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Methodology Behind the Quarterly Food-at-Home Price Database

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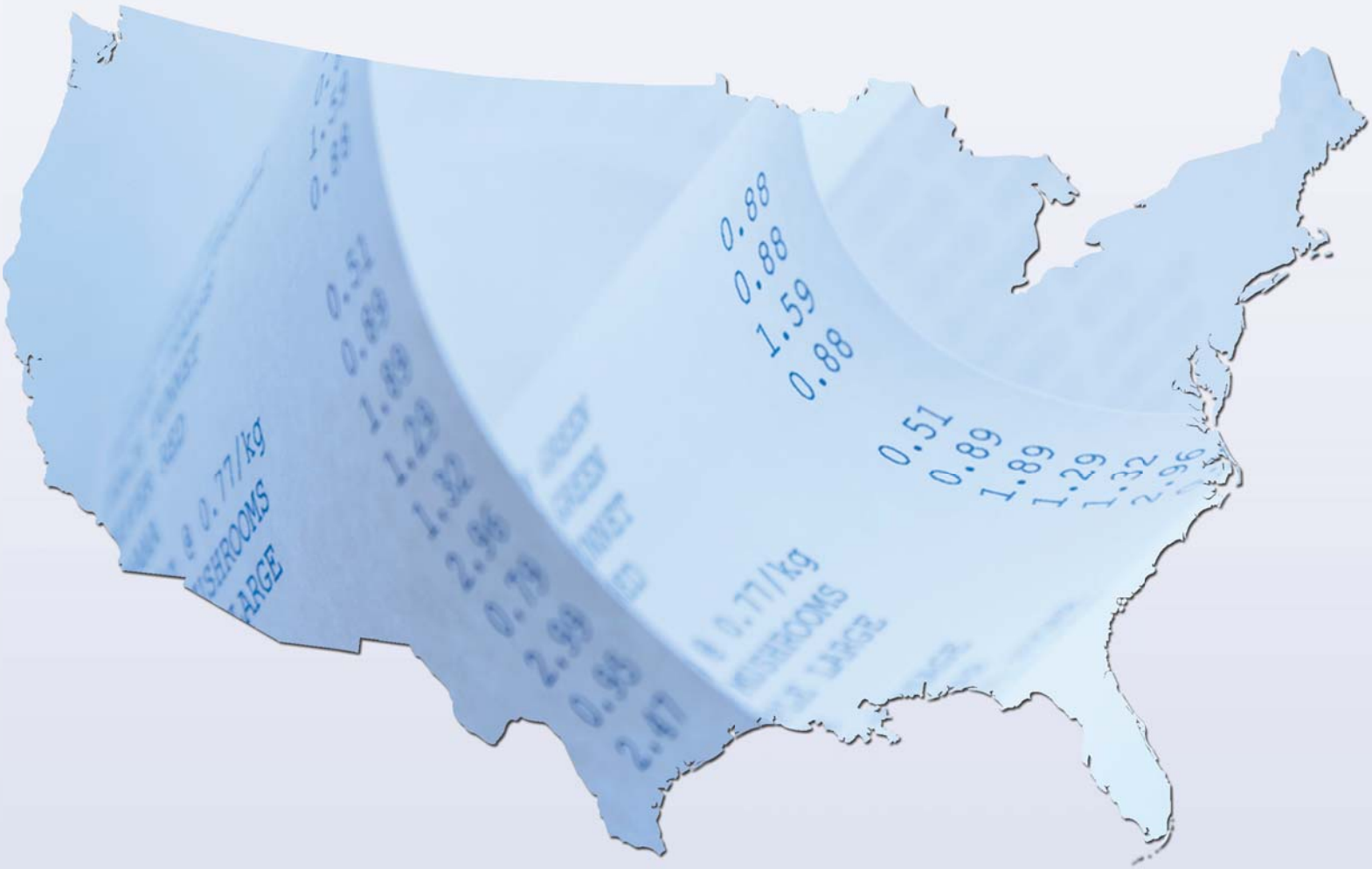

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Methodology Behind the Quarterly Food-at-Home Price Database

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Abstract

The Quarterly Food-at-Home Price Database (QFAHPD) was developed to provide market-level food prices that can be used to study how prices affect food choices, intake, and health outcomes. This report presents a detailed description of the methodology used to construct the QFAHPD. The database, constructed from 1999-2006 Nielsen Homescan data, includes quarterly observations on the mean price of 52 food categories for 35 market groups covering the contiguous United States. Data from 2006 indicate that cross-market price variation can be as much as three to four times greater than annual food price inflation.

Keywords: Nielsen Homescan, food prices, diet quality, market prices

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Contents

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Summary

Food prices are crucial for economic modeling of consumer food choice and dietary patterns. Variations in living costs and other market conditions across the United States imply that analyses using national-level food prices may not accurately capture the effects of food prices on consumer behavior or well-being. Measuring local food prices may better indicate the effect of prices on food choices. Since prices are also likely to fluctuate across seasons, particularly for perishable goods such as fruits and vegetables, quarterly prices are preferred to an annual estimate when modeling food choices.

What Is the Issue?

Despite the fact that food prices are likely to vary across the country, a dataset that provides a consistent measure of market-level food prices does not exist. This lack of price data makes it difficult to study the effects that food prices have on consumer choices and diet/health outcomes, such as the potential impact of policies that would alter the relative cost of foods—possibly through taxes or subsidies—to encourage healthier food choices.

What Is the Contribution?

The Quarterly Food-at-Home Price Database (QFAHPD) was developed to fill the gap in available food price data and to support research on the economic determinants of diet quality and health outcomes. The QFAHPD contains regional and market-level quarterly prices for 52 separate food groups between 1999 and 2006 for 30 market groups (for 1999 to 2001) and 35 market groups (for 2002 to 2006) that cover all 48 contiguous States. The food categories were created to correspond with the U.S. Department of Health and Human Services and U.S. Department of Agriculture's *2005 Dietary Guidelines*, as well as to capture price premiums for convenience and processing. Prices are presented in dollars per 100 grams of food as purchased. The QFAHPD demonstrates that food prices vary widely across geographic areas.

How Was the Study Conducted?

We used data from the 1999-2006 Nielsen Homescan panels. Information on household-level purchases of both UPC (Universal Product Code)-coded and random-weight food items was aggregated to estimate household-level quarterly prices for 52 food groups. The household-level prices were then aggregated to estimate quarterly market-level prices.

Introduction

Variation in living costs and other market conditions across the United States imply that analyses using national-level food prices may not provide an accurate measure of the effects of food prices on consumer behavior or well-being. Previous research has shown that food prices are likely to vary by proximity to point of production, the types of food outlets in the area, and socio-demographic characteristics of the community, such as income (Volpe and Lavoie, 2008; Hausman and Leibtag, 2007). Seasonality can also affect food prices, particularly for perishable foods such as fruits and vegetables. Thus, measuring food prices quarterly and at the market level, instead of national annual measures, may better indicate the effect of prices on food choices.

Linking market-level, time varying food price data to existing nationally representative surveys on dietary patterns or health outcomes can support research addressing economic barriers to healthy diets and related health outcomes. Previous efforts at linking food prices to individual data on health outcomes have relied on currently available price data sets, which typically price only a few specific foods that are then classified as either "healthy" or "unhealthy" (see, for example, Chou et al., 2004; Gelbach et al., 2007).

The Quarterly Food-at-Home Price Database (QFAHPD) was developed to fill the gap in available food price data and to support research on the economic determinants of diet quality and health outcomes. The database contains quarterly market-level prices for food-at-home (primarily, grocery store) items, covering the 48 contiguous States for the period 1999 to 2006. To balance the need for coverage against tractability, foods are classified into 52 separate groups based on the *2005 Dietary Guidelines* and other factors relevant for food shopping and preparation. The QFAHPD prices are for foods as purchased by consumers and do not account for losses associated with inedible portions or changes in weights due to cooking since our goal was to provide a price database for foods as purchased (not as consumed).

Alternative Price Databases

Some existing food price datasets can be disaggregated beyond the national level. These include the Bureau of Labor Statistics' (BLS) average price data, the Council for Community and Economic Research (C2ER, formerly known as ACCRA) price data, commercial store-based scanner data such as Nielsen's Scantrack or Information Resources Inc.'s (IRI's) Infoscan, and the Food Prices Database developed by the Center for Nutrition Policy and Promotion (CNPP). Each source has its strengths, but none are ideal for studies on how food prices affect food choices, diet quality and health outcomes. For example, as part of its calculation of the Consumer Price Index, the BLS collects average price data using rigorous sampling procedures for a limited number of food products.[1] However, these prices are only available at the national and broad regional level—Northeast, Midwest, South, and West. In addition to the limited number of food items and markets, researchers have shown that the BLS price data may be biased. Hausman and Leibtag (2007) show that the methodology BLS uses to calculate the food Consumer Price Index (CPI) may overestimate the price of food, especially in areas with Walmart supercenters, as lower prices observed at these and at other nontraditional retail outlets are not fully captured when consumers shift more of their food spending to these lower priced outlets.

The C2ER price database has broader geographic coverage, but includes fewer foods than the BLS data. C2ER data are used to make cross-market comparisons of the cost of living by pricing a number of consumer goods each quarter in over 300 metropolitan areas across the United States. The prices collected include 24 food-at-home (grocery store) items and 3 food-away-from-home (restaurant) items. Within each market area, price collectors are instructed to select grocery stores that individuals from professional and managerial households (defined as households with incomes in the upper quintile of the local distribution) would normally shop and to collect prices from these stores each quarter.[2] However, there is little detail on the sampling frame used to collect these data, leaving questions about the representation and coverage. There are also some challenges in using these data for time series analysis since they were designed for cross-sectional analysis only (Sturm and Datar, 2005).

Store-based scanner data, such as Nielsen Scantrack, provide records of weekly dollar sales and units sold of all UPC transactions at participating grocery stores. Average weekly prices can be calculated for selected UPCs, as well as broader food categories, by dividing the dollar sales volume by the number of units sold. Thus, the prices reflect the transaction-weighted average of all purchases made.

One shortcoming of standard store-based scanner data is that foods without UPC codes (random weight foods)—such as some fresh fruits and vegetables, baked goods, and deli items—are not included. Also, these data do not include price data from discount supercenter or warehouse club stores such as Walmart and Costco, which now comprise over 30 percent of consumer food-at-home expenditures. The omission of random-weight food items and supercenter purchases may put a significant upward bias on price estimates. A comparison of U.S. egg prices over time among the four food price

[1]For the full list of food prices collected by BLS, see the BLS website at http://data.bls.gov:8080/PDQ/outside.jsp?survey=ap.

[2]For each metro area, 5 to 10 stores are selected each quarter. For more information on the C2ER methodology, see their cost-of-living index report at http://www.coli.org/surveyforms/coli-manual.pdf.

datasets—BLS average price data, C2ER, Nielsen Scantrack, and Nielsen Homescan—shows that while all four datasets show similar trends in the price of eggs over time, the price estimates from Nielsen Homescan data are always lowest (Leibtag, 2008).

USDA's Center for Nutrition Policy and Promotion (CNPP) created another food price dataset using Nielsen Homescan data (described in the next section) in order to evaluate whether the Thrifty Food Plan is adequate to consume a healthy diet from food prepared at home. The CNPP Food Prices Database provides the price of each food, as consumed (accounting for inedible portions, water loss and/or gain from cooking, etc.), reported in the 2001-02 National Health and Nutrition Examination Survey (NHANES). Details about the database and its construction are documented by Carlson et al. (2008). Prices for foods reported in the 2003-04 NHANES have also been released and include regional prices in addition to national mean prices. These data provide detailed information about the average cost of foods as consumed, which as designed, is useful for determining the minimal cost of a healthy diet. However, the geographic variation is limited to four census regions, and the data are not designed to provide information about the cost of healthier alternatives. The dataset also does not include the price of substitutes and complements to the foods consumed, which are important determinants of individuals' food consumption.

Nielsen Homescan Data

Nielsen Homescan data contain detailed information about household food-at-home purchases. The 1999-2003 data include purchase and demographic information for about 8,000 households each year. These households reported all UPC and random-weight transactions from all outlet channels, including grocery, drug, mass-merchandise, club, supercenter, and convenience stores. This sample of households is also referred to as the Fresh Foods subpanel. Beginning in 2004, ERS purchased the full Homescan panel that includes about 40,000 households per year, but the additional 32,000 households only report their UPC-coded transactions, and not their random-weight items.

Nielsen calculates household-level weights to project a demographically balanced panel to match the U.S. population as closely as possible at the metropolitan market (52 are identified, see below), regional, and national level using census demographic information for each geographic area.[3] In the 2004-06 data, two weights are computed for households in the Fresh Foods subpanel—one that makes the Fresh Foods sample representative of each market and the entire contiguous 48 States, and one for use when the Fresh Foods households are part of the entire sample. For each food item purchased, the data include date of purchase, item description, number of units purchased, price paid, and any promotional prices or coupon savings. For purchases made in stores tracked by Nielsen Scantrack, Nielsen assigns the store-level, weighted-mean weekly price for the item to the household's purchase; for non-Scantrack stores, panelists directly report the price paid.[4]

[3]See Muth et al. (2007) for a more complete description of the Nielsen sampling design and weighting system.

[4]For more details of the impact of this two-tiered price reporting system, see Einav, Leibtag, and Nevo (2008).

Food Classification

Classification Strategies Used by Others

Previous research on the relationship between food prices and diet/weight outcomes had to rely on the limited price data described above, and food classification has mainly been limited to food-at-home versus food-away-from-home or healthy versus unhealthy foods. For example, Chou et al. (2004) look at the effect of the price at full-service restaurants, the price at fast-food restaurants, and the price of food at home on adult obesity. They obtain the full-service restaurant price from the Census of Retail Trade, while prices for fast food and food at home come from the C2ER Cost of Living Index. The price index for food at home is constructed from the prices of only 13 specific food items.

Gelbach et al. (2007) examine how the relative cost of healthful to unhealthful foods affects obesity among adults. They classify 44 individual foods, priced by BLS, as either healthful or unhealthful, but do not provide any justification for how the foods are divided. This lack of detail leads to some questionable groupings. For example, whole milk, soda crackers, and jelly are classified as healthful, while peanut butter is considered unhealthful. The majority of the foods classified as healthful are fruits and vegetables, but many of these have relatively low nutritional value (e.g., iceberg lettuce) or make up a very small proportion of overall consumption or recommended daily intake (e.g., cucumbers, celery, mushrooms, radishes, lemons, and grapefruit). In addition, each food item is weighted equally to comprise the total price index within each category, despite the fact that actual purchase and consumption can vary widely across foods.

Sturm and Datar (2005) use prices of 16 foods from C2ER to construct prices for 3 at-home food groups (meat, fruits and vegetables, and dairy), as well as 1 price for food away from home. The price of each at-home food group is a weighted average of each individual food, in which the weights are the share of the consumer basket in the food group, while the food-away-from-home price is a simple mean of the price for three fast-food meals. The prices for each group are then normalized by the average for all areas, and then by the cost of living in each Metropolitan Statistical Area (MSA). It is unclear how the share of the consumer basket for each food was determined.

Other approaches to food classification are based on nutrient profiling or energy density. The Food Standards Agency (FSA) in the United Kingdom uses nutrient profiling to determine which foods are subject to limitations on advertising to children (FSA, 2009). The model adds points for higher content of calories, fat, sugar, and sodium, while it subtracts points for fruit, vegetable, nut, fiber, and protein content. Higher scoring foods are classified as less healthy (see Rayner et al. (2005) for more details). This type of classification approach requires that the exact nutrient content of each food is known. To date, we know of no single dataset that includes both the nutrient content and the prices of foods that would allow for the estimation of geographic differences in the prices of nutrients in food as purchased.

Drewnowski (2004) classifies foods based on their nutrient density, arguing that low-income households, with limited budgets for food, maximize calories. He finds that more energy-dense foods are the least expensive per calorie, which he suggests is a main reason why low-income households struggle to have a nutritious diet. However, the assumption that households maximize caloric intake, or optimize by choosing specific nutrients rather than foods, contrasts with the way we observe how most households shop and make food purchase decisions. Furthermore, classification based on caloric density requires information that is not available with purchase data.

The QFAHPD Classification Strategy

To support research on the economic determinants of diet quality and adherence to dietary recommendations, we had two main considerations when determining how to group foods: USDA dietary guidelines (DGs) (USDA and DHHS, 2005) and convenience premiums (premiums paid for preparation (e.g. frozen, ready-to-cook meals) and other processing). Our first step was to categorize foods in the Nielsen data by the seven main food groups identified in the DGs: grains, vegetables, fruits, milk, meat and beans, oils, and discretionary calories.

Each major grouping was further subdivided into the specific form recommended by the DGs. For example, individuals are encouraged to ensure that at least half of their grains are whole grains. Thus, whole grains are separated from refined grains. The guidelines also distinguish between whole fruits and fruit juices. Thus, fruit juices are separated from whole fruits. In addition, individuals are encouraged to choose low-fat dairy products over the regular versions. We classify dairy products as low fat if they contain 2 percent or less milk fat. The DGs distinguish dark green and orange vegetables and legumes from other vegetables. Moreover, the Dietary Guidelines encourage the consumption of a variety of vegetables, identifying five main groups of vegetables: dark green, orange, dry beans and peas, starchy vegetables, and other vegetables. We further divided the other vegetables category into two groups (table 1)—those listed in the DGs as a source of eight select nutrients (see Appendix A, USDA and HHS, 2005) and all other remaining vegetables. The goal of this division is to distinguish vegetables that can help meet dietary needs of key nutrients from those with lower nutritional quality. Legumes are also identified as foods appropriate for meeting recommendations for the meat and beans category, providing another reason for pricing them separately from the dark green and orange vegetables.

As for protein sources (the meat and bean category), the DGs encourage the selection of lean cuts of meat as well as a higher consumption of fish and nuts/seeds over meat and poultry. Meat and other protein sources are classified into the five groups identified in the recommendations for this category: meat, poultry, fish, nuts and seeds, and eggs. The sixth group identified in this category is legumes, which were already identified in a separate category for vegetables. Meat is further divided into low-fat and regular cuts. Following FDA requirements, low-fat meats are those that can be labeled as fat free, low fat, lean, or extra lean (table 2).

Discretionary calories are identified as the additional calories in foods coming from the addition of fat, sugar, or alcohol. Because the DGs distinguish

Table 1
Classification of vegetables, with examples

Dark green	**Starchy vegetables**
Bok choy	Corn
Broccoli	Green peas
Collard greens	Lima beans (green)
Dark green leafy lettuce	Potatoes
Kale	
Mesclun	
Mustard greens	**Other vegetables (source of**
Romaine lettuce	**select nutrients)**
Spinach	Artichokes
Turnip greens	Avocado
Watercress	Brussels sprouts
	Cabbage
Orange vegetables	Cauliflower
Acorn squash	Green or red peppers
Butternut squash	Okra
Carrots	Parsnips
Hubbard squash	Tomatoes
Pumpkin	
Sweet potatoes	
	Other vegetables
Dry beans and peas	Asparagus
Black beans	Bean sprouts
Black-eyed peas	Celery
Garbanzo beans (chickpeas)	Cucumbers
Kidney beans	Eggplant
Lentils	Green beans
Lima beans (mature)	Iceberg (head) lettuce
Navy beans	Onions
Pinto beans	Mushrooms
Soy beans	Beets
Split peas	Zucchini
Tofu (bean curd made from soybeans)	Turnips
White beans	Wax beans

Source: USDA My Pyramid, Inside the Pyramid (http://www.mypyramid.gov/pyramid/vegetables.html) and authors' separation of "other" vegetables.

between oils and solid fats, our classification also follows this breakdown of fats. We include a single category for sugars and sweeteners and three separate categories for beverages—water; carbonated non-alcoholic drinks; and sugar-sweetened beverages such as fruit drinks and powerades.

The Dietary Guidelines also recommend limiting intake of total fat, added sugars, and sodium. Often, these nutrients are added in food processing. Fruits canned in syrup contain added sugars, canned meats and vegetables are usually pre-cooked and often have added sodium, and processed nuts (such

Table 2
Definitions for various low-fat description labels

Label (synonyms)	Definition
Fat free (without fat, no fat, zero fat)	< 0.5 grams (g) of fat per serving
Low fat	<=3g fat per 100g and no more than 30% of calories from fat <=1g saturated fat per 100g and no more than 10% calories from saturated fat <=20 milligrams (mg) cholesterol per 100g and <=2g saturated fat per 100g
Lean	<10g fat (and <4g saturated fat) per serving and per 100g
Extra lean	<5g fat (and <2g saturated fat) per serving and per 100g
% fat free	90% fat free = lean, 95% fat free = extra lean

Source: "A Little 'Lite' Reading" (http://www.fda.gov/Fdac/special/foodlabel/lite.html).

as peanut butter) usually include both added sugars and sodium. This motivates a further breakdown of fruits, vegetables, and meats into canned versus fresh or frozen and the distinction between raw and processed nut products.

Finally, many foods purchased for consumption at home are in forms that reduce the preparation time required for consumption. Canned soups, frozen entrees, and many rice dishes are packaged ready to heat. Many other foods—such as cookies, chips, and deli items—are packaged ready to eat. These foods are often composed of several ingredients, making it difficult to separate the items into distinct categories. Thus, convenience items and commercially prepared composite foods are grouped separately from primary food items. The final 52 food groups are summarized in table 3. Food groups that include random-weight items are identified in the final column.

Table 3
Food groups and subgroups

Primary category	Subcategory level 1	Subcategory level 2	Food group	Group includes random weight foods?
Fruits	Whole	Fresh/Frozen	1	yes
		Canned	2	no
	Fruit juice		3	no
Vegetables	Dark green	Fresh/Frozen	4	yes
		Canned	5	no
	Orange	Fresh/Frozen	6	yes
		Canned	7	no
	Starchy	Fresh/Frozen	8	yes
		Canned	9	no
	Other-nutrient dense	Fresh/Frozen	10	yes
		Canned	11	no
	Other-mostly water	Fresh/Frozen	12	yes
		Canned	13	no
	Legumes	Fresh//Frozen/Dried	14	no
		Canned/Processed	15	no
Grains	Whole grain	Packaged (bread, rolls, pita, rice, pasta, cereal)	16	no
		Flour and mixes	17	no
		Frozen/Ready to cook	18	no
	Refined grain	Packaged (bread, rolls, pita, rice, pasta, cereal)	19	yes
		Flour and mixes	20	no
		Frozen/Ready to cook	21	no
Dairy	Low fat	Milk	22	no
		Cheese	23	yes
		Yogurt & other	24	no
	Regular fat	Milk	25	no
		Cheese	26	yes
		Yogurt & other	27	no
Meats	Low-fat meat	Fresh/Frozen	28	yes
	Regular meat	Fresh/Frozen	29	yes
		Canned	30	no
	Poultry	Fresh/Frozen	31	yes
		Canned	32	no
	Fish	Fresh/Frozen	33	yes
		Canned	34	no
	Nuts and seeds	Raw	35	yes
		Processed/nut butters	36	no
	Eggs		37	no
Fats and Oils	Oils		38	no
	Solids		39	no
Sugar and sweeteners	Raw		40	no

—continued

Table 3
Food groups and subgroups—Continued

Primary category	Subcategory level 1	Subcategory level 2	Food group	Group includes random weight foods?
Beverages	Carbonated nonalcoholic		41	no
	Fruit drinks and other noncarbonated sugary beverages		42	no
	Water		43	no
Commercially prepared items	Sweet	Frozen (ice cream, frozen desserts)	44	no
		Mixes (pancake, muffin and cake mixes)	45	no
		Packaged (cookies, candy bars, bars)	46	yes
		Ready-to-eat (bakery items)	47	yes
	Not sweet	Frozen (pizzas, pizza rolls, french fries, breaded veggies, fish sticks, and entrees)	48	no
		Canned (soups, sauces, etc,)	49	no
		Packaged/Snacks	50	no
		Packaged/Meals and sides	51	no
		Ready-to-eat (hot and cold deli items)	52	yes

Defining Markets and Calculating Average Prices

Defining Markets

Nielsen constructs the Homescan data by including households from both metropolitan (metro) and nonmetropolitan (nonmetro) areas in order to create a national sample of households. Nielsen metro households are defined as living in one of 52 large metropolitan areas[5], while nonmetro households are those residing outside of one of those 52 areas (nonmetro). For 2002-2006 data, all nonmetro households are identified geographically based on the State and county in which they reside, allowing us to identify the census division in which the household lives, while the 1999-2001 data identify only the census region for nonmetro households.

To construct prices for as many localized markets as possible, while maximizing use of all available purchase information, we had to make some decisions regarding aggregation. Our initial goal was to construct prices for as many of the 52 metropolitan areas as possible (along with nonmetro prices at the division/region level); however, the sample size in some metropolitan areas was too small to provide reliable estimates of the expenditure shares and prices for some of the food groups. This was especially a problem for food groups with a large share of random-weight food purchases since purchases of those items are recorded only by the Fresh Foods subsample. We therefore aggregated the metro area data into 26 market groups[6] such that the Fresh Foods sample for each grouping contains at least 30 households and the differences between the Fresh Foods sample and remaining Homescan sample for average price and expenditures on UPC-coded products are minimized in the 2004-06 data.[7] We use the same metro market group definitions for 1999-2003. For nonmetro households, we group households based on the nine nonmetro census divisions for 2002-06 (four nonmetro regions for 1999-2001 due to a lack of detailed nonmetro location data for those years).[8] Table 4 lists the QFAHPD market groups and figure 1 maps them.

Calculating Average Prices

The Nielsen Homescan data provide detailed information about each food purchase, including number of units or packages, total weight, and total amount paid. Using this information, we calculate the price per 100 grams (unit value) for each purchase of each food item. For dry weights, we use a conversion of 28.35 grams per ounce, and a conversion factor of 29.57 grams per ounce for liquids.[9] In some cases, however, only the number of items purchased (e.g., ears of corn) is reported. In these cases, we used the USDA National Nutrient Database for Standard Reference (Release 20) to convert the unit counts to weight, assuming the food was medium-sized (if there are multiple sizes in the database). Although it was possible to convert most unit counts to gram weights using this approach, not all purchases reported only as counts were convertible. Those food items that were not converted were excluded from the price calculations.[10] We did not reduce the weight of foods purchased by the amount of the food that is inedible since our database is constructed for prices of foods as purchased, not as consumed.

[5]See table 4 for the full list of Nielsen's 52 metro areas.

[6]A market group sometimes includes just one metropolitan area. In these cases, our market definition is exactly the same as the Nielsen-defined market. For example, the Boston metro area is a Nielsen-defined market with sufficient sample size to be a QFAHPD market group itself, while Cincinnati, Cleveland, and Columbus were combined into one market group due to sample size concerns.

[7]Prices for UPC-coded and random-weight food items differ within a food group. To ensure that the metro areas that we combine into a given market group are consistent, we check that the mean household price paid for UPC-coded foods is no different for the Fresh Foods panel households than for the full sample in each market group. This allows us to calculate prices for food groups containing random-weight foods as a weighted average of the price of UPC-coded and random-weight foods.

[8]State of residence is not known prior to 2002 and nonmetro households for 1999-2001 are identified at the census region level only.

[9]We recognize that the gram weight of liquids will vary according to the density of the liquid. However, the variation is quite small. For example, the difference between whole and skim milk is 10 grams per gallon or 0.08 grams per ounce. We used a standard conversion for all liquids so that the prices could be easily converted back to ounces.

[10]For the most part, purchase exclusions were very limited, accounting for a negligible share of all purchases. Purchases of collard or mustards greens, swiss chard, broccoli rabe, or brocollini reported as counts (1.2% of all fresh/frozen dark green vegetable purchases in 2006) were excluded from the fresh/frozen dark green vegetable group because the USDA National Nutrient Database for Standard Reference (Release 20) does not contain information for standard measures of these vegetables. Tortillas were excluded from both the whole and refined packaged grain food groups (1.2% and 4.5% of purchases in 2006, respectively). Ice pops reported as counts (about 28% of all frozen sweet observations in 2006) were not convertible.

Table 4

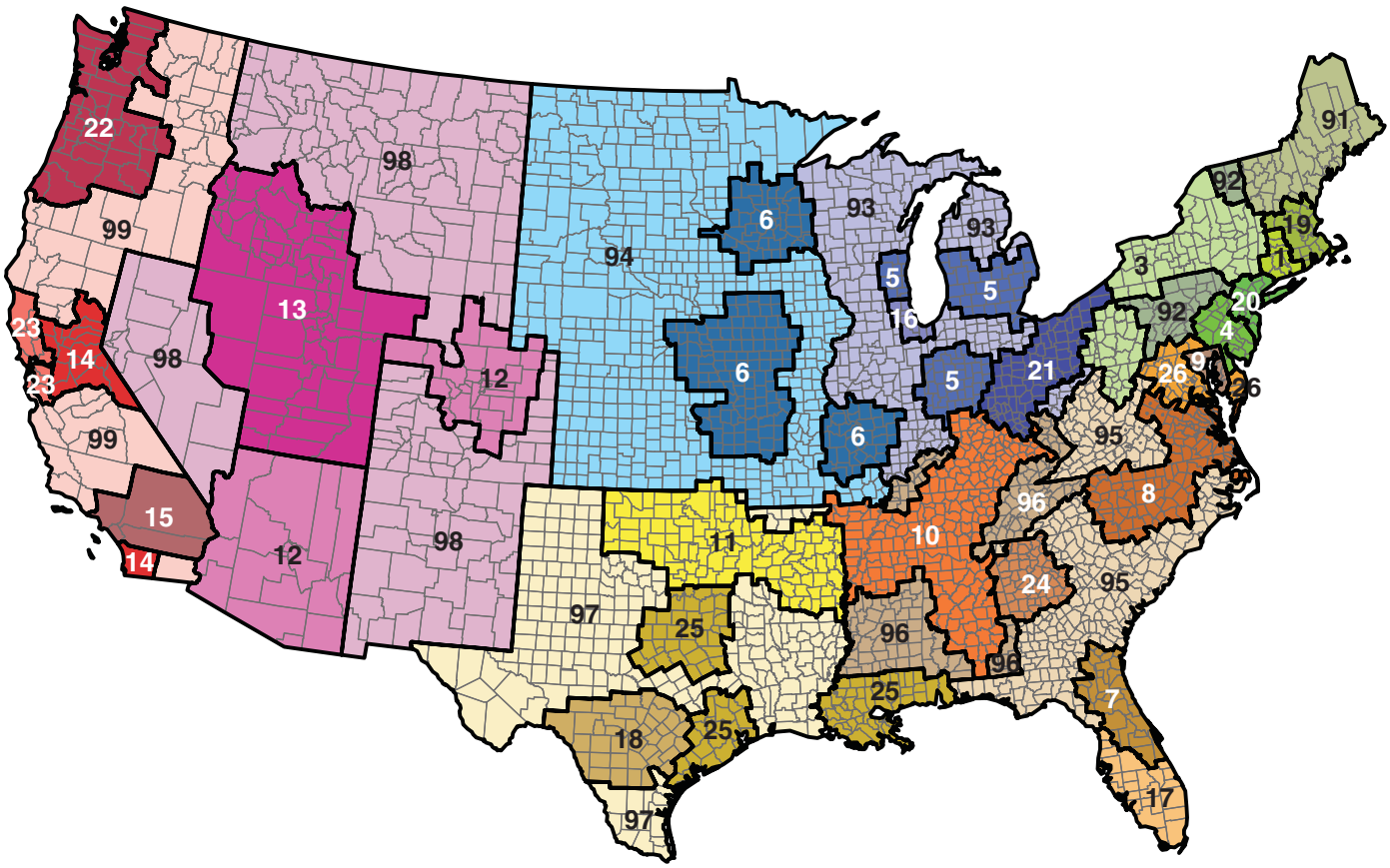
Summary of regions, divisions, and market groups

Census region	Census division	QFAHPD market group	Nielsen-identified markets included in the QFAHPD market group
East	New England	Hartford	Hartford
		Boston	Boston
		Nonmetro New England	n/a
	Middle Atlantic	Urban NY	Urban NY
		Western NY/PA	Pittsburgh, Buffalo, Albany, Syracuse
		Philadelphia	Philadelphia
		Other NY	Suburban NY, Exurban NY
		Nonmetro Middle Atlantic	n/a
Central	East North Central	Metro Midwest 1	Indianapolis, Detroit, Milwaukee, Grand Rapids
		Chicago	Chicago
		Metro Ohio	Cincinnati, Cleveland, Columbus
		Nonmetro East North Central	n/a
	West North Central	Metro Midwest 2	Kansas City, Minneapolis, St. Louis, Des Moines, Omaha
		Nonmetro West North Central	n/a
South	South Atlantic	North Florida	Jacksonville, Orlando
		Metro South 1	Raleigh-Durham, Charlotte, Richmond
		Baltimore	Baltimore
		South Florida	Miami, Tampa
		Atlanta	Atlanta
		Washington, DC	Washington, DC
		Nonmetro South Atlantic	n/a
	East South Central	Metro South 2	Nashville, Birmingham, Memphis, Louisville
		Nonmetro East South Central	n/a
	West South Central	Metro South 3	Little Rock, Oklahoma City-Tulsa
		San Antonio	San Antonio
		Metro South 4	Houston, Dallas, New Orleans
		Nonmetro West South Central	n/a
West	Mountain	Metro Mountain	Denver, Phoenix
		Salt Lake City	Salt Lake City
		Nonmetro Mountain	n/a
	Pacific	Metro California	San Diego, Sacramento
		Los Angeles	Los Angeles
		Metro Northwest	Seattle, Portland
		San Francisco	San Francisco
		Nonmetro Pacific	n/a

n/a = Not applicable. QFAHPD = Quarterly Food-at-Home Price Database.
Note: See the U.S. Census Bureau map detailing the location of States within divisions, http://www.census.gov/geo/www/us_regdiv.pdf.

Figure 1

Quarterly Food-at-Home Price Database Market Groups, 2002-06



Notes: For 1999-2001, markets 91 and 92 are combined as market 81; markets 93 and 94 are combined as market 82; markets 95, 96, and 97 are combined as market 83; and markets 98 and 99 are combined as market 84.

1	Hartford
2	Urban NY
3	Western NY/PA
4	Philadelphia
5	Metro Midwest 1
6	Metro Midwest 2
7	North Florida
8	Metro South 1
9	Baltimore
10	Metro South 2
11	Metro South 3
12	Metro Mountain
13	Salt Lake City
14	Metro California
15	Los Angeles
16	Chicago
17	South Florida
18	San Antonio
19	Boston
20	Other NY
21	Metro Ohio
22	North Pacific
23	San Francisco
24	Atlanta
25	Metro South 4
26	Washington, DC
91	Nonmetro New England
92	Nonmetro Middle Atlantic
93	Nonmetro East North Central
94	Nonmetro West North Central
95	Nonmetro South Atlantic
96	Nonmetro East South Central
97	Nonmetro West South Central
98	Nonmetro Mountain
99	Nonmetro Pacific

Since all households report both UPC-coded and random-weight purchases in 1999 through 2003, we aggregated the purchase data by first constructing for each household j the average price of food group *k* in quarter *q* ($\overline{p}_{j,k,q}$). The household average price weights each purchase occasion equally, so that an observed household price is not adjusted for the specific expenditure amount purchased during that shopping trip.[11] For example, if a household purchases milk each week, the household mean quarterly price is the simple mean of the 13 prices paid per 100 grams each week for milk. The quarterly price for each food group in market group *i* is then the weighted mean of the household average prices in each market group:

$$\overline{p}_{i,k,q} = \frac{\sum_{j=1}^{n} HHweight_j * \overline{p}_{j,k,q}}{\sum_{j=1}^{n} HHweight_j} \quad (1)$$

where *HHweight* is the household-specific weight assigned by Nielsen to each household *j*. We use this same approach for 2004-06 for food groups that do not include random-weight foods (see last column of table 3).

In order to be able to use the larger sample of households available for 2004-06, we used a weighted-average method to calculate the market group price for 2004-06 for food groups that contain random-weight food items. For some food groups, random-weight purchases make up a large share of purchases (e.g., fresh fruit, vegetables, and meats). Since only about 20 percent of the households in 2004-06 reported purchases of these items, we do not observe purchase data for a large share of some food groups for many households in the data. One solution to unobserved random-weight food purchases is to ignore all such purchases and use only UPC-coded purchases to construct our market prices. However, as table 5 shows for fruit and vegetables, the mean price of random-weight foods is lower than that for UPC-coded foods. This is probably due to the fact that UPC-coded products include convenience and packaging premiums—such as pre-washed, pre-cut, or frozen forms of produce—while random-weight products are usually fresh, unprocessed items. Thus, ignoring the random-weight purchases could overestimate the mean price of each fruit and vegetable group and the magnitude

[11] Alternatively, one could construct an expenditure-weighted household average price, but since our goal with the QFAHPD is to provide an estimate of average market group prices, we allow all price observations to count equally in the household-level price calculation.

Table 5
National average prices ($ per 100 grams) for fresh/frozen fruit and vegetables, UPC-coded and random weight, 2006

	UPC-coded	Random weight
Dark green	0.391	0.281
Orange	0.274	0.173
Starchy	0.244	0.208
Other - select nutrients	0.547	0.325
All other vegetables	0.376	0.235
Fruit	0.455	0.225

UPC = Universal Product Code. Average prices for UPC-coded and random-weight foods are statistically significantly different at the 99% level of confidence.

Source: Authors' calculations using the 2006 Nielsen Homescan data.

of the bias depends on the share of purchases in each group that are not UPC-coded. The prices of meat, poultry, and fish would be similarly affected if the price of UPC-coded products also differs from random-weight products in those categories.

In the interest of utilizing all available purchase data and reducing bias in our prices for 2004-06, we calculate a market group price as the weighted average of the price of UPC-coded foods and the price of random-weight foods, in which the weights for each type of food are the average share of expenditures on each type among the Fresh Foods panel households. More formally, for the food groups that contain random-weight items (see table 3), the price for food group k in each market group i in each quarter q is calculated as:

$$\overline{p}_{i,k,q} = s^{upc}_{k,i,FF} \frac{\sum_{j=1}^{n} HHweight_j \, p^{upc}{}_{k,j,q}}{\sum_{j=1}^{n} HHweight_j} + s^{rw}_{k,i,FF} \frac{\sum_{j=1}^{m} HHweight_j \, p^{rw}{}_{k,j,q}}{\sum_{j=1}^{m} HHweight_j} \qquad (2)$$

where $s^{upc}{}_{k,i,FF}$ is the food group- and market group-specific share of household expenditures on UPC-coded products by Fresh Foods (FF) panel households, $s^{rw}{}_{k,i,FF}$ is the food group- and market group-specific share of household expenditures on random weight products by Fresh Foods Panel households, *HHweight* is the household weight, $p^{upc}{}_{k,j,q}$ is the average price paid on UPC-coded foods in food group k by household j in quarter q, $p^{rw}{}_{k,j,q}$ is the average household price paid on random-weight foods in food group k by household j in quarter q, m is the number of Fresh Foods panel households, and n is the total number of households in the panel (including Fresh Foods households). Within each market group, equation (2) assumes that the average price and expenditure share of random-weight items in each food group among the Fresh Foods panelists represents what *would be* observed among the full panel of households if the full panel also reported their random-weight purchases. This assumption is supported by our finding that there were no significant differences between the Fresh Foods and full-sample households in the mean household price and mean household expenditure on UPC purchases of fruits and vegetables.

Although the minimum sample size per market group used to aggregate the Nielsen-defined metro areas into market groups for the QFAHPD was 30 Fresh Foods households, the average number of households in each market group is much larger. For 1999-2003, it is more than 225 (table 6), and for 2004-06 it is over 1,000 households (table 7).[12] Despite the large average sample size, some food groups are purchased infrequently (e.g., canned dark green vegetables, canned poultry) so that there are fewer than 30 households that report purchases in some market groups in some quarters. In these cases, the price is not included in the public-release version of the QFAHPD.[13]

[12] There are two markets where the number of households is less than 30 for at least one year from 1999 to 2003.

[13] Prices for food groups with fewer than 30 purchasing households in a given quarter are available, for research purposes only, from the authors upon request.

Table 6

Number of households by market and year, 1999-2003

QFAHPD market group		1999	2000	2001	2002	2003
1	Hartford	68	57	57	50	41
2	Urban NY	226	223	233	270	283
3	Western NY/PA	264	206	199	188	177
4	Philadelphia	106	536	646	75	69
5	Metro Midwest 1	242	230	220	224	196
6	Metro Midwest 2	210	212	189	188	161
7	North Florida	40	30	72	474	479
8	Metro South 1	60	68	130	45	39
9	Baltimore	265	253	246	250	256
10	Metro South 2	42	53	107	121	116
11	Metro South 3	15	19	46	36	50
12	Metro Mountain	157	151	132	126	117
13	Salt Lake City	97	90	76	619	738
14	Metro California	59	58	56	121	160
15	Los Angeles	690	657	654	714	710
16	Chicago	633	593	590	653	654
17	South Florida	80	81	132	146	152
18	San Antonio	461	434	425	620	638
19	Boston	79	54	58	49	49
20	Other NY	501	466	490	735	724
21	Metro Ohio	145	144	141	144	127
22	North Pacific	109	100	89	79	81
23	San Francisco	37	383	586	66	67
24	Atlanta	833	786	779	829	857
25	Metro South 4	62	66	127	152	190
26	Washington, DC	543	518	533	550	565
81	Nonmetro East	125	111	116	n/a	n/a
91	Nonmetro New England	n/a	n/a	n/a	46	51
92	Nonmetro Middle Atlantic	n/a	n/a	n/a	52	53
82	Nonmetro Central	581	514	544	n/a	n/a
93	Nonmetro East North Central	n/a	n/a	n/a	275	263
94	Nonmetro West North Central	n/a	n/a	n/a	211	188
83	Nonmetro South	105	328	123	n/a	n/a
95	Nonmetro South Atlantic	n/a	n/a	n/a	148	152
96	Nonmetro East South Central	n/a	n/a	n/a	71	78
97	Nonmetro West South Central	n/a	n/a	n/a	111	117
84	Nonmetro West	289	250	272	n/a	n/a
98	Nonmetro Mountain	n/a	n/a	n/a	116	109
99	Nonmetro Pacific	n/a	n/a	n/a	117	103

QFAHPD = Quarterly Food-at-Home Price Database.

Source: ERS tabulations of Nielsen Homescan data, 1999-2003.

Table 7

Number of households by market and year, 2004-06

QFAHPD market group		2004		2005		2006	
		Full panel	FF panel	Full panel	FF panel	Full panel	FF panel
1	Hartford	218	39	193	36	186	31
2	Urban NY	599	282	577	266	557	236
3	Western NY/PA	1,895	164	1,740	164	1,748	152
4	Philadelphia	260	63	248	54	237	49
5	Metro Midwest 1	1,481	177	1,614	164	1,617	151
6	Metro Midwest 2	2,985	152	2,900	142	2,825	131
7	North Florida	958	440	900	410	909	397
8	Metro South 1	1,269	43	1,191	48	1,133	49
9	Baltimore	333	229	356	215	334	192
10	Metro South 2	1,721	140	1,758	122	1,764	119
11	Metro South 3	819	47	879	45	811	41
12	Metro Mountain	2,433	122	2,339	109	2,247	110
13	Salt Lake City	832	657	921	656	882	569
14	Metro California	2,366	147	2,261	135	2,192	115
15	Los Angeles	1,238	668	1,151	625	1,150	581
16	Chicago	1,148	592	1,064	558	1,069	490
17	South Florida	1,629	156	1,548	137	1,509	121
18	San Antonio	1,018	717	995	711	963	662
19	Boston	1,280	40	1,275	42	1,197	34
20	Other NY	1,106	777	1,183	827	1,118	743
21	Metro Ohio	1,843	116	1,780	111	1,710	106
22	North Pacific	1,505	79	1,413	76	1,337	70
23	San Francisco	385	84	378	82	378	77
24	Atlanta	1,018	800	1,039	784	976	699
25	Metro South 4	2,464	172	2,378	138	2,482	135
26	Washington, DC	743	516	759	508	743	477
81	Nonmetro East	n/a	n/a	n/a	n/a	n/a	n/a
91	Nonmetro New England	185	45	167	41	160	40
92	Nonmetro Middle Atlantic	232	59	208	52	201	50
82	Nonmetro Central	n/a	n/a	n/a	n/a	n/a	n/a
93	Nonmetro East North Central	1,081	242	1,127	231	1,090	224
94	Nonmetro West North Central	761	173	760	163	687	150
83	Nonmetro South	n/a	n/a	n/a	n/a	n/a	n/a
95	Nonmetro South Atlantic	674	176	683	172	668	158
96	Nonmetro East South Central	792	86	813	71	793	59
97	Nonmetro West South Central	1,260	114	1,280	108	1,163	93
84	Nonmetro West	n/a	n/a	n/a	n/a	n/a	n/a
98	Nonmetro Mountain	542	114	512	121	520	120
99	Nonmetro Pacific	504	105	466	101	430	95

QFAHPD = Quarterly Food-at-Home Price Database. FF = Fresh Foods.

Source: ERS tabulations of Nielsen Homescan data, 2004-06.

Accessing the QFAHPD

The QFAHPD can be downloaded as a set of 4 Excel[14] spreadsheets from http://www.ers.usda.gov/Briefing/CPIFoodAndExpenditures/QFAHPD.htm: fruits and vegetables (food groups 1-15); grains and dairy (food groups 16-27); meats, nuts, and eggs (food groups 28-37); and fats, beverages, and prepared foods (food groups 38-52). Each Excel file includes a codebook spreadsheet identifying the codes for food groups, market groups, regions, and divisions. Each food group is included in a separate worksheet. Quarterly prices are not reported when fewer than 30 households reported purchases of a particular food group.

The variables included in the database are: market group, year, quarter, price ($ per 100 grams), standard error (se, estimated via jackknife, see Appendix B), number of households (n) from which the price is estimated, Census division (division), Census region (region), the sum of household weights within the market (aggweight, can be used to aggregate market group prices to division- or region-level prices)[15], and total (weighted) quarterly expenditure on the food group in the market group (totexp, can be used to construct prices for aggregated food groups).

[14]Use of commercial and trade names does not imply approval or constitute endorsement by USDA.

[15]Aggregation up to the census region is possible for all years (1999-2006) and up to the census division for 2002-06 only.

Cross-Market Variation as Evidenced by the 2006 Data

The paucity of market-level food price data has made it difficult to estimate the extent to which food prices vary across the country and to study the relationship between food prices and diet and health outcomes and overall well-being. In this section, we use the 2006 QFAHPD data to explore the extent of cross-market price variation.

We use the coefficient of variation (CV, the standard deviation divided by the mean quarterly market group price) as a measure of cross-market dispersion because in addition to summarizing the cross-market variation, it allows us to compare cross-market variation across food groups.[16] Table 8 reports the mean market group price and the coefficient of variation for each quarter of 2006 for a subset of the 52 food groups. There is quite a bit of variation across markets, with the coefficients of variation ranging from 5 percent (canned soups and sauces, 1st quarter) to 18 percent (eggs, 3rd quarter).

To look more closely at the variation in market group prices, table 9 presents an extract of the QFAHPD that includes the 2006 first-quarter price for fresh and frozen fruit (food group 1) for each of the 35 market groups. The lowest price (22.9 cents per 100 grams) is found in market group 94, which includes portions of Oklahoma, Nebraska, and North and South Dakota (see fig. 1 on p. 13). The highest price (42.2 cents) is observed in Hartford (market group 1). A t-test reveals that the difference between these two prices (19.3 cents, or 65 percent of the mean market group price that quarter) is statistically significant at the 99-percent level of confidence ($p < .01$). But not all differences in market group prices are statistically significant. For example, the first-quarter price in market group 94 is not statistically different from the second lowest market group price (23.7 cents per 100 grams, a difference of 0.8 cent, or 2.7 percent of the mean) found in market group 99 (Nonmetro Pacific, which includes parts of California, Oregon, and Washington).

Table 10 reports the minimum and maximum market group price for the first quarter of 2006 and the maximum price as percent of the minimum price for the same subset of food groups presented in table 8. Among these food groups, the range in market group prices is lowest for canned soups and sauces (maximum market group price is 25 percent above the lowest market group price) and highest for low-fat cheese (117 percent). The difference between the minimum and maximum market group price is statistically significant ($p<0.01$) for all food groups except packaged sweets and baked goods (food group 46).

We also calculate the weighted mean prices and coefficients of variation for the four census regions for these same select food groups (table 11). The CVs reveal that cross-market dispersion within each census region depends on the specific food group and the region. In some food groups, the variation within regions (as measured by the coefficient of variation) is smaller than the variation observed across all market groups, but for other food groups the regional variation is just as large or larger than the overall cross-market variation. For example, the CVs for canned fruit are greater in the East (13.3 percent) and West (10.6 percent) than for all market groups (10.5 percent). On the other

[16]Normally, the standard deviation (the square root of a variable's variance) is used to examine dispersion of a variable. In a normal distribution, 68 percent of the observations (in this case, market groups) will be within 1 standard deviation of the mean and about 95 percent will be within 2 standard deviations. Since each food group has a different mean price, the standard deviations are not comparable. Because the coefficient of variation is normalized by the mean market group price, the measure can be compared across food groups.

Table 8

Mean quarterly market group prices ($ per 100 grams) and coefficients of variation (percent), select food groups, 2006

Food group		1st quarter	2nd quarter	3rd quarter	4th quarter
(1)	Fresh/frozen fruit	0.298 (10.7)	0.301 (10.1)	0.297 (9.0)	0.289 (10.9)
(2)	Canned fruit	0.288 (10.5)	0.279 (9.5)	0.290 (9.1)	0.282 (8.1)
(3)	Fruit juice	0.174 (9.6)	0.180 (10.5)	0.182 (12.0)	0.184 (8.5)
(4)	Fresh/frozen dark green vegetables	0.342 (10.1)	0.356 (12.0)	0.351 (10.8)	0.315 (10.3)
(6)	Fresh/frozen orange vegetables	0.247 (7.4)	0.253 (8.2)	0.258 (7.9)	0.233 (6.7)
(8)	Fresh/frozen starchy vegetables	0.219 (10.4)	0.221 (11.2)	0.225 (9.7)	0.222 (11.1)
(15)	Canned legumes	0.150 (11.5)	0.156 (10.8)	0.157 (10.3)	0.155 (10.7)
(16)	Whole-grain bread, rolls, rice, pasta, cereal	0.470 (5.8)	0.473 (6.2)	0.478 (6.3)	0.477 (5.9)
(19)	Refined-grain bread, rolls, rice, pasta, cereal	0.376 (7.8)	0.384 (8.8)	0.380 (7.7)	0.384 (7.3)
(22)	Low-fat milk	0.093 (13.1)	0.091 (13.1)	0.091 (13.1)	0.094 (13.4)
(23)	Low-fat cheese	0.639 (12.8)	0.634 (12.8)	0.628 (12.1)	0.646 (12.9)
(29)	Fresh/frozen regular fat meat	0.735 (10.4)	0.741 (11.1)	0.756 (10.3)	0.754 (11.7)
(31)	Fresh/frozen poultry	0.550 (11.6)	0.549 (15.8)	0.576 (12.5)	0.517 (11.5)
(33)	Fresh/frozen fish	1.190 (11.7)	1.259 (11.8)	1.260 (12.7)	1.310 (10.2)
(37)	Eggs	0.188 (15.5)	0.178 (17.5)	0.177 (18.5)	0.203 (14.8)
(41)	Non-alcoholic carbonated beverages	0.087 (6.8)	0.086 (8.0)	0.087 (7.7)	0.088 (7.7)
(42)	Non-carbonated caloric beverages	0.119 (12.0)	0.114 (11.5)	0.119 (26.1)	0.118 (10.2)
(46)	Packaged sweets/baked goods	0.972 (13.8)	0.935 (14.3)	0.893 (15.4)	0.910 (8.3)
(48)	Frozen entrees and sides	0.652 (6.8)	0.657 (7.5)	0.654 (6.8)	0.658 (6.6)
(49)	Canned soups, sauces, prepared foods	0.249 (5.0)	0.245 (6.8)	0.251 (6.7)	0.253 (6.3)
(50)	Packaged snacks	0.794 (7.7)	0.802 (6.4)	0.805 (6.9)	0.799 (7.4)

Source: ERS calculations using 2006 Quarterly Food-at-Home Price Database; coefficient of variation in parentheses; weighted means reported.

Table 9

QFAHPD first-quarter 2006 data, food group 1 (fresh and frozen fruit)

QFAHPD market group	year	quarter	price	se	n	division	region	aggweight	totexp
1	2006	1	0.4217	0.0591	132	1	1	1,220,140	$15,814,053
2	2006	1	0.3164	0.0194	382	2	1	3,296,844	$43,328,030
3	2006	1	0.3162	0.0128	1,296	2	1	4,350,804	$63,329,913
4	2006	1	0.3137	0.0080	893	2	1	3,464,067	$67,899,846
5	2006	1	0.2701	0.0092	1,261	3	2	5,889,043	$75,720,632
6	2006	1	0.2914	0.0136	2,019	4	2	4,960,659	$56,332,924
7	2006	1	0.2841	0.0110	299	5	3	2,523,582	$39,723,652
8	2006	1	0.3255	0.0208	1055	5	3	3,980,952	$55,007,253
9	2006	1	0.3430	0.0184	271	5	3	1,089,065	$19,000,109
10	2006	1	0.2761	0.0128	1,203	6	3	4,704,570	$44,905,832
11	2006	1	0.2835	0.0298	511	7	3	2,339,893	$18,040,062
12	2006	1	0.3088	0.0195	1,586	8	4	3,933,781	$48,339,432
13	2006	1	0.2462	0.0232	162	8	4	1,289,480	$19,479,797
14	2006	1	0.2616	0.0173	760	9	4	2,213,982	$26,200,949
15	2006	1	0.2974	0.0108	918	9	4	5,650,944	$98,105,794
16	2006	1	0.3068	0.0115	868	3	2	3,343,922	$65,182,733
17	2006	1	0.3161	0.0144	1,678	5	3	4,641,030	$63,330,287
18	2006	1	0.3182	0.0162	736	7	3	1,423,906	$30,117,234
19	2006	1	0.3296	0.0297	824	1	1	3,151,092	$35,943,906
20	2006	1	0.3675	0.0133	698	2	1	4,173,092	$76,369,759
21	2006	1	0.3058	0.0146	1,320	3	2	4,380,276	$53,592,174
22	2006	1	0.2793	0.0213	899	9	4	3,145,148	$40,051,625
23	2006	1	0.3344	0.0098	798	9	4	2,607,957	$65,955,631
24	2006	1	0.2914	0.0085	819	5	3	2,288,210	$43,336,196
25	2006	1	0.2885	0.0166	1,676	7	3	5,896,993	$57,562,596
26	2006	1	0.3334	0.0116	632	5	3	2,763,040	$64,142,661
91	2006	1	0.3430	0.0275	113	1	1	889,672	$13,507,918
92	2006	1	0.3035	0.0239	145	2	1	1,084,815	$14,145,782
93	2006	1	0.2485	0.0102	836	3	2	5,136,716	$65,944,788
94	2006	1	0.2290	0.0129	503	4	2	2,855,429	$24,419,772
95	2006	1	0.2822	0.0150	485	5	3	4,973,485	$48,939,970
96	2006	1	0.2911	0.0204	548	6	3	2,052,783	$18,738,228
97	2006	1	0.3114	0.0243	767	7	3	3,260,843	$29,260,779
98	2006	1	0.2868	0.0178	379	8	4	3,073,814	$42,435,889
99	2006	1	0.2365	0.0147	312	9	4	2,372,146	$27,975,480

Notes: se = standard error, n = sample size (number of households), aggweight = aggregate household weight, totexp = total quarterly expenditures. QFAHPD = Quarterly Food-at-Home Price Database.

Table 10

Range in market group prices, first-quarter 2006, select food groups

	Food group	Minimum price	Maximum price	Max as percent of min.
		$ per 100 grams		
1	Fresh/frozen fruit	0.229	0.422	184.1
2	Canned fruit	0.237	0.385	162.4
3	Fruit juice	0.146	0.223	152.3
4	Fresh/frozen dark green vegetables	0.259	0.399	154.0
6	Fresh/frozen orange vegetables	0.202	0.302	149.7
8	Fresh/frozen starchy vegetables	0.176	0.277	157.3
15	Canned legumes	0.116	0.208	178.7
16	Whole grain bread, rolls, rice, pasta, cereal	0.429	0.540	125.8
19	Refined-grain bread, rolls, rice, pasta, cereal	0.335	0.467	139.7
22	Low-fat milk	0.067	0.124	185.9
23	Low-fat cheese	0.432	0.938	217.2
29	Fresh/frozen regular fat meat	0.598	0.906	151.4
31	Fresh/frozen poultry	0.468	0.856	182.9
33	Fresh/frozen fish	0.891	1.506	169.1
37	Eggs	0.143	0.250	174.6
41	Non-alcoholic carbonated beverages	0.075	0.104	138.5
42	Noncarbonated caloric beverages	0.095	0.160	168.4
46	Packaged sweets/baked goods	0.803	1.463	182.3
47	Bakery items, ready to eat	0.399	0.652	163.3
48	Frozen entrees and sides	0.590	0.784	133.0
49	Canned soups, sauces, prepared foods	0.226	0.283	125.4
50	Packaged snacks	0.709	1.025	144.5

Source: ERS calculations using 2006 Quarterly Food-at-Home Price Database.

hand, the CVs for canned legumes are smaller in all census regions (9.1, 7.5, 7.7 and 10.5 percent) as compared to the national CV (11.5 percent).

This brief overview of the 2006 data demonstrates that food prices vary widely across geographic areas. The more localized price estimates in the QFAHPD show that variation across market groups is much greater than food price variation over time, which averaged just 3 percent per year over the past 20 years (table 12). Fresh fruit and vegetable prices, which generally exhibit greater inflation rates than do other food categories, averaged less than 5 percent inflation per year, but the coefficient of variation (across market groups) was as high as 10 percent in 2006 alone. The greater price variation across market groups as compared to the price variation over time suggests that research investigating the determinants of cross-market price variation deserves greater attention, or at least as much focus as the determinants of price change over time.

Table 11

Mean market group prices ($ per 100 grams) and coefficients of variation (percent), first-quarter 2006, by census region and overall

Food group		East	Central	South	West	National
1	Fresh/frozen fruit	0.334 (8.9)	0.276 (9.6)	0.300 (6.6)	0.288 (9.5)	0.298 (10.7)
2	Canned fruit	0.306 (13.3)	0.267 (5.9)	0.281 (5.2)	0.306 (10.6)	0.288 (10.5)
3	Fruit juice	0.162 (5.0)	0.172 (3.1)	0.167 (7.0)	0.198 (7.2)	0.174 (9.6)
4	Fresh/frozen dark green vegetables	0.369 (4.5)	0.329 (6.3)	0.356 (8.5)	0.307 (10.0)	0.342 (10.1)
6	Fresh/frozen orange vegetables	0.242 (6.5)	0.248 (1.7)	0.256 (8.0)	0.236 (7.7)	0.247 (7.4)
8	Fresh/frozen starchy vegetables	0.246 (5.7)	0.206 (4.9)	0.217 (11.3)	0.214 (7.8)	0.219 (10.4)
15	Canned legumes	0.152 (9.1)	0.144 (7.5)	0.141 (7.7)	0.170 (10.5)	0.150 (11.5)
16	Whole grain bread, rolls, rice, pasta, cereal	0.497 (2.4)	0.451 (2.6)	0.463 (6.7)	0.477 (4.4)	0.470 (5.8)
19	Refined-grain bread, rolls, rice, pasta, cereal	0.379 (4.8)	0.361 (5.1)	0.365 (5.6)	0.410 (7.7)	0.376 (7.8)
22	Low-fat milk	0.100 (13.7)	0.079 (5.6)	0.099 (7.0)	0.090 (11.2)	0.093 (13.1)
23	Low-fat cheese	0.713 (11.7)	0.567 (8.0)	0.660 (7.7)	0.615 (13.6)	0.639 (12.8)
29	Fresh/frozen regular fat meat	0.820 (5.9)	0.688 (5.9)	0.705 (9.9)	0.764 (8.4)	0.735 (10.4)
31	Fresh/frozen poultry	0.613 (13.4)	0.528 (9.1)	0.532 (8.9)	0.550 (8.7)	0.550 (11.6)
33	Fresh/frozen fish	1.297 (6.0)	1.103 (7.9)	1.139 (13.2)	1.276 (6.9)	1.190 (11.7)
37	Eggs	0.211 (11.9)	0.162 (8.8)	0.176 (5.9)	0.215 (13.5)	0.188 (15.5)
41	Non-alcoholic carbonated beverages	0.082 (6.2)	0.085 (2.5)	0.087 (2.6)	0.096 (5.9)	0.087 (6.8)
42	Non-carbonated caloric beverages	0.120 (10.8)	0.119 (6.2)	0.112 (12.2)	0.130 (11.8)	0.119 (12.0)
46	Packaged sweets/baked goods	0.992 (6.8)	0.885 (5.0)	0.937 (6.9)	1.110 (18.4)	0.972 (13.8)
48	Frozen entrees and sides	0.685 (5.9)	0.636 (9.0)	0.636 (4.7)	0.668 (4.1)	0.652 (6.8)
49	Canned soups, sauces, prepared foods	0.245 (5.8)	0.247 (2.8)	0.245 (4.0)	0.263 (3.5)	0.249 (5.0)
50	Packaged snacks	0.806 (5.9)	0.748 (6.3)	0.788 (5.3)	0.844 (8.6)	0.794 (7.7)

Source: ERS calculations using 2006 Quarterly Food-at-Home Price Database; coefficient of variation in parentheses; weighted means reported.

Table 12

Average annual U.S. food price inflation, 1989-2008

Food group	Average annual inflation (%)
All Food	3.0
Food away from home	2.9
Food at home	3.1
Beef	3.5
Pork	2.6
Poultry	2.6
Fish	2.7
Eggs	5.0
Dairy	3.4
Fats and oils	2.9
Cereal and bakery products	3.6
Fresh fruits	4.6
Fresh vegetables	4.5
Processed fruits and vegetables	2.9
Non-alcoholic beverages	2.0

Source: ERS calculations using Bureau of Labor Statistics Consumer Price Index for All Urban Consumers (CPI-U) data.

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Appendix A: Examples of Foods Included in Select Food Groups

Packaged grains (whole [16] or refined [19])

Oriental noodles
rice, packaged and bulk
rice, instant
pasta
ready-to-eat cereal, including granola
rice cakes
fresh baked bread, buns, bagels, rolls, biscuits
wheat germ
hominy grits
barley

Grain mixes (whole [17] or refined [20])

flour, all purpose or single purpose
biscuit, rolls or bread mixes
matzo meal
corn meal
hushpuppy mixes

Frozen grains (whole [18] or refined [21])

frozen dough products
frozen biscuits, rolls, muffins, bread
refrigerated pasta

Commercially prepared sweet frozen [44]

ice pops, frozen yogurt, ice milk, sherbet, ice cream, etc.
frozen doughnuts, cheesecake, pies, breakfast cakes, sweet rolls, brownies

Commercially prepared sweet mixes [45]

cake, brownie, muffin, cookie, and other dessert mixes
pie crust mix
pudding and gelatin mixes
ice cream mixes

Commercially prepared sweet packaged [46]

candy, cookies, ice cream cones
chocolate, marshmallows, refrigerated pudding

Ready-to-eat sweet (bakery items) [47]

Random-weight sweet baked goods (cakes, pies, cookies, etc.)
single-serving canned desserts
refrigerated gelatin and fruit salads
fresh muffins, cakes, sweet rolls, donuts, pies, etc.

Commercially prepared frozen, not sweet [48]

frozen entrees, hors d'oeuvres, and snacks
frozen pizzas
frozen vegetable dishes (breaded, with sauces, fried)

Commercially prepared frozen, not sweet [48]—continued

frozen breaded/fried seafood
frozen corndogs

Canned soups and sauces, etc. [49]

canned vegetables/beans with meat
canned potato salad
tomato, pizza, pasta sauces
corned beef and roast beef hash
beef and other stews
canned Mexican dinners, refried beans
chili, ravioli, spaghetti, lasagna
soup
chow mein and other oriental foods

Commercially packaged snacks [50]

pork rinds, puffed cheese, potato chips, corn chips, popcorn, pretzels, crackers, trail mix, granola bars, breakfast bars

Commercially prepared packaged meals and sides [51]

dehydrated vegetables
shelf-stable entrees/side dishes
ramen noodles, misc. oriental foods
soup mixes
rice mixes
instant meals
ethnic mixes

Ready-to-eat hot and cold deli items [52]

prepared dishes
ready-made salads
sandwiches
combination lunches

Appendix B: Jackknife Methodology Used To Calculate Standard Errors

Standard errors of the quarterly prices are estimated via the following jackknife approach.

Let N represent the number of households that purchase a given food group in a given market group in a given quarter. We obtain N estimates of the quarterly market group price by dropping one household at a time and estimating the price using the remaining households.

Let μ be the estimated quarterly market level price for a given food group. Let $\hat{\mu}_n$ represent the estimated quarterly market level price in the food group when household n is dropped. The jackknife estimated standard error for μ is then:

$$\sigma = \sqrt{\frac{N-1}{N}} \sum_{n=1}^{N} (\mu - \hat{\mu}_n)^2$$

Appendix C: Comparison of Price Variation Across Markets Observed in Full Sample to Low-Income Sample

One concern with the QFAHPD is that the geographic variation in food prices observed when all households are used to estimate the prices may not accurately depict the variation in prices that low-income households face when food shopping. Specifically, the foods available to low-income households may be of a different quality than those available to other households. This appendix considers how differences in household income may affect the cross-market variation in food prices through differences in quality of foods.

Quality can refer to any attribute of a food item that influences unit cost. The attributes can reflect categorical differences in the item (type of fruit or vegetable, cuts of beef, species of fish), the processing or convenience (pre-cut melons and vegetables, grated cheese, or ready-to-cook entrees), packaging (single serving vs. family size), brand (national vs. store) or production methods (organic vs. conventional). In addition, the choice of outlet may affect the unit cost of food as different outlet types may face different operating costs, with different markups over wholesale prices.

Classifying foods into particular subgroups addresses the issue of quality in part by separating higher priced forms of foods from lower priced alternatives (for example, fresh/frozen vs. canned vegetables, or raw ingredients from packaged/prepared versions). However, within each food group, it is possible that low-income households purchase different products, face different prices, or have different levels of access than households with higher income. If the variation in prices (across locales) faced by low-income households is similar to the variation in prices faced by higher income households, patterns that hold for the whole sample would reasonably hold for the low-income households in the sample.

We tested whether the variation in prices of specific food groups across markets is affected by household income. We compared the variation in mean prices calculated using the full sample to prices calculated using only low-income households (income less than 185 percent of the Federal poverty line). We chose the 185-percent cutoff (rather than a lower income level, such as 100 percent or 130 percent of the Federal poverty line) as it allowed us to have at least 30 low-income households in each of the 35 market groups included in the QFAHPD. Since the sample of low-income households is much smaller than the full sample, we limited our comparison to food groups that do not include random-weight food items.

Mean market prices are constructed as in equation 1 for both the full and the low-income samples in each market for canned fruit, packaged whole grains, low-fat milk, eggs, and carbonated beverages. Prices in each market are normalized by the weighted national mean price for each sample to construct a price index for the food group. When the markets are ranked by the price index in each food group, we consistently see the most expensive markets as determined by the full sample also appearing as the most expensive markets in the low-income sample, and the same pattern holds for the least expensive markets as well (tables C1-C5). Thus, the relative price differences across

markets hold regardless of the sample we select. Although we recognize that within each market the average price paid by low-income households is lower than that paid by households with higher income, we are confident that the QFAHPD provides relevant price information for research on how low-income households or individuals react to food prices.

Table C-1

Comparison of price variation across market groups, full sample vs. low-income sample, canned fruit (food group 2), 2006 Nielsen Homescan

Full sample		Low-income sample	
Market group	Price relative to national mean (%)	Market group	Price relative to national mean (%)
Nonmetro Middle Atlantic	84.5	Nonmetro Middle Atlantic	84.7
Nonmetro East South Central	87.2	Nonmetro East South Central	84.9
Nonmetro West North Central	88.4	Salt Lake City	87.2
Nonmetro East North Central	88.8	San Antonio	92.3
Metro South 3	89.9	Metro South 3	93.1
Salt Lake City	91.4	Nonmetro New England	93.9
San Antonio	91.7	Metro South 2	94.3
Metro South 2	91.7	Metro South 1	94.3
Nonmetro West South Central	91.8	Nonmetro West North Central	94.9
Metro Midwest 2	92.4	Western NY/PA	95.0
Metro Ohio	94.4	Metro Midwest 1	95.1
Metro Midwest 1	96.3	Nonmetro Mountain	95.3
Western NY/PA	97.2	Nonmetro East North Central	95.8
Metro South 1	97.3	Baltimore	96.7
Metro South 4	97.5	Metro Ohio	97.1
Nonmetro South Atlantic	98.3	Metro South 4	97.8
Nonmetro New England	99.2	Nonmetro West South Central	98.3
Atlanta	99.9	Atlanta	99.0
North Pacific	100.0	Metro Midwest 2	99.1
Philadelphia	100.2	North Florida	99.5
Nonmetro Mountain	100.5	Hartford	99.9
North Florida	101.0	Nonmetro South Atlantic	100.1
Chicago	101.0	Washington, DC	102.0
South Florida	102.0	Chicago	102.9
Nonmetro Pacific	105.6	North Pacific	103.5
Baltimore	105.8	Metro Mountain	103.7
Other NY	105.8	Nonmetro Pacific	104.0
Metro Mountain	105.9	Philadelphia	104.1
Washington, DC	106.1	Metro California	107.0
Hartford	106.6	South Florida	107.9
Metro California	109.9	Los Angeles	108.8
Los Angeles	111.9	Other NY	112.3
Boston	115.9	Urban NY	114.3
Urban NY	122.1	Boston	116.5
San Francisco	126.2	San Francisco	121.0

Note: National mean prices are weighted and calculated separately for each sample; low-income households have income less than 185% of the Federal poverty line.

Source: ERS calculations using 2006 Nielsen Homescan data.

Table C-2

Comparison of price variation across market groups, full sample vs. low-income sample, packaged whole grains (food group 16), 2006 Nielsen Homescan

Full sample		Low-income sample	
Market group	Price relative to national mean (%)	Market group	Price relative to national mean (%)
San Antonio	89.6	Salt Lake City	88.8
Salt Lake City	92.1	San Antonio	91.1
Nonmetro West North Central	92.9	Nonmetro South Atlantic	91.9
Nonmetro East North Central	93.6	Chicago	93.7
Nonmetro West South Central	94.1	Nonmetro West South Central	93.8
Nonmetro South Atlantic	94.2	Metro South 4	95.2
Metro South 2	95.1	Metro Midwest 1	95.8
Metro Ohio	95.4	Nonmetro East North Central	95.9
Metro South 1	95.6	Nonmetro West North Central	96.0
Atlanta	96.2	Metro South 2	96.9
Metro South 4	96.3	Nonmetro Middle Atlantic	97.1
Metro Midwest 1	96.4	Los Angeles	97.4
Metro South 3	96.5	Nonmetro Mountain	97.8
Nonmetro East South Central	96.6	Metro Ohio	98.6
Metro Mountain	97.7	Metro Midwest 2	98.7
Nonmetro Pacific	98.0	Metro Mountain	99.4
Nonmetro Mountain	98.4	Nonmetro East South Central	100.1
North Pacific	99.3	Metro South 1	100.6
Metro Midwest 2	99.6	Other NY	100.9
Nonmetro Middle Atlantic	99.7	Washington, DC	100.9
Western NY/PA	99.8	Nonmetro Pacific	101.4
Chicago	100.9	Boston	101.9
Los Angeles	101.5	North Florida	102.1
Washington, DC	102.8	Western NY/PA	102.2
Nonmetro New England	103.3	Philadelphia	103.2
North Florida	105.5	Metro South 3	104.6
Other NY	106.4	San Francisco	104.7
Metro California	106.8	Atlanta	106.5
San Francisco	106.9	Hartford	106.7
Philadelphia	106.9	North Pacific	106.8
Urban NY	108.8	Metro California	106.9
Boston	108.9	Nonmetro New England	107.2
Hartford	109.1	Baltimore	107.7
Baltimore	113.3	Urban NY	107.7
South Florida	115.0	South Florida	122.0

Note: National mean prices are weighted and calculated separately for each sample; low-income households have income less than 185% of the Federal poverty line..

Source: ERS calculations using 2006 Nielsen Homescan data.

Table C-3

Comparison of price variation across market groups, full sample vs. low-income sample, low-fat milk (food group 23), 2006 Nielsen Homescan

Full sample		Low-income sample	
Market group	Price relative to national mean (%)	Market group	Price relative to national mean (%)
Salt Lake City	72.8	Salt Lake City	65.6
Nonmetro East North Central	80.3	Metro Ohio	81.8
Metro Ohio	81.5	Nonmetro East North Central	82.1
Metro Midwest 1	82.4	Metro Midwest 1	82.6
Western NY/PA	83.4	Metro Mountain	84.0
North Pacific	86.7	Nonmetro Pacific	84.2
Chicago	87.3	Western NY/PA	86.0
Nonmetro West North Central	88.2	Chicago	87.4
Metro Mountain	89.0	North Pacific	87.7
Metro Midwest 2	89.2	Nonmetro Mountain	88.0
Metro South 3	93.7	Metro Midwest 2	90.7
Nonmetro Pacific	94.4	Metro South 3	91.5
Metro South 2	94.7	Nonmetro West North Central	92.5
Nonmetro Middle Atlantic	97.9	Metro South 2	96.2
Nonmetro Mountain	98.0	Boston	101.9
Philadelphia	105.6	Nonmetro West South Central	104.5
Nonmetro West South Central	106.3	Metro South 4	105.4
Nonmetro South Atlantic	106.3	Nonmetro East South Central	105.7
Metro South 4	106.6	Nonmetro New England	105.9
Boston	107.1	Philadelphia	106.0
Nonmetro New England	107.6	Other NY	106.1
Nonmetro East South Central	108.5	Washington, DC	108.9
Washington, DC	110.6	San Francisco	110.6
Baltimore	111.4	Hartford	110.7
Other NY	111.4	Metro California	112.5
San Antonio	111.6	Atlanta	113.3
Atlanta	111.8	North Florida	113.9
Metro California	111.9	Baltimore	114.2
Los Angeles	112.9	South Florida	116.2
North Florida	113.6	Nonmetro South Atlantic	116.4
San Francisco	115.1	Metro South 1	117.2
Hartford	115.5	Los Angeles	117.5
South Florida	116.8	San Antonio	118.8
Metro South 1	117.7	Nonmetro Middle Atlantic	122.5
Urban NY	128.7	Urban NY	131.4

Note: National mean prices are weighted and calculated separately for each sample; low-income households have income less than 185% of the Federal poverty line.

Source: ERS calculations using 2006 Nielsen Homescan data.

Table C-4

Comparison of price variation across market groups, full sample vs. low-income sample, eggs (food group 37), 2006 Nielsen Homescan

Full sample		Low-income sample	
Market group	Price relative to national mean (%)	Market group	Price relative to national mean (%)
Nonmetro West North Central	77.1	Salt Lake City	78.4
Nonmetro East North Central	79.1	Nonmetro West North Central	80.9
Salt Lake City	80.0	Nonmetro East North Central	83.3
Metro Midwest 2	82.0	Metro Midwest 2	85.4
Metro Ohio	86.4	Metro South 3	88.8
Metro South 3	86.6	Nonmetro East South Central	88.9
Metro South 2	86.7	Metro South 2	88.9
Nonmetro West South Central	87.0	Metro Ohio	90.9
Metro Midwest 1	88.5	Nonmetro West South Central	90.9
Nonmetro East South Central	88.9	Metro Midwest 1	91.3
Atlanta	89.8	Metro South 4	91.8
Metro South 4	91.3	North Florida	92.4
Western NY/PA	91.4	Western NY/PA	92.8
San Antonio	92.3	Atlanta	93.1
Nonmetro South Atlantic	93.7	Metro South 1	93.5
Chicago	96.0	San Antonio	95.2
South Florida	96.3	Chicago	96.3
Nonmetro Middle Atlantic	96.4	Nonmetro Middle Atlantic	96.4
North Florida	97.3	Nonmetro South Atlantic	98.0
Nonmetro Mountain	98.2	Nonmetro Mountain	98.4
Metro South 1	100.4	South Florida	100.0
Metro Mountain	102.1	Metro Mountain	101.5
Washington, DC	103.4	Baltimore	104.5
Philadelphia	105.0	Washington, DC	105.6
Baltimore	107.0	Philadelphia	107.3
North Pacific	110.3	Nonmetro New England	113.1
Nonmetro New England	113.3	North Pacific	117.5
Nonmetro Pacific	118.7	Other NY	120.4
Other NY	124.0	Hartford	123.4
Urban NY	125.6	Los Angeles	125.5
Boston	127.2	Boston	127.1
Metro California	129.3	Nonmetro Pacific	127.8
Hartford	131.1	Urban NY	130.0
Los Angeles	132.7	Metro California	130.5
San Francisco	140.8	San Francisco	138.8

Note: National mean prices are weighted and calculated separately for each sample; low-income households have income less than 185% of the Federal poverty line.

Source: ERS calculations using 2006 Nielsen Homescan data.

Table C-5

Comparison of price variation across market groups, full sample vs. low-income sample, carbonated beverages (food group 37), 2006 Nielsen Homescan

Full sample		Low-income sample	
Market group	Price relative to national mean (%)	Market group	Price relative to national mean (%)
Nonmetro Middle Atlantic	87.3	Nonmetro Middle Atlantic	84.8
Western NY/PA	89.1	Chicago	88.5
Nonmetro New England	91.8	Metro South 1	89.2
Boston	92.5	Western NY/PA	89.8
Metro Ohio	92.5	Baltimore	90.9
Chicago	92.5	North Florida	91.3
Other NY	94.8	Nonmetro New England	92.5
Nonmetro South Atlantic	95.4	Boston	93.3
Nonmetro East North Central	95.8	Other NY	93.5
Metro Midwest 1	96.4	Nonmetro South Atlantic	93.9
North Florida	96.4	San Antonio	95.0
Nonmetro West North Central	96.7	Metro Midwest 1	95.4
Metro Midwest 2	97.7	Metro Ohio	95.7
San Antonio	98.0	Washington, DC	96.1
South Florida	98.1	Metro Midwest 2	97.1
Nonmetro West South Central	98.6	Philadelphia	97.2
Metro South 2	98.8	Los Angeles	97.4
Metro South 1	99.2	Nonmetro East North Central	97.6
Nonmetro East South Central	99.2	Metro South 2	98.7
Metro Mountain	99.6	Metro South 3	99.2
Metro South 3	99.8	Urban NY	100.2
Metro South 4	101.1	South Florida	100.6
Philadelphia	101.7	Metro South 4	100.7
Baltimore	102.2	Nonmetro West North Central	101.0
Urban NY	103.7	Nonmetro West South Central	103.0
Washington, DC	103.9	Nonmetro East South Central	103.3
Los Angeles	104.3	Metro Mountain	107.7
Salt Lake City	104.8	Hartford	108.9
Atlanta	106.6	Atlanta	110.4
Hartford	107.7	North Pacific	113.3
Nonmetro Pacific	107.9	Salt Lake City	114.2
North Pacific	112.7	Nonmetro Mountain	115.8
Nonmetro Mountain	113.2	Metro California	122.1
Metro California	119.8	San Francisco	124.7
San Francisco	124.6	Nonmetro Pacific	131.9

Note: National mean prices are weighted and calculated separately for each sample; low-income households have income less than 185% of the Federal poverty line.

Source: ERS calculations using 2006 Nielsen Homescan data.

Appendix D: Outlier Cleaning

To ensure that the average market prices are not influenced by errors in household reporting or data entry, we drop extreme outliers. Any purchases for which the price per 100 grams is greater than 4 standard deviations above the market group quarter mean is considered an outlier and dropped from the household average price calculations.