.16	\$5.92	\$0.76

Note: IQR/M is the interquartile range divided by the median of the respective category of redemptions.

Source: State agency WIC electronic benefit redemption data.

Appendix table C4

**Summary statistics of prices in the Mountain Plains State agency (SA) by store format and product category**

MOUNTAIN PLAINS SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
01: Mass merchandise	Cereal, 1 oz	\$0.07	\$0.16	\$0.17	\$0.22	\$0.31	\$0.35
	Cheese, 16 oz	\$2.48	\$4.43	\$4.98	\$5.28	\$5.68	\$0.17
	Reduced-fat milk, gallon	\$1.99	\$2.86	\$3.42	\$3.69	\$4.06	\$0.24
	Peanut butter	\$1.98	\$2.38	\$2.68	\$3.08	\$3.38	\$0.26
	Whole milk, gallon	\$1.99	\$2.99	\$3.42	\$3.69	\$4.06	\$0.20
	Infant F/V, 4 oz	\$0.48	\$0.52	\$0.62	\$0.72	\$0.80	\$0.32
	Juice, bottled	\$2.00	\$2.48	\$2.73	\$3.13	\$3.88	\$0.24
	Whole grains, 16 oz	\$0.80	\$1.28	\$1.92	\$2.56	\$3.52	\$0.67

—continued

**Summary statistics of prices in the Mountain Plains State agency (SA) by store format and product category—continued**

SOUTHWEST SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
03: National grocery	Cereal, 1 oz	\$0.03	\$0.21	\$0.31	\$0.37	\$0.49	\$0.52
	Cheese, 16 oz	\$3.00	\$4.25	\$4.64	\$5.49	\$6.99	\$0.27
	Reduced-fat milk, gallon	\$0.25	\$2.61	\$3.15	\$3.49	\$4.39	\$0.28
	Peanut butter	\$1.09	\$2.49	\$3.50	\$3.98	\$4.49	\$0.43
	Whole milk, gallon	\$1.00	\$2.89	\$3.34	\$3.69	\$4.39	\$0.24
	Infant F/V, 4 oz	\$0.40	\$0.56	\$0.68	\$0.80	\$1.00	\$0.35
	Juice, bottled	\$1.29	\$2.37	\$3.04	\$4.09	\$5.59	\$0.57
	Whole grains, 16 oz	\$0.96	\$1.68	\$2.48	\$3.28	\$4.00	\$0.65
07: Independent grocers	Cereal, 1 oz	\$0.08	\$0.19	\$0.30	\$0.41	\$0.48	\$0.73
	Cheese, 16 oz	\$2.99	\$4.33	\$4.91	\$5.95	\$9.00	\$0.33
	Reduced-fat milk, gallon	\$1.25	\$3.38	\$4.04	\$4.60	\$6.35	\$0.30
	Peanut butter	\$1.50	\$2.59	\$3.20	\$3.56	\$5.95	\$0.30
	Whole milk, gallon	\$0.81	\$3.69	\$4.25	\$4.99	\$6.85	\$0.31
	Infant F/V, 4 oz	\$0.48	\$0.64	\$0.82	\$1.00	\$1.52	\$0.44
	Juice, bottled	\$1.25	\$2.77	\$3.60	\$4.53	\$6.00	\$0.49
	Whole grains, 16 oz	\$0.80	\$1.60	\$2.40	\$3.20	\$4.64	\$0.67

—continued

**Summary statistics of prices in the Mountain Plains State agency (SA) by store format and product category**

MOUNTAIN PLAINS SA							
Store category	Variable	Minimum	25th pctl	Median	75th pctl	Maximum	IQR/M
09: Other, Specialty stores	Cereal, 1 oz	.	.	.	.	.	.
	Cheese, 16 oz	.	.	.	.	.	.
	Reduced-fat milk, gallon	\$4.09	\$4.13	\$4.13	\$4.13	\$4.13	\$0.00
	Peanut butter	.	.	.	.	.	.
	Whole milk, gallon	\$4.29	\$4.29	\$4.29	\$4.29	\$4.29	\$0.00
	Infant F/V, 4 oz	\$0.64	\$0.64	\$0.64	\$0.64	\$0.64	\$0.00
	Juice, bottled	\$1.75	\$1.75	\$1.75	\$1.75	\$1.75	\$0.00
	Whole grains, 16 oz	.	.	.	.	.	.

Note: WIC = Special Supplemental Nutrition Program for Women, Infants, and Children. F/V = fruits/vegetables. IQR/M is the interquartile range divided by the median of the respective category of redemptions.

Source: State agency WIC electronic benefit redemption data.