



# The WIC Fruit and Vegetable Cash Voucher

## Does Regional Price Variation Affect Buying Power?

Ephraim Leibtag and Aylin Kumcu



[www.ers.usda.gov](http://www.ers.usda.gov)

## Visit Our Website To Learn More!

For additional information, see:

[www.ers.usda.gov/Data/FruitVegetableCosts/](http://www.ers.usda.gov/Data/FruitVegetableCosts/)

[www.ers.usda.gov/Briefing/CPIFoodAndExpenditures/](http://www.ers.usda.gov/Briefing/CPIFoodAndExpenditures/)

### **Recommended citation format for this publication:**

Leibtag, Ephraim, and Aylin Kumcu. *The WIC Fruit and Vegetable Cash Voucher: Does Regional Price Variation Affect Buying Power?* EIB-75. U.S. Dept. of Agriculture, Econ. Res. Serv. May 2011.

Photo credit: Shutterstock.

---

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and, where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.



United States  
Department  
of Agriculture

Economic  
Information  
Bulletin  
Number 75

May 2011



A Report from the Economic Research Service

[www.ers.usda.gov](http://www.ers.usda.gov)

# The WIC Fruit and Vegetable Cash Voucher

## Does Regional Price Variation Affect Buying Power?

Ephraim Leibtag, [eleibtag@ers.usda.gov](mailto:eleibtag@ers.usda.gov)

Aylin Kumcu, [akumcu@ers.usda.gov](mailto:akumcu@ers.usda.gov)

### Abstract

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides supplemental foods to low-income women, infants, and children at nutritional risk. Since October 2009, WIC packages have included a fixed-value voucher for purchasing fruits and vegetables. Although this should help increase fruit and vegetable consumption for all WIC participants, regional price variation could lead to different buying power—and nutritional benefits—across the country. Using 2004-06 Nielsen Homescan data, the authors examine the prices of fruits and vegetables (fresh, frozen, and canned) in 26 metropolitan market areas to determine how price variations affect the voucher's purchasing power. The authors find that the 20 most commonly purchased fruits and vegetables cost 30-70 percent more in the highest priced market areas than in the lowest, implying that WIC participants in more expensive areas might be able to purchase fewer fruits and vegetables than those living where these items are cheaper. The lowest priced market for fruits and vegetables was the Nashville, Birmingham, Memphis, and Louisville area, while the highest was San Francisco.

**Keywords:** WIC, fruit and vegetable voucher, fruit and vegetable prices, Nielsen Homescan, geographic price variation

### Acknowledgments

The authors would like to thank Helen Jensen, Professor of Economics, Iowa State University, Tatiana Andreyeva, Director of Economic Initiatives at the Rudd Center for Food Policy & Obesity at Yale University, and Elizabeth Frazao, Economic Research Service, USDA, whose recommended changes greatly improved the report. The authors would also like to thank Ababayehu Tegene, Elise Golan, and Laurian Unnevehr of USDA's Economic Research Service for their comments on various drafts of the paper, Courtney Knauth for editorial assistance, and Curtia Taylor for design services.

**Contents**

Summary ..... iii

Introduction ..... 1

    Previous Studies on Fruit and Vegetable Price Variation ..... 3

    Data and Methodology ..... 4

    Results ..... 7

    Conclusion ..... 12

References ..... 12

Appendix ..... 16

## Summary

### What Is the Issue?

A large portion of the eligible U.S. population takes part in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), which provides supplemental foods, health care referrals, and nutrition education to low-income pregnant, breastfeeding, and postpartum women and to infants and children at nutritional risk. Despite this dietary boost, most WIC participants remain at nutritional risk, predisposing them to adverse health conditions now and later in life. To reduce this risk, the Federal Government enhanced the nutritional value of WIC food packages in October 2009. The most significant addition was a fixed-value voucher to purchase fruits and vegetables, which previously had not been included in WIC packages. But because food prices vary across the country, there is concern that the fixed-value provision of the vouchers may undercut their effectiveness for WIC participants in higher priced market areas. To assess the possible impact of price variation on the purchasing power of WIC fruit and vegetable vouchers, we examined the prices of individual fruits and vegetables at the metropolitan (metro) level across the United States.

### What Did the Study find?

The purchasing power of fruit and vegetable vouchers differed substantially across market areas due to significant price variation, implying that WIC participants in some areas will be unable to buy as many fruits and vegetables as those living in other areas. Results of the study show that:

- Most fruits and vegetables were 30-70 percent more expensive in their highest priced market than their lowest. However, the overall price range was wider: 26 percent for pears—the smallest price spread across markets—to 140 percent for grapefruit—the largest spread across markets.
- The Metro South 2 market (Nashville, Birmingham, Memphis, and Louisville) tended to have the lowest *average* prices, while San Francisco tended to have the highest. Average prices were more than 20 percent higher in San Francisco than in the Metro South 2 area.
- The relative prices of the various fruits and vegetables held constant across U.S. markets. The most expensive vegetables were peppers and tomatoes, and the most expensive fruits were strawberries and grapes. The lowest cost vegetables were cabbage and corn, while bananas and oranges were the lowest cost fruits.
- A WIC participant with a \$10 voucher could purchase 17 percent more tomatoes per month or 13 percent more apples per month in the lowest priced market compared with the national average, while in the most expensive market she would be able to buy 15 percent fewer tomatoes and 11 percent fewer apples compared with the national average.

## How Was the Study Conducted?

We used the 2004-06 Nielsen Homescan panel data for households, in which respondents recorded all of their purchases at a wide variety of food retailers, including traditional grocery stores and nontraditional stores, such as warehouse clubs and supercenters. We calculated the mean market-level prices of 20 fresh and processed fruits and vegetables in 26 aggregate market areas. By comparing prices of the most commonly purchased fruits and vegetables based on national U.S. averages, we were able to quantify how many more or fewer fruits and vegetables WIC participants in the various market areas would be able to purchase. Finally, we constructed a price index to rank markets from least to most expensive.



## Introduction

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is a non-entitlement Federal food assistance program. It provides supplemental foods, health care referrals, and nutrition education to low-income pregnant, breastfeeding, and nonbreastfeeding postpartum women and to infants and children who are found to be at nutritional risk. The goal of the program is to improve birth outcomes and support infant and child growth and development.

WIC is one of the fastest growing food assistance programs, with \$6.5 billion dollars spent in fiscal year (FY) 2009 and 9.1 million people participating each month. Nearly 50 percent of all infants in the United States, 25 percent of children aged 1-4, and 25 percent of pregnant, breastfeeding, and postpartum women participated in WIC in fiscal year 2009. The average monthly cost per person has been growing since the program began in 1972, reaching \$42.40 in FY 2009 (U.S. Department of Agriculture, Food and Nutrition Service, 2010b). WIC offers seven food packages,<sup>1</sup> each specifying a maximum monthly quantity of food that participants can purchase from WIC-authorized retailers, and including a voucher for fruits and vegetables, with the costs paid by the U.S. Department of Agriculture (USDA) (Oliveira, 2009; Oliveira and Frazao, 2009).

While WIC is entirely federally funded and the food package contents are determined at the national level, the program is administered by State agencies, who have limited autonomy to create rules for the food packages. USDA's Food and Nutrition Service (FNS) designs the food packages and sets the participation requirements, such as the maximum monthly food allowance and the income eligibility cutoff, but State agencies may restrict the brand, container size, or form of food that can be purchased. States may also adjust the income eligibility cutoff<sup>2</sup> in order to reduce administrative burdens and costs, as long as the adjustments remain within the Federal guidelines (Oliveira, 2009; Oliveira and Frazao, 2009).<sup>3</sup>

At the end of 2007, a WIC food package revision was announced, with a goal of better meeting WIC participants' nutritional needs and more fully aligning the food packages with the *2005 Dietary Guidelines for Americans* and the infant feeding guidelines of the American Academy of Pediatrics. One of the most significant WIC revisions was the addition of a fixed-value voucher for fruits and vegetables.<sup>4</sup> Studies have shown that the fruits and vegetables Americans eat fall well below the recommended amounts and that, as a result, our diets lack important nutrients. This lack is especially true for the WIC-eligible population, which is "at increased risk of morbidity and mortality from virtually every disorder listed among the leading causes of death in the United States (cardiovascular disease, cancer, diabetes, and digestive diseases)" (Committee on Dietary Risk Assessment in the WIC Program, 2002). The increased risk is in part due to low consumption of fruits and vegetables and high consumption of saturated fats. The *2005 Dietary Guidelines for Americans* highlight a number of "Food Groups to Encourage," including an adequate amount and variety of fruits and vegetables. The Guidelines further recommend specific amounts of some vegetable categories, including those that are dark green, orange, and starchy

<sup>1</sup>The quantity and type of food included in each package depend on the dietary needs of the four groups that are served by WIC: infants, children ages 1-4, pregnant women, and breast-feeding mothers.

<sup>2</sup>All State agencies currently set the income eligibility cutoff at the maximum, 185 percent of the Federal poverty limit.

<sup>3</sup>For example, the Federal requirements for all food packages allow participants to purchase 1 dozen eggs. In California, however, brown eggs, powdered or liquid eggs, and specialty eggs, such as organic, cage-free or enriched, are excluded (U.S. Department of Agriculture, 2010; California Department of Public Health, 2010).

<sup>4</sup>The monthly voucher amount depends on participant characteristics; children receive \$6 per month and all women receive \$10 per month. (These were the figures as of April 2011. WIC hopes to increase the voucher for children to \$8, as recommended by the IOM Committee to Review the WIC Food Packages (2006).)

(U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2005).

Two studies conducted by the USDA Center for Nutrition Policy and Promotion show that American consumption of whole fruits and of vegetables is substantially below recommended amounts and that dark green and orange vegetables are among the important food categories in which Americans are most deficient (Guenther et al., 2008a, 2008b). Low-income individuals, in particular, consume significantly fewer vegetables, including dark green and orange varieties, than high-income individuals (Guenther et al., 2008b). Furthermore, a study by the Committee to Review the WIC Food Packages (2006) of the Institute of Medicine (IOM) found that priority targets were increased consumption of iron, vitamin E, potassium, and fiber and that fruit and vegetables should be included in the food packages to this end.<sup>5</sup>

Following the IOM Committee recommendations, the WIC food packages were revised in 2007, and State agencies were required to implement the new fruit and vegetable vouchers by October 2009 (U.S. Department of Agriculture, 2007). The vouchers may be redeemed for any fruits or vegetables except white potatoes and canned or frozen fruits and vegetables with added sugar, sodium, or other ingredients with little nutritional value other than additives necessary for preservation. The vouchers are accepted at any WIC-authorized retailers, including some farmers' markets. The primary goal of the voucher is to increase fruit and vegetable intake among participants in order to reduce the risk of disease, help decrease the prevalence of obesity, improve nutrition through increased vitamin and mineral consumption, and encourage healthy long-term eating habits among children.

Another goal of the voucher is to encourage participants to purchase an array of fruits and vegetables in various forms (fresh, canned, and frozen) (Committee to Review the WIC Food Packages, 2006). The reviewing committee recommended a fixed-value voucher rather than the quantity voucher supplied in other Federal food packages in order to help contain USDA costs. WIC State agencies have some freedom in administering the fruit and vegetable vouchers, but all participants within a given category receive the same dollar value in their vouchers. However, this fixed value may lead to large variations in quantities consumed and nutritional benefits gained. One potential driver of these differences is variation in retail food prices across the country.

The Committee to Review the WIC Food Packages estimated that the \$8 and \$10 vouchers they recommended would provide approximately 9.76 pounds of fresh fruits and 12.2 pounds of vegetables. The committee report specifies that the intention is to provide this quantity of fruits and vegetables and that the value of the voucher "may need to be adjusted upward to account for local prices in some State agencies" (2006) to ensure that participants can purchase the target amount.

To evaluate the need for adjustment, the study authors analyze the potential impact of the new WIC cash vouchers for fruits and vegetables, using 2004-06 household-level data that include all purchases of fruits and vegetables, in order to estimate how much can be purchased with the current voucher and how much this quantity varies across the United States.<sup>6</sup> We

<sup>5</sup>The committee was given the task of evaluating the WIC food packages and suggesting changes. While the focus was on improving health outcomes among WIC participants, the committee was also asked to ensure that their suggestions were culturally appropriate, cost-neutral, and efficient for nationwide distribution and vendor checkout and would minimize administrative burdens. Therefore, the study's recommended changes allow individuals the freedom to purchase fruits and vegetables according to their own preferences through cash vouchers, while maintaining a system that is simple for vendors and is efficient for nationwide distribution.

<sup>6</sup>Nielsen Homescan data after 2006 no longer included detailed information on produce that does not have a universal product code, so more recent years would not provide the needed level of detail to conduct this analysis. Although we lack current data, the trends in relative prices across markets has remained relatively stable over the past 20 years, and we are confident that the results from 2004-06 data would be consistent with the cross-market trends for more recent years.



compare the most commonly purchased fruits and vegetables across metro areas in order to reflect consumers' actual purchasing behavior and the choices that are available to them. We find that average prices vary greatly for these common fruits and vegetables, allowing WIC participants to purchase different amounts depending on where they live. We also find that this metro-level variation in the buying power of the vouchers is greater than State- or regional-level variation.

## Previous Studies on Fruit and Vegetable Price Variation

A number of studies have examined fruit and vegetable prices and expenditures by low-income households and regional food price variation. Blisard, Stewart, and Jolliffe (2004) find that lower income households spend less on fruits and vegetables than do higher income households (\$3.59 versus \$5.02 per month in 2000), and that unlike high-income households, low-income households do not increase fruit and vegetable purchases when they receive small increases in income. Leibtag and Kaufman (2003) found that, compared with high-income households, low-income households spend 11.5 percent less per pound on vegetables and 9.6 percent less per pound on fruits because of economizing practices. These households stretch their food dollars by purchasing promotional items, a greater portion of private-label or fixed-weight items, and lower priced vegetables and fruits, such as bananas.

Leibtag (2007) showed that food prices vary substantially across the country. The prices of a representative basket of food items in the West and East census regions are above the national average by 11 and 8 percent, respectively, while the prices of this basket in the South and Midwest census regions are below the national average by 7 and 5 percent. In a study on the cost of State WIC packages, Davis and Leibtag (2005) found that nearly 80 percent of the variation in cost was due to variation in food prices (as opposed to differences in how each State administers the program). Some of the difference in food prices was mitigated by differences in caseload composition<sup>7</sup> and cost-containment practices, so the actual difference in package costs was sometimes less than the difference implied from prices alone. This means that, in many cases, States with above-average food prices had more to gain from cost-containment practices than States with lower food prices.

These past studies examined price variation in large geographic areas such as State or census regions. However, such a high level of aggregation obscures the variation at the metro level. To address this gap in the literature, Todd et al. (2010) constructed a database of quarterly prices for 52 food-at-home categories in 26 markets, using Nielsen Homescan data. They found that food prices varied greatly across metropolitan areas of the United States and that the variation between the lowest and highest priced markets could be as much as three to four times greater than annual food price inflation. For example, the difference between the lowest and highest priced markets was 25 percent for canned soups and sauces and more than 100 percent for low-fat cheese. Todd et al. also found that some healthier foods are more expensive than their unhealthy alternatives, but that this varies across markets.

Our study builds on previous work by examining metropolitan-level price variation for individual fruits and vegetables at the market level. We quantify the extent to which specific fruits and vegetable prices vary across markets;

<sup>7</sup>Caseload composition is defined as the distribution of WIC participants by type in a given area (number of pregnant women, post-partum women, infants, children, etc.).

for example, how much more expensive are tomatoes in San Francisco than in Nashville?

## Data and Methodology

We use the 2004-06 Nielsen Homescan panel data of households to conduct our analysis. (See appendix table A.1 for a comparison between Nielsen Homescan data and Bureau of Labor Statistics average prices.) These data are the most recent available for this type of analysis, because in 2007 Nielsen discontinued the collection of detailed data on non-universal product coded fruits and vegetables priced by the pound (“random weight”). The Nielsen population universe is all non-grouped households (i.e., excluding institutions or dorms) in the 48 continental States, in 52 metro areas that roughly correspond to the Census Bureau’s Metropolitan Statistical Areas (MSAs), and in 9 remaining non-metro areas. Due to limited sample size, we combine the 52 metro markets into 26 aggregate market groups (see table 1 for the list of Nielsen markets in the aggregate groups).<sup>8</sup> Households record all of their purchases at a wide variety of stores, including traditional food retailers such as grocery stores, nontraditional food retailers such as warehouse club stores and supercenters, and farmers’ markets.

Nielsen Homescan data contain information on food purchases and household characteristics. Demographic information collected from each participating household includes income range, household size and composition, and information about household heads. Each household confirms or updates this information in response to an annual survey. Householders who agree to record all their food-related purchases are given a handheld scanner, which they use to enter information about each purchase as they are unloading their groceries at home. For items with a UPC code, data are automatically recorded on such attributes as brand name, size and type of container, and specific flavor, form, and type of the item. These data are not collected for non-UPC items, such as fresh fruits and vegetables priced by the pound (“random weight” items). For scanned UPC items purchased from stores in Nielsen’s Scantrack database, the price is electronically imputed on a weekly basis as a weighted average of prices paid by all consumers, including discounts from loyalty cards. Prices for items not in Scantrack are recorded by the household and are quality checked by comparing them with prices of similar items purchased elsewhere.<sup>9</sup> In addition to price, information supplied by the household includes the type of store from which the item was purchased (grocery store, warehouse club, convenience store, etc.) and the purchase date. The household also records whether the item was on sale and whether coupons were used, which affect the final price of the item.

The Nielsen Homescan data consist of two samples: the total sample of approximately 40,000 households that record purchases of UPC items, and the smaller Fresh Foods Panel of approximately 8,000 households that record purchases of both UPC items and random weight items. Nielsen provides a separate household weight for each sample based on 12 geographic areas and 9 demographic variables in order to raise household data to the aggregate U.S. level (Muth et al., 2007). To compute one price for all forms of a fruit or vegetable (canned, frozen, fresh UPC, and fresh random weight), we combine the two samples by calculating an expenditure-share-weighted average price of each form.

<sup>8</sup>For more information on the aggregation of markets to market groups, see Todd et al., 2010.

<sup>9</sup>For more details on the impact of this two-tiered price reporting system, see Einav et al., 2008.

Table 1

**Aggregated market group and Nielsen markets**

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

Source: Information reprinted from table 4 of Todd et al., 2010, p. 12.

We calculate the aggregate mean price per pound<sup>10</sup> in each market for an individual fruit or vegetable, averaged across the form of processing (canned, frozen, fresh UPC, and fresh random weight), season, and year.<sup>11</sup> We compare individual items across regions rather than comparing a basket of preselected fruits and vegetables, because WIC participants are able to choose among different fruits and vegetables and evidence suggests that they will purchase a wide variety with their vouchers (Committee to Review the WIC Food Packages, 2006). Comparing individual items frees us from having to make specific assumptions about consumer behavior in different

<sup>10</sup>Note that focusing on purchase prices as opposed to costs of consumption (accounting for inedible waste such as peelings and calculating a price per serving) would only affect our results if these adjustments were to vary within a fruit type across markets. Since we do not believe this to be the case, we proceed with a presentation of purchase prices that reflect differences in effective purchasing power of the voucher.

<sup>11</sup>Some items, such as heads of iceberg lettuce, are measured by count, not ounces or pounds. These items are converted to pounds using the average weight of a medium-sized item, based on the USDA Standard National Nutrient Database for Standard Reference (U.S. Department of Agriculture, 2009).

markets or about nutritional content of specific fruits and vegetables or different forms (canned, frozen, or fresh).

For our comparison, we selected the 10 fruits and 10 vegetables for which the highest quantities were purchased by Nielsen households between 2004 and 2006. We investigated the following vegetables (in order of highest to lowest aggregate quantity purchased by all Nielsen households): tomatoes, onions, lettuce, green beans, corn, carrots, broccoli, cucumbers, peppers, and cabbage. We also investigated the following fruits (in order of highest to lowest amount purchased): bananas, apples, watermelons, oranges, grapes, strawberries, peaches, pineapples, pears, and grapefruit. These 20 items represent approximately 77 percent of all fruit and vegetable quantities purchased. This list would be similar if we selected the 10 fruits and 10 vegetables with the highest expenditures rather than the most purchases, except that the vegetable expenditure list would include mushrooms instead of cabbage, and the fruit expenditure list would include cherries instead of grapefruit.

The mean market price for each item is calculated in two stages. The first stage determines the seasonal price, which is an expenditure-share-weighted average price of the form of processing, according to equation 1. The second stage is the average across seasons and years:

$$\bar{P}_{misy} = \sum_{f=1}^K \left( \frac{\sum_{h=1}^N \left( \frac{\sum_{c=1}^D E_{isyfhc} * W_h}{\sum_{c=1}^D L_{isyfhc}} \right) * W_h}{\sum_{h=1}^N W_h} * \frac{\sum_{h=1}^N E_{isyfhc} * W_h}{\sum_{h=1}^N (\sum_{f=1}^K E_{isyfhc} * W_h)} \right) \quad (1)$$

The subscripts index the following:

- $c$  = purchase
- $h$  = household
- $i$  = individual fruit or vegetable
- $f$  = form
- $m$  = market
- $s$  = season
- $y$  = year.

$\bar{P}_{misy}$  is the mean price in each market ( $m$ ) for each item ( $i$ , fruit or vegetable) by season ( $s$ ) by year ( $y$ );  $E_{isyfhc}$  is the household ( $h$ ) expenditure for a given purchase ( $c$ ) of a form of an item ( $f$ ) in a given season and year;  $L_{isyfhc}$  is the total number of pounds for this household purchase of a form of an item in a given season and year; and  $W_h$  is the household aggregation weight (projection factor) developed by Nielsen.

The first fraction in equation 1 is the market-level mean price per pound for each form of processing of each fruit and vegetable by season and year. The price each household paid for each form of processing of each fruit and vegetable is calculated by dividing the sum of all expenditures on each purchase by the sum of all pounds in each purchase in each season of each year. To

aggregate to the market level, a weighted mean price per pound is calculated using the household aggregation weights developed by Nielsen.

The second fraction in equation 1 is the average market expenditure share on the different forms of fruits and vegetables by households in the Fresh Foods Panel. This share is calculated as the weighted sum of each household's expenditures on all forms of processing divided by the total weighted sum of each household's expenditures on that fruit or vegetable. The total mean market price of each fruit and vegetable by season by year is the sum of the market prices of the four forms of each fruit and vegetable multiplied by their expenditure shares. We report the comparison of mean market prices as a simple average of these prices across years and seasons.

To determine which markets are more or less expensive, we create a quantity-weighted price index to rank each item, with the national average as the base. The quantity weight is the national share of aggregate pounds of each item,  $i$ , purchased out of all 20 items,

$$Q_i = \frac{\sum_{h=1}^N [(\sum_{c=1}^D L_{ihc}) * W_h]}{\sum_{i=1}^{20} [\sum_{h=1}^N [(\sum_{c=1}^D L_{ihc}) * W_h]]} \quad (2)$$

where  $L_{ihc}$  is the total number of pounds of an item that a household purchased (in this case it refers to all purchases of that item, including all forms, all seasons, and all 3 years from 2004 to 2006), and  $W_h$  is the household aggregation weight (projection factor) developed by Nielsen. The index ranking  $R_m$  is calculated according to equation 3,

$$R_m = \frac{\sum_{i=1}^{20} Q_i * P_{im}}{\sum_{i=1}^{20} \left[ Q_i * \left( \frac{\sum_{m=1}^{26} P_{im}}{20} \right) \right]} * 100 \quad (3)$$

where  $m$  refers to the market;  $Q_i$  is the national share of aggregate pounds of each item,  $i$ , purchased out of all 20 items according to equation 2; and  $P_{im}$  is the average price of each item in each market from equation 1.

To create the index, we calculate one national quantity share for each of the 20 items (equation 2) in order to compare the same combination of items across markets, and then we multiply the national quantity share for each item by the price of that item in each market. We sum these products across items to obtain a quantity-weighted average price for each market (the numerator in equation 3). The base is the quantity-weighted average price, calculated using national average prices for each item (the denominator in equation 3). Thus, the index for each market is the quantity-weighted average market price divided by the *national* quantity-weighted average price, times 100.

## Results

### *Regional Price Variation*

We found a large amount of variation in the average price paid (per pound) in many markets across the United States (table 2). Most fruit and vegetable prices were 30 to 70 percent higher in the most expensive market than in the lowest priced market. The price spread across market areas for vegetables



ranged from 30 percent to 120 percent for lettuce and green beans, respectively, while fruit price variation ranged from 26 to 140 percent between the lowest and highest priced markets for pears and watermelon. In overall comparison with the national average, we found that on average fruits and vegetables were 20 percent lower in the least expensive market and 25 percent higher in the most expensive market. For example, green bean prices were 38 percent less than the national average in the lowest priced market, and watermelons were 43 percent less than the national average price in their lowest market. Pepper prices, on the other hand, were 37 percent higher than the national average price in their most expensive market, and orange prices were 47 percent higher than the national average in their most expensive market.

Some general patterns emerged with respect to which items and markets were cheaper or more expensive across the country. Peppers and tomatoes were

Table 2  
**Market prices for the 20 most popular fruits and vegetables, with the deviation of their minimum and maximum prices from national average, 2004-2006**

Vegetables and fruits	National average of market prices per lb	Minimum market price per lb	Maximum market price per lb	Difference from minimum to maximum	Difference from national average to minimum	Difference from national average to maximum
	<i>Dollars</i>			<i>Percent</i>		
Tomatoes	1.66	1.42	1.98	39	-15	19
Onions	1.33	0.95	1.68	77	-29	26
Lettuce	1.01	0.89	1.17	30	-11	16
Green beans	0.96	0.59	1.31	12	-38	36
Corn	0.89	0.74	1.11	50	-17	25
Carrots	1.18	0.99	1.38	39	-16	17
Broccoli	1.34	1.10	1.61	46	-18	20
Cucumbers	1.02	0.81	1.33	64	-21	30
Peppers	1.72	1.18	2.35	100	-32	37
Cabbage	0.52	0.42	0.70	68	-20	34
Bananas	0.49	0.40	0.62	55	-19	26
Apples	1.10	0.98	1.24	27	-12	12
Watermelon	0.87	0.49	1.19	140	-43	37
Oranges	0.85	0.72	1.25	73	-15	47
Grapes	1.51	1.31	1.70	30	-14	12
Strawberries	2.41	2.15	2.86	33	-11	19
Peaches	1.13	0.95	1.40	47	-15	25
Pineapples	1.29	0.99	1.63	65	-23	26
Pears	1.06	0.94	1.18	26	-11	12
Grapefruit	0.98	0.78	1.24	60	-21	27

Note: All minimum and maximum prices are significantly different from the national average at the 5-percent level. Prices are in current dollars. Source: Authors' calculations using Nielsen Homescan data.

usually the most expensive per pound of the 10 most popular vegetables in each of the 26 markets. Onions and broccoli were next, followed by carrots and then by cucumbers, lettuce, green beans, and corn, while cabbage was by far the cheapest vegetable in all 26 markets. Among the 10 fruits analyzed, strawberries were by far the most expensive. Grapes were next, followed by pineapples, peaches, apples, pears, grapefruit, watermelon, and oranges, in roughly that order. Bananas were the cheapest fruit in all 26 markets.<sup>12</sup> (See appendix table A.2 for comparison of mean prices of different forms of all vegetables and all fruits.)

The lowest priced market was the Metro South 2 market group (Nashville, Birmingham, Memphis, and Louisville), followed by Metro Ohio (Cincinnati, Cleveland, and Columbus) and Salt Lake City. San Francisco had the highest prices, followed by Hartford-New Haven and Washington, DC. Prices in the Metro South 2 were 9.2 percent lower than the national average, while prices in the highest priced market, San Francisco, were 13.9 percent higher than the national average, a spread of 23.1 percentage points between the least and most expensive markets. (See table 3 for a full list of rankings.) Other markets that fall in the bottom quintile of prices include the Metro South 3 market group (Little Rock, Oklahoma City, and Tulsa) and the Metro Mountain market group (Denver and Phoenix). Additional markets in the top quintile with San Francisco include Baltimore and the South Florida market group (Miami and Tampa). This index ranking, which is based on what consumers actually purchased, indicates that although participants may be able to substitute among certain fruits and vegetables, substantial price variation remains across markets.

### ***Price Variation and WIC***

The substantial price differences between markets imply that the same-value voucher allows WIC participants to purchase substantially different amounts of fruits and vegetables depending on where they live. Using data from 1999, the Committee to Review the WIC Food Packages (2006) estimated that with the monthly \$8 and \$10 vouchers, participants would be able to purchase 10 and 12 pounds of fresh fruits and vegetables per month, respectively, corresponding to roughly 1 or 2 servings a day.<sup>13</sup> When we examine the national average prices of the 20 most commonly purchased fruits and vegetables between 2004-06, however, we find that participants would be unable to stretch their vouchers this far unless they purchased only the cheapest fruits and vegetables.<sup>14</sup> Participants in markets with prices higher than the national average will have an even more difficult time purchasing 10-12 pounds of fruits and vegetables per month, while those buying in markets with lower than average prices may be able to purchase more fruits and vegetables than the amount recommended (table 4, discussed in detail below).

Green beans display one of the most dramatic differences between the highest and lowest priced markets. They are 36 percent cheaper in the lowest priced market (Metro South 3—Little Rock, Oklahoma City, and Tulsa) than the national average and 38 percent more expensive in the highest priced market (San Francisco). This difference translates to 37 cents per pound less in Little Rock, Oklahoma City, and Tulsa and 35 cents per pound more in San Francisco. While these differences may seem relatively small, the national average for 1 pound of green beans is 96 cents. With a fixed-value voucher

<sup>12</sup>In this study, we calculate prices based on total pounds purchased. That is, we do not address the number of servings or the portion of the fruits and vegetables that can be consumed. For an analysis of this issue, see Stewart et al. (2011).

<sup>13</sup>As mentioned above, the committee's report also suggests that the voucher be adjusted upward in States where local prices prevent participants from purchasing this amount with the \$8 and \$10 vouchers the committee recommends.

<sup>14</sup>Our results are based on the average prices for all forms of fruits and vegetables (fresh, canned, and frozen) since the national guidelines for the voucher allow all forms. For most of the items we examined, the canned version is the cheapest, followed by fresh random weight, then frozen, and finally UPC fresh items (see appendix table 2).

Therefore, the mean market price of only fresh items is the same or higher for all items (except onions) when canned and frozen prices are excluded.

Table 3

**Index ranking of markets from lowest to highest priced for the 20 fruits and vegetables most frequently purchased by U.S. households, 2004-06**

Aggregate market group	Index ranking
Metro South 2	90.8
Metro Ohio	91.9
Salt Lake City	92.2
Metro Mountain	92.8
Metro South 3	93.8
San Antonio	93.8
Metro Midwest 1	95.0
Chicago	95.3
Metro South 4	95.4
Urban New York City	96.3
Metro Midwest 2	96.4
Los Angeles	97.4
Western NY/PA	98.1
Metro Northwest	99.9
National average	100.0
Atlanta	101.1
Metro California	101.7
Mid-Atlantic	102.2
Other New York City	103.4
Boston	103.8
Philadelphia	103.9
North Florida	104.4
South Florida	104.7
Baltimore	108.8
Washington, DC	110.9
Hartford-New Haven	111.9
San Francisco	113.9

Source: Authors' calculations using Nielsen Homescan data.

of \$10, a WIC mother could hypothetically purchase 10.4 pounds of green beans each month at national average prices. However, she would be able to purchase 16.8 pounds of green beans if she were living in Little Rock, but only 7.6 pounds if she were living in San Francisco.

Tomato prices, on the other hand, display the least variation across markets.<sup>15</sup> The national average price for 1 pound of tomatoes is \$1.66. They are

<sup>15</sup>Only lettuce has a smaller price spread of 30 percent.

Table 4

**Buying power of vouchers for fruit and vegetables in different markets, by weight**

Vegetables and fruits	\$6 voucher			\$10 voucher		
	National average	Market with minimum price	Market with maximum price	National average	Market with minimum price	Market with maximum price
	<i>Pounds</i>			<i>Pounds</i>		
Tomatoes	3.6	4.2	3.0	6.0	7.0	5.1
Onions	4.5	6.3	3.6	7.5	10.5	6.0
Lettuce	6.0	6.7	5.1	9.9	11.2	8.6
Green beans	6.2	10.1	4.6	10.4	16.8	7.6
Corn	6.7	8.1	5.4	11.2	13.4	9.0
Carrots	5.1	6.0	4.4	8.5	10.1	7.3
Broccoli	4.5	5.5	3.7	7.5	9.1	6.2
Cucumbers	5.9	7.4	4.5	9.8	12.4	7.5
Peppers	3.5	5.1	2.6	5.8	8.5	4.3
Cabbage	11.5	14.4	8.5	19.1	24.0	14.2
Bananas	12.3	15.1	9.7	20.4	25.1	16.2
Apples	5.4	6.2	4.8	9.1	10.3	8.1
Watermelon	6.9	12.1	5.1	11.5	20.2	8.4
Oranges	7.1	8.3	4.8	11.8	13.9	8.0
Grapes	4.0	4.6	3.5	6.6	7.7	5.9
Strawberries	2.5	2.8	2.1	4.2	4.6	3.5
Peaches	5.3	6.3	4.3	8.9	10.5	7.1
Pineapples	4.6	6.1	3.7	7.7	10.1	6.1
Pears	5.7	6.4	5.1	9.5	10.6	8.4
Grapefruit	6.1	7.7	4.8	10.2	12.9	8.1

Source: Authors' calculations using Nielsen Homescan data.

cheapest in the Metro South 2 market (Nashville, Birmingham, Memphis, and Louisville) at \$1.42, and they are the most expensive in San Francisco at \$1.98. A WIC mother could purchase 6 pounds of tomatoes each month, based on national average prices. She would be able to purchase 7 pounds of tomatoes if she were living in Nashville, but only 5.1 pounds in San Francisco.

Comparing fruit prices in a similar way, we find that watermelons have the largest price spread between the least and most expensive markets at 140 percent. They cost 87 cents per pound on average, but they cost 49 cents in the Metro California market (San Diego and Sacramento) and \$1.19 in Baltimore. Again, a WIC mother could use her \$10 voucher to purchase 11.5 pounds of watermelons at national average prices, but she would be able to buy 20.2 pounds in San Diego and only 8.4 pounds in Baltimore. Apples, one of the most popular fruits in our sample, have a price spread of 27 percent and cost \$1.10 per pound on average.<sup>16</sup> Apples are cheapest in the Metro Ohio

<sup>16</sup>Only pears have a smaller price spread at 26 percent.

market (Cincinnati, Cleveland, and Columbus) at 98 cents, and they are most expensive in San Francisco and North Florida (Jacksonville and Orlando) at \$1.24. A WIC mother could buy 9.1 pounds of apples at national average prices, but would be able to buy 10.3 pounds in Cincinnati and only 8.1 pounds in Jacksonville.

These results indicate that participants in higher priced markets can purchase substantially smaller amounts of fruits and vegetables, even for items that display modest differences between the highest and lowest priced markets. Thus, while the voucher allows substitution between cheaper and more expensive fruits and vegetables, price variations mean that the WIC voucher buys substantially smaller amounts of many of the 20 fruits and vegetables studied in some markets than in others.

## **Conclusion**

Revising the WIC packages to include a fixed-value voucher for fruits and vegetables aims to encourage WIC participants to consume more fruits and vegetables, potentially decreasing both short- and long-term health risks faced by pregnant and postpartum women, infants, and children. By examining aggregate categories of food at the regional level, previous research has shown that food prices vary substantially across the country. The present study shows that the prices of individual fruits and vegetables vary even more at a more localized level. This price variation implies that WIC participants in higher cost areas cannot purchase as many fruits and vegetables with their fixed-value voucher as participants in lower priced areas, which could lead to differences in the nutritional benefits that the voucher is intended to make available for WIC participants.



## References

- Blisard, Noel, Hayden Stewart, and Dean Jolliffe (2004). *Low-Income Households' Expenditures on Fruits and Vegetables*. Agricultural Economic Report Number 833, U.S. Department of Agriculture, Economic Research Service, May. <http://www.ers.usda.gov/Briefing/FoodNutritionAssistance/ResearchFindings/>.
- California Department of Public Health, California WIC Program (2010). "WIC Authorized Food List Shopping Guide." April 5, 2010. Available at [www.cdph.ca.gov/programs/wicworks/WIC%20Foods/WICAuthorizedFoodListShoppinGuide-4-2010.pdf](http://www.cdph.ca.gov/programs/wicworks/WIC%20Foods/WICAuthorizedFoodListShoppinGuide-4-2010.pdf).
- Davis, David E., and Ephraim S. Leibtag (2005). *Interstate Variation in WIC Food Package Costs: The Role of Food Prices, Caseload Composition, and Cost-Containment Practices*. Food Assistance and Nutrition Research Report No. 41, U.S. Department of Agriculture, Economic Research Service, January. <http://www.ers.usda.gov/Briefing/FoodNutritionAssistance/2005FinalReport.pdf>.
- Einav, Liran, Ephraim Leibtag, and Aviv Nevo (2008). *On The Accuracy of Nielsen Homescan Data*. U.S. Department of Agriculture, Economic Research Report 69, Economic Research Service, November. <http://www.ers.usda.gov/Publications/ERR69/ERR69fm.pdf>.
- Guenther, Patricia M., WenYen Juan, Jill Reedy, Patricia Britten, Mark Lino, Andrea Carlson, Hazel H. Hiza, and Susan M. Krebs-Smith (2008a). *Diet Quality of Americans in 1995-1996 and 2001-2002 as Measured by the Healthy Eating Index*. Nutrition Insight 37, U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, August.
- Guenther, Patricia M., WenYen Juan, Mark Lino, Hazel A. Hiza, Thomas Fungwe, and Richard Lucas (2008b). *Diet Quality of Low-Income and Higher Income Americans in 2003-04 as Measured by the Healthy Eating Index-2005*. Nutrition Insight 42, U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, December.
- Committee on Dietary Risk Assessment in the WIC Program, Food and Nutrition Board (2002). *Dietary Risk Assessment in the WIC Program*. Institute of Medicine, Washington, DC: The National Academies Press.
- Committee to Review the WIC Food Packages, Food and Nutrition Board (2006). *WIC Food Packages: Time for a Change*. Institute of Medicine, Washington, DC: The National Academies Press.
- Leibtag, Ephraim (2007). *Stretching the Food Stamp Dollar: Regional Price Differences Affect Affordability of Food*. Economic Information Bulletin No. 29-2, U.S. Department of Agriculture, Economic Research Service, September. <http://www.ers.usda.gov/publications/eib29/eib29-2/eib29-2.pdf>.

- Leibtag, Ephraim, and Phil Kaufman (2003). *Exploring Food Purchase Behavior of Low-Income Households: How Do They Economize?* Current Issues in Economics of Food Markets, Agriculture Information Bulletin No. 747-07, U.S. Department of Agriculture, Economic Research Service, June. <http://www.ers.usda.gov/publications/aib747/aib74707.pdf>.
- Oliveira, Victor (2009). *The Food Assistance Landscape: FY 2008 Annual Report*. Economic Information Bulletin No. 6-6, U.S. Department of Agriculture, Economic Research Service, April. <http://www.ers.usda.gov/Publications/EIB6-6/EIB6-6.pdf>.
- Oliveira, Victor, and Elizabeth Frazao (2009). *The WIC Program: Background, Trends, and Economic Issues*, 2009 Edition. Economic Research Report No. 73, U.S. Department of Agriculture, Economic Research Service, April. <http://www.ers.usda.gov/Publications/ERR73/ERR73Fm.pdf>.
- Stewart, Hayden, Jeffery Hyman, Elizabeth Frazão, Jean Buzby, and Andi Carlson (2011). “Can Low-Income Americans Afford To Satisfy MyPyramid Fruit and Vegetable Guidelines?” *Journal of Nutrition Education and Behavior* 43 (2011):173-79.
- Todd, Jessica E., Lisa Mancino, Ephraim Leibtag, and Christina Tripodo (2010). *Methodology Behind the Quarterly Food-at-Home Price Database*. Technical Bulletin No. 1926, U.S. Department of Agriculture, Economic Research Service, April. <http://www.ers.usda.gov/Publications/TB1926/TB1926.pdf>.
- U.S. Department of Agriculture, Agricultural Research Service (2009). *USDA National Nutrient Database for Standard Reference, Release 22*. Nutrient Data Laboratory Home Page. <http://www.ars.usda.gov/ba/bhnrc/ndl>.
- U.S. Department of Agriculture, Food and Nutrition Service, Women, Infants, and Children (2010). “WIC Food Packages – Maximum Monthly Allowances.” <http://www.fns.usda.gov/wic/benefitsandservices/foodpkgallowances.HTM>.
- U.S. Department of Agriculture, Food and Nutrition Service (2007). “Special Supplemental Nutrition Program for Women, Infants and Children (WIC): Revisions in the WIC Food Packages; Interim Rule.” Federal Register 72 (234), U.S. Department of Agriculture, 7 CFR Part 246. <http://www.fns.usda.gov/wic/regspublished/wicfoodpkginterimrulepdf.pdf>.
- U.S. Department of Agriculture, Food and Nutrition Service (2010). “WIC Program Participation and Costs.” August 31, 2010. <http://www.fns.usda.gov/pd/wisummary.htm>.
- U.S. Department of Health and Human Services and U.S. Department of Agriculture (2005). *Dietary Guidelines for Americans 2005*. <http://www.healthierus.gov/dietaryguidelines>.

## Appendix

Appendix table 1

### Comparison of Nielsen Homescan data; Bureau of Labor Statistics, Average Price Data; and Bureau of Labor Statistics, Consumer Price Index over time

Vegetables and Fruits	Nielsen 2004-06	BLS 2004-06	BLS 2010	CPI change
	<i>Dollars</i>			<i>Percent</i>
Tomatoes	1.66	1.65	1.74	6
Lettuce	1.01	0.84	0.85	10
Broccoli	1.34	1.32	1.55	15*
Cabbage	0.52	0.59	0.62	6
Bananas	0.49	0.50	0.58	16
Apples	1.10	1.02	1.23	16
Oranges	0.85	0.98	1.03	14
Grapes	1.51	2.13	2.10	-1*
Strawberries	2.41	2.13	2.03	-5*
Peaches	1.13	1.55	1.75	12*
Pears	1.06	1.14	1.26	9*
Grapefruit	0.98	1.01	0.92	13**

\* BLS does not publish disaggregate CPI for these items. These are percentage changes in average price from 2004-06 to 2010.

\*\* BLS does not publish disaggregate CPI for grapefruit. This is the percentage change in CPI for citrus fruit.

Source: Authors' calculations using Nielsen Homescan data; Bureau of Labor Statistics, Average Price Data; and Bureau of Labor Statistics, Consumer Price Index.

Appendix table 2

### Market prices for four forms of fruits and vegetables and deviation of minimum and maximum prices from national average, 2004-06

Item	National average of market prices per lb	Minimum market price per lb	Maximum market price per lb	Percent price difference	Percent difference in minimum	Percent difference in maximum	
	<i>Dollars</i>	<i>Dollars</i>		<i>Percent</i>	<i>Percent</i>		
Veggies	Canned	1.87	1.55	2.42	56	-17	30
	Frozen	1.48	1.22	1.80	48	-18	22
	UPC	2.13	1.83	2.50	37	-14	18
	RW	1.13	0.98	1.34	37	-13	19
Fruit	Canned	1.32	1.16	1.64	42	-12	25
	UPC	1.53	1.33	1.78	34	-13	17
	RW	1.35	1.09	1.54	41	-20	14

UPC = items marked with a universal product code; RW = raw weight.

Source: Authors' calculations using Nielsen Homescan data.