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Geographic Differences in the Relative Price of Healthy Foods

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Abstract

Although healthy foods can be affordable, if less healthy foods are cheaper, individuals may have an economic incentive to consume a less healthful diet. Using the Quarterly Food-at-Home Price Database, we explore whether a select set of healthy foods (whole grains, dark green vegetables, orange vegetables, whole fruit, skim and 1% milk, fruit juice, and bottled water) are more expensive than less healthy alternatives. We find that not all healthy foods are more expensive than less healthy alternatives; skim and 1% milk are less expensive than whole and 2% milk and bottled water is generally less expensive than carbonated nonalcoholic drinks. We also find considerable geographic variation in the relative price of healthy foods. This price variation may contribute to geographic variation in diet and health outcomes.

Keywords: Quarterly Food-at-Home Price Database (QFAHPD), healthy food, price, geographic variation

Acknowledgments

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About the Authors

Jessica E. Todd and Ephraim Leibtag work in the Food Economics Division, Economic Research Service (ERS), U.S. Department of Agriculture. Todd is an agricultural economist in the Diet, Safety, and Health Branch; and Leibtag is Deputy Director for Research and Product Coordinator. Corttney Penberthy works at the Bureau of Economic Analysis, U.S. Department of Commerce.

Contents

Summary

A balanced and healthful diet consists of a variety of foods. The Dietary Guidelines for Americans indicate that within broad food groups, such as dairy, meat, or grains, there are more healthful options (those that maximize nutrients and minimize added fats or sugars) and less healthful ones. Although healthy foods can be affordable, if less healthy foods are cheaper, individuals may have an economic incentive to consume a less healthful diet. Using a unique price database, we explore whether healthy foods generally cost more than less healthy options and whether the price differences between healthy and less healthy foods vary across the country.

What Did the Study Find?

The study looked at seven healthy food groups (whole grains, dark green vegetables, orange vegetables, whole fruit, low-fat milk (skim and 1%), fruit juice, and bottled water) and compared their prices per 100 grams with the prices of less healthy alternatives.

- Some healthy foods were more expensive than less healthy foods, but in other cases, healthier options were less expensive.
    - Whole grains were more expensive than refined grains across the United States, with prices ranging from 23 percent higher (San Francisco) to more than 60 percent higher (nonmetro Pennsylvania and New York) than for refined grains.
    - Fresh and frozen dark green vegetables were more expensive than starchy vegetables in all markets (prices ranging from 20 to 80 percent higher than starchy vegetables), but orange vegetables (e.g., carrots, sweet potatoes, and winter squash) were less expensive than starchy vegetables in some markets, including metro New York, San Francisco, and Florida.
    - Low-fat milk (skim and 1%) was between 10 and 20 percent less expensive than whole and 2% milk in most markets.
    - Low-fat milk was more expensive than nonalcoholic carbonated beverages in some markets, but less expensive in others.
    - Bottled water is the same price or less expensive than soda in all but one market (urban New York), with a price ranging from 6 percent (Boston) to over 33 percent (San Francisco) lower than the price for soda.
- Prices of healthy foods vary widely across the United States.
    - Whole grains (compared with refined grains), dark green and orange vegetables (compared with starchy vegetables), low-fat milk (compared with soda), and fruit juice (compared with fruit drinks) demonstrate the largest geographic price variation.
    - The geographic variation in the price of whole fruit when compared with sweet or savory commercially prepared snacks is generally

smaller than that of other comparisons. On a per-gram basis, whole fruit is 60-70 percent less expensive in all markets.

- Some price differences narrowed between 1998 and 2006.

  - Whole grains became relatively less expensive over time; the relative price decreased 5 percentage points, on average.

  - The price of low-fat milk, as compared with the price of carbonated soda, decreased nearly 12 percentage points, on average.

How Was the Study Conducted?

Using prices from the Quarterly Food-at-Home Price Database, we compared prices per 100 grams of packaged whole-grain products with their refined-grain counterparts; dark green vegetables with starchy vegetables, orange vegetables with starchy vegetables, whole fruit with commercially prepared sweet snacks, low-fat milk with whole and 2% milk, low-fat milk with carbonated nonalcoholic beverages, bottled water with carbonated nonalcoholic beverages, and fruit juice with noncarbonated nonalcoholic caloric beverages (fruit drinks). We calculated market-level relative prices of the healthy food groups and their less healthy counterparts for 2006, as well as the quarterly and annual average relative prices within nine census divisions between 1998 and 2006.

Introduction

A balanced and healthful diet consists of a variety of foods. *The Dietary Guidelines for Americans* point out that within broad food groups, such as dairy, meat, or grains, there are more healthful (maximizes nutrients and minimizes added fats or sugars) and less healthful options (HHS and USDA, 2005). Thus, when selecting foods to meet recommendations within a food group, such as grains or dairy, consumers can make healthy and less healthy choices. Although healthy foods can be affordable, if less healthy foods are cheaper, individuals may have an economic incentive to consume a less healthful diet. There is little consensus, however, about whether healthy foods are more expensive than less healthy alternatives because findings depend on whether one considers the cost per nutrient, the cost per unit weight, or the cost per calorie (Burns, 2010; Drewnowski, 2010; Lipsky, 2009).

We compare prices of select food (healthy and unhealthy) groups, based on *a priori* notions of close substitutes and complements:

- Food groups for which intake is below recommended amounts, such as whole grains and dark green vegetables;
- Food groups containing nutrients for which intake is above the *Dietary Guidelines* recommendations, such as fats and added sugars; and
- Food groups that are currently the focus of policy debate, such as soda and other caloric sweetened beverages and commercially prepared snacks.

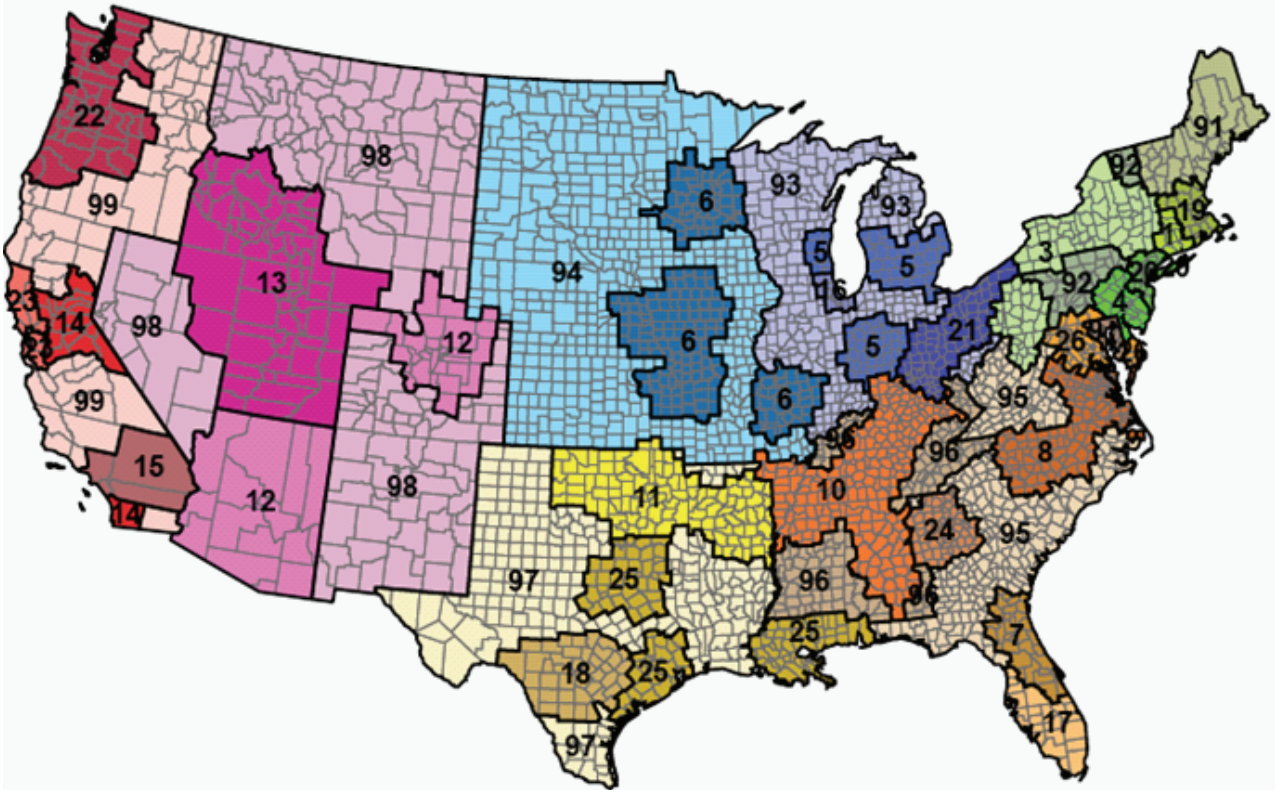
Specifically, we compare the price of packaged whole-grain products with their refined-grain counterparts; dark green vegetables with starchy vegetables; orange vegetables with starchy vegetables; whole fruit with commercially prepared sweet snacks; low-fat (skim and 1%) milk with whole and 2% milk; low-fat milk with carbonated nonalcoholic beverages; bottled water with carbonated nonalcoholic beverages; and fruit juice with noncarbonated nonalcoholic caloric beverages (fruit drinks).

Data and Methods

We use food prices from the Quarterly Food-at-Home Price Database (QFAHPD). The 1998-2006 QFAHPD was constructed using Nielsen Homescan panel data[1] and provides market-level quarterly food-at-home prices for 52 food categories (Todd et al. 2010). To construct the QFAHPD, individual food purchases were first aggregated into household-level average prices, which were then aggregated to estimate market-level prices (price per 100 grams). A total of 30 geographic market groups between 1998 and 2001 and 35 market groups between 2002 and 2006 covering the 48 contiguous United States are included in the QFAHPD (fig. 1).

[1]Homescan households report all of their food-at-home purchases from all store outlets, including grocery stores, discount stores, mass merchandisers, club stores, and convenience stores over the course of a year. The Homescan sample included approximately 8,000 households between 1998 and 2003 and increased to 40,000 or more households beginning in 2004. Thus, QFAHPD prices are more precisely estimated for 2004-06, particularly for foods less frequently purchased. See Todd et al. (2010) for a detailed description of the construction of the QFAHPD.

Figure 1
Quarterly Food-at-Home Price Database market groups, 2002-06



1	Hartford	13	Salt Lake City	25	Metro South 4
2	Urban NY	14	Metro California	26	Washington, DC
3	Western NY/PA	15	Los Angeles	91	Nonmetro New England
4	Philadelphia	16	Chicago	92	Nonmetro Middle Atlantic
5	Metro Midwest1	17	South Florida	93	Nonmetro East North Central
6	Metro Midwest2	18	San Antonio	94	Nonmetro West North Central
7	North Florida	19	Boston	95	Nonmetro South Atlantic
8	Metro South 1	20	Other NY	96	Nonmetro East South Central
9	Baltimore	21	Metro Ohio	97	Nonmetro West South Central
10	Metro South 2	22	North Pacific	98	Nonmetro Mountain
11	Metro South 3	23	San Francisco	99	Nonmetro Pacific
12	Metro Mountain	24	Atlanta		

Notes: For 1999-2001, market 81 is composed of market 91; market 82 is composed of markets 93 and 94; market 83 is composed of markets 95, 96, and 97; and market 84 is composed of markets 98 and 99.

Source: Todd et al. (2010).

The QFAHPD offers several advantages over other price data, such as those published by the Council for Community and Economic Research (C2ER, formerly ACCRA) or the Bureau of Labor Statistics (BLS). QFAHPD prices are based on purchases from all store types, such as grocery stores, convenience stores, and club or supercenters, in contrast to only grocery store purchases found in C2ER or BLS data. QFAHPD prices are comparable not only across geographic areas (as in the other data), but also across time (unlike the C2ER data). Another main difference between QFAHPD and other data is the aggregation of food items. Both C2ER and BLS data provide prices for specific items, such as a loaf of white bread or a 1-gallon jug of milk. In contrast, the QFHAPD provides average prices for groups of similar food items, such as dark green vegetables, salty snacks, and carbonated beverages. Within broad food groups (fruits, grains, dairy, etc.), the QFAHPD also includes specific subcategories relevant to estimating healthy versus less healthy options, such as low-fat milk (skim and 1%); dark green vegetables; and whole grain products (see Todd et al. (2010) for more information about how the QFAHPD compares with other price databases).

The QFAHPD food groups were constructed to minimize cross-market price variations due to quality differences in food items within a food group. For example, canned fruits and vegetables are separated from higher cost fresh and frozen forms. While the types of foods included in each food group are fixed, the contribution of each food to the market group price varies according to market conditions and household purchases in the market (table 1 lists some foods included in the vegetable group, whole and refined grain groups, and commercially prepared groups). For example, collard and other greens are likely more available and more preferred in the South, while spinach and broccoli are more readily available in the West given the proximity to production. The market group prices are weighted averages of the household level prices (weighted by purchase frequency, not total expenditures). Thus, some variation in market group prices could be due to variation in the types of items purchased within the food groups as a result of seasonality and other supply and demand factors.

Table 1
Example of food items included in select food groups

Food group	Food items
Dark green vegetables	Bok choy, broccoli, collard greens, dark green leafy lettuce, kale, mesclun, mustard greens, romaine lettuce, spinach, turnip greens, and watercress
Orange vegetables	Acorn squash, butternut squash, carrots, Hubbard squash, pumpkin, and sweet potatoes
Starchy vegetables	Corn, green peas, lima beans (green), and potatoes
Grain items (whole or refined)	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, and barley
Commercially prepared sweet packaged snacks	Candy, cookies, ice cream cones, chocolate, marshmallows, and refrigerated pudding
Commercially packaged snacks (not sweet)	Pork rinds, puffed cheese, potato chips, corn chips, popcorn, pretzels, crackers, trail mix, granola bars, and breakfast bars

Source: Todd et al. (2010).

We compare prices per 100 grams, not per serving. When comparing very similar food groups, such as milk and soda, in which serving sizes are equivalent, the ratio of the two prices is the same. For less similar food groups (whole fruit and sweet snacks), however, the ratio of prices per 100 grams may be different than a price per edible serving or calorie. We calculate price ratios for three time and geographic aggregations: annual market level, annual division level, and quarterly division level. We estimate the annual market-level prices (p^m_{annual}, where m denotes market) as the simple mean of the four quarterly market prices (p^m_{q1}, p^m_{q2}, p^m_{q3}, p^m_{q4}) in each year:

$$(p^m_{annual}, = (p^m_{q1} + p^m_{q2} + p^m_{q3} + p^m_{q4}) /4 \quad (1)$$

We estimate division-level prices (p^d, annual and quarterly) as the weighted average of the prices in each metro market in each division using the market-level weights (w_m) in the QFAHPD,[2] where the annual market price is constructed as above.

$$p^d_{annual} = \frac{\sum_m w_m p^m_{annual}}{\sum_m w_m} \quad (2)$$

The relative price of the healthy food is the price of the healthy food divided by the price of the less healthy alternative.

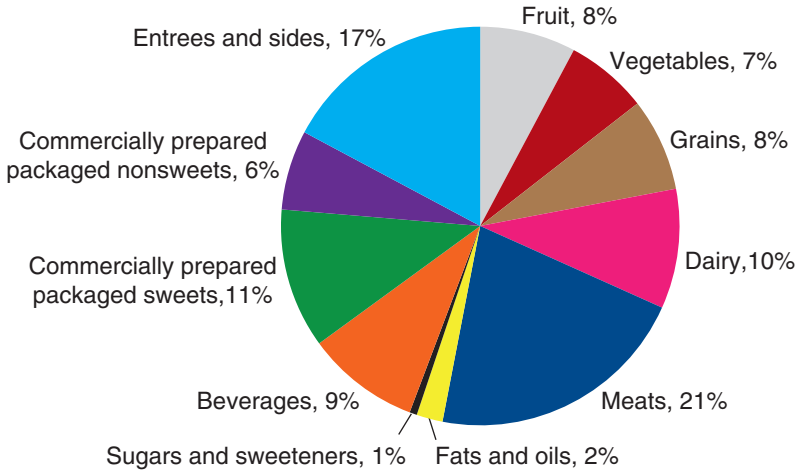
In addition to the average price for each food group, the QFAHPD provides the total expenditures on each food group per quarter. On average, over a third of food-at-home expenditures were spent on commercially prepared foods in 2006—17 percent on entrées and sides, 11 percent on sweets, and 6 percent on savory snacks (fig. 2). Meats (including fish, eggs, and nuts) accounted for another 21 percent of expenditures, followed by dairy (10 percent), beverages (9 percent), fruits (8 percent), grains (8 percent), vegetables (7 percent), fats and oils (2 percent), and sugars and sweeteners (1 percent). Between 1998 and 2006, allocations remained fairly constant, although commercially prepared food slowly captured a larger share of expenditures (fig. 3). These food expenditure estimates are consistent with those from BLS's Consumer Expenditure (CE) Survey, as all directly comparable categories fall within 2 percentage points of the BLS estimated shares.[3]

[2]When we aggregated to the census division, we excluded the nonmetro market groups, because their definition changed over time in the QFAHPD.

[3]For a more general discussion of how expenditure share estimates using Nielsen Homescan compare with CE data, see Zhen et al. (2009)

Figure 2

National expenditure share on food groups, 2006

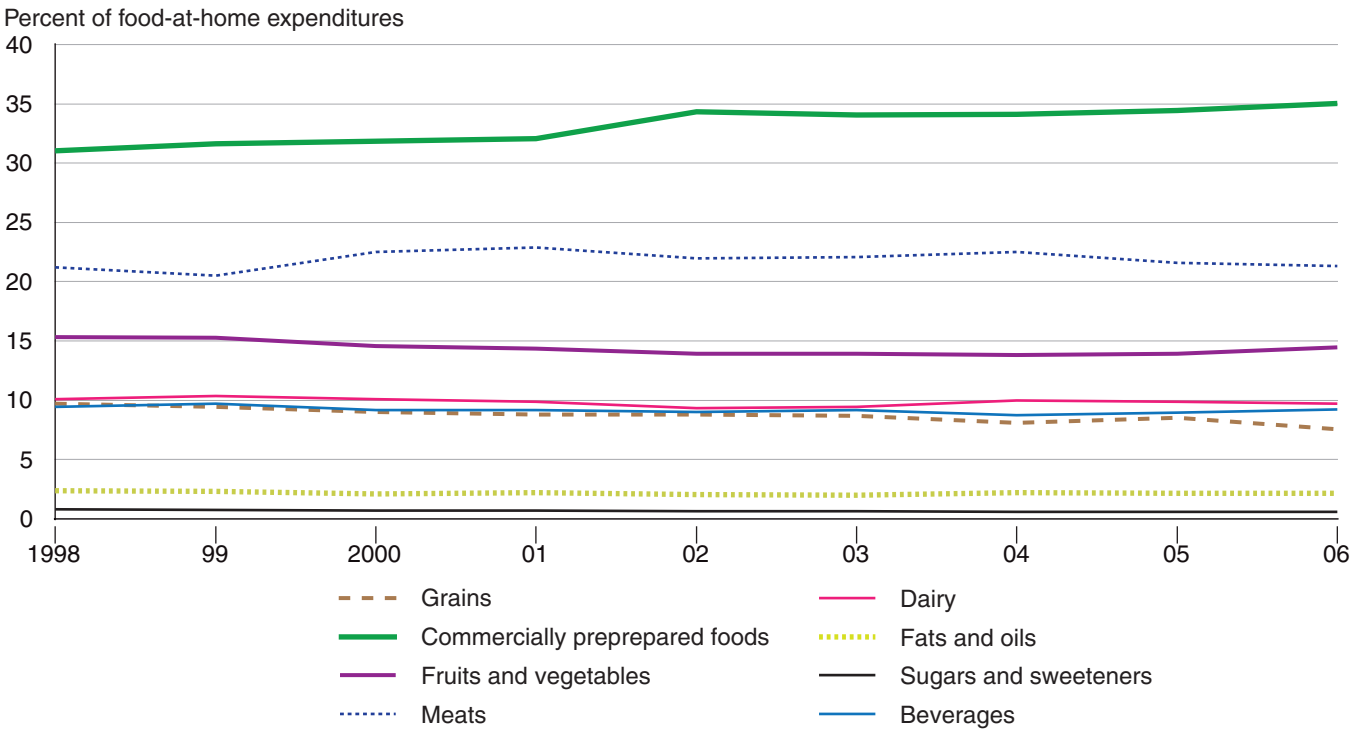


Notes: Expenditure shares calculated from total expenditures on the 52 food groups in the Quarterly Food-at-Home Price Database. These groups cover the vast majority of food-at-home expenditures. Fruits include fresh, frozen, and canned fruit; vegetables include all fresh, frozen, and canned vegetables and legumes; grains include all packaged bread, rolls, pita, rice, pasta, cereal, flours, and frozen ready-to-cook rolls and breads; dairy includes milk, cheese, and yogurt; meats include all fresh, frozen, and canned meats, poultry, fish, nuts and seeds, and eggs; beverages include all nonalcoholic beverages except milk.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 3

National expenditure share on food groups, 1998-2006



Notes: Expenditure shares calculated from total expenditures on the 52 food groups in the Quarterly Food-at-Home Price Database. The 52 food groups cover the vast majority of food-at-home expenditures. Fruits include fresh, frozen, and canned fruit; vegetables include all fresh, frozen, and canned vegetables and legumes; grains include all packaged bread, rolls, pita, rice, pasta, cereal, flours, and frozen ready-to-cook rolls and breads; dairy includes milk, cheese, and yogurt; meats include all fresh, frozen, and canned meats, poultry, fish, nuts, seeds, and eggs; beverages include all nonalcoholic beverages except milk.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Geographic Differences in the Relative Price of Healthy Foods

Grains: Whole Versus Refined

The *Dietary Guidelines* state that at least half of a person's daily grain intake should come from whole grains, but only 10 percent of actual grain intake, on average, comes from whole grains (Mancino and Buzby, 2005). Mancino et al. (2008) found that beginning in 2003 food manufacturers expanded their offerings of whole grain products, both by introducing new products and reformulating others prior to the release of the 2005 *Dietary Guideline*s. In addition to taste, texture, availability, variety, identifiableness, knowledge, and preparation, people often cite price as a barrier to purchasing whole-grain foods (Cleveland et al., 2000; Kantor et al., 2001).

We compare the cost of whole grains relative to refined grains across 35 market groups in 2006 (fig. 4). The left side of the chart shows which markets are included in each census division and census region. Whole grains were more expensive than refined grains, with prices ranging from approximately 23 percent to 60 percent higher than those for refined grains. As illustrated, the relative price of whole grains was, on average, lowest in the Pacific, which includes Metro California, Los Angeles, San Francisco, as well as the North Pacific and nonmetro Pacific areas. In general, the relative cost of whole grains has declined over time. Division-level average relative prices ranged from 34 to 50 percent higher than those for refined grains in 1998 to 26 to 46 percent higher in 2006 (fig. 5). On average, the relative price of whole grains declined 5.2 percentage points ($p<0.05$).[4] At the same time, the share of grain expenditures on whole grains increased, growing from 15 percent in 1998 to 23 percent in 2006. Consistent with previous findings, the increase in expenditures on whole grains occurred prior to the release of the 2005 *Dietary Guidelines*, which outlined specific whole-grain intake recommendations (Mancino et al., 2008). The largest increases in whole-grain purchases, however, transpired after the release of the 2005 *Dietary Guidelines*, climbing from 18 percent to 23 percent of national expenditures between 2005 and 2006. We see greater volatility in relative prices before 2004, probably due to the smaller sample size from which the prices were estimated (see footnote 1), particularly for whole grains, which are purchased less frequently, especially before the release of the 2005 *Dietary Guidelines*. We do not observe any seasonal patterns in relative prices or expenditure shares (fig. 6).

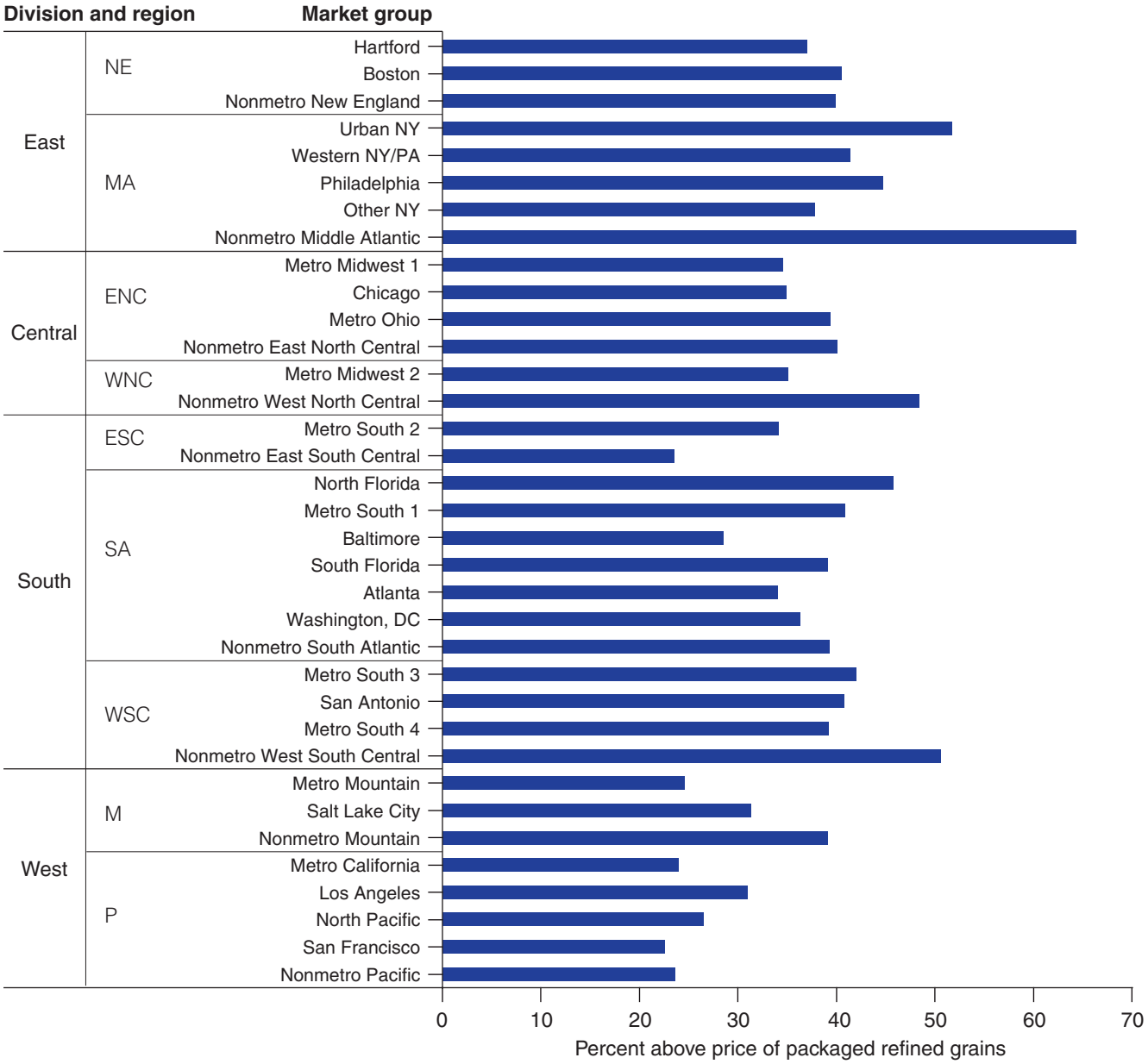
[4]To test for changes in relative prices over time, we regressed division-level ratios in 1998 and 2006 on division dummies and an indicator for 2006.

Fruits and Vegetables

Studies suggest that people who consume generous amounts of fruits and vegetables as part of a healthful diet see a reduced risk of chronic diseases, including stroke and other cardiovascular diseases, and certain cancers compared with those who consume less fruits and vegetables (CDC, 2010). Americans eat less than the recommended amount of fruits and vegetables as outlined in the *Dietary Guidelines*; in 2008, average consumption was only 68 percent of the recommend 2.5 cups per day (Wells and Buzby, 2008).

Figure 4

Price of packaged whole grains relative to packaged refined grains, by market group, 2006

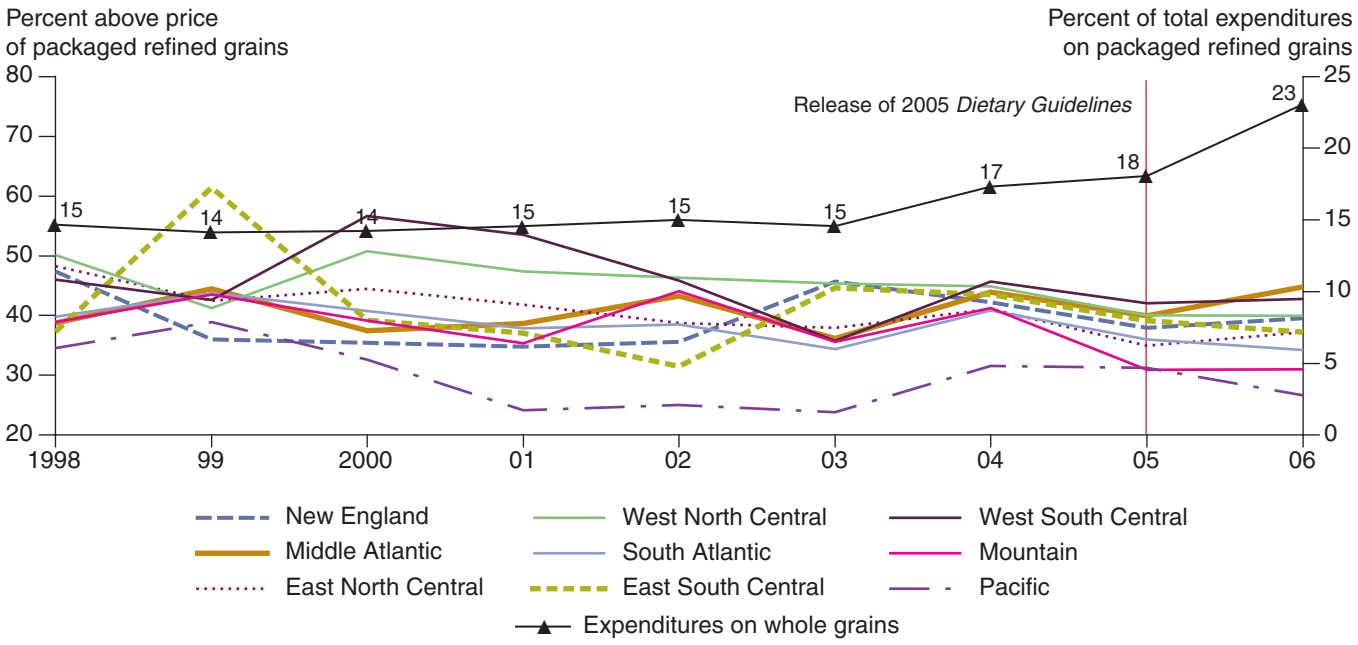


Notes: NE= New England, MA= Middle Atlantic, ENC= East North Central, WNC=West North Central, ESC=East South Central, SA=South Atlantic, WSC=West South Central, M=Mountain, and P=Pacific.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 5

Annual average price of packaged whole grains relative to packaged refined grains, by division (metro areas only)

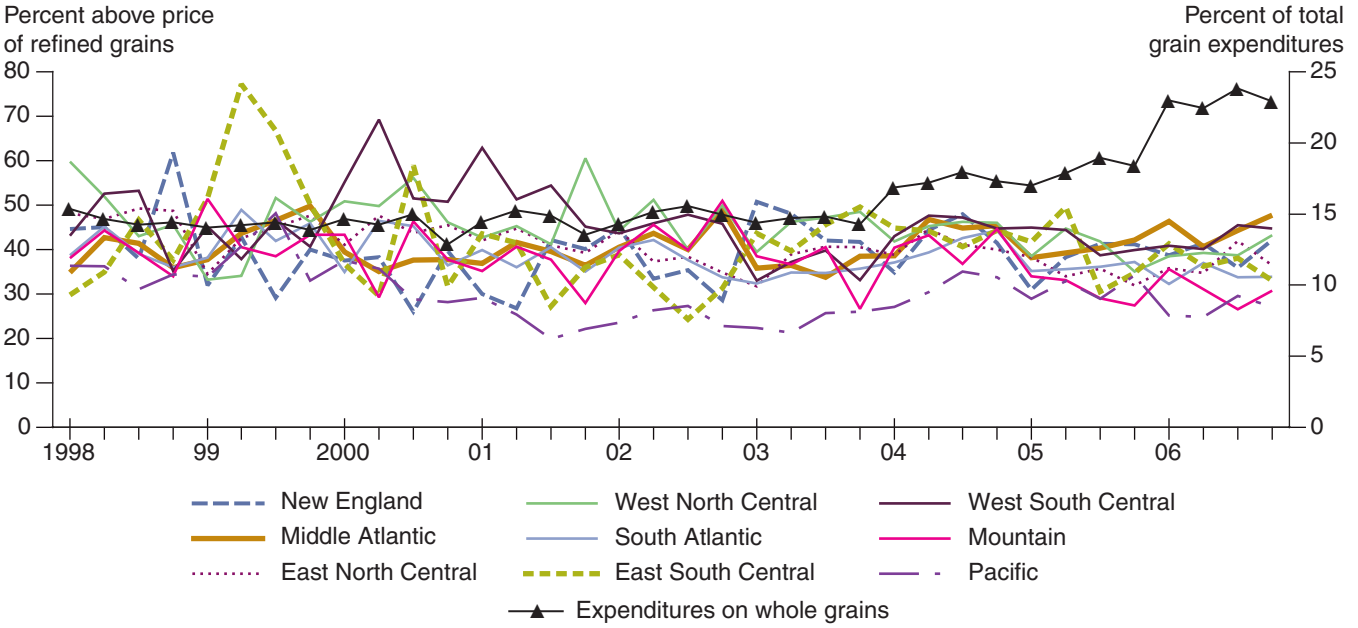


Notes: Red line denotes release of 2005 Dietary Guidelines. Expenditure share of packaged whole grains calculated as the national expenditure on packaged whole grains divided by the total national expenditure on packaged whole and refined grains.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 6

Quarterly price of packaged whole grains relative to packaged refined grains, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Nutrient-Dense Dark Green and Orange Vegetables versus Starchy Vegetables

In addition to eating too few vegetables, the proportion in which Americans eat vegetables is not in alignment with dietary recommendations. Starchy vegetables, particularly potatoes, account for a third of total vegetable consumption, which is double the share recommended (Guthrie et al., 2005). Relative price differences may explain some of the deviation from the *Dietary Guidelines* in the proportion of vegetables consumed.

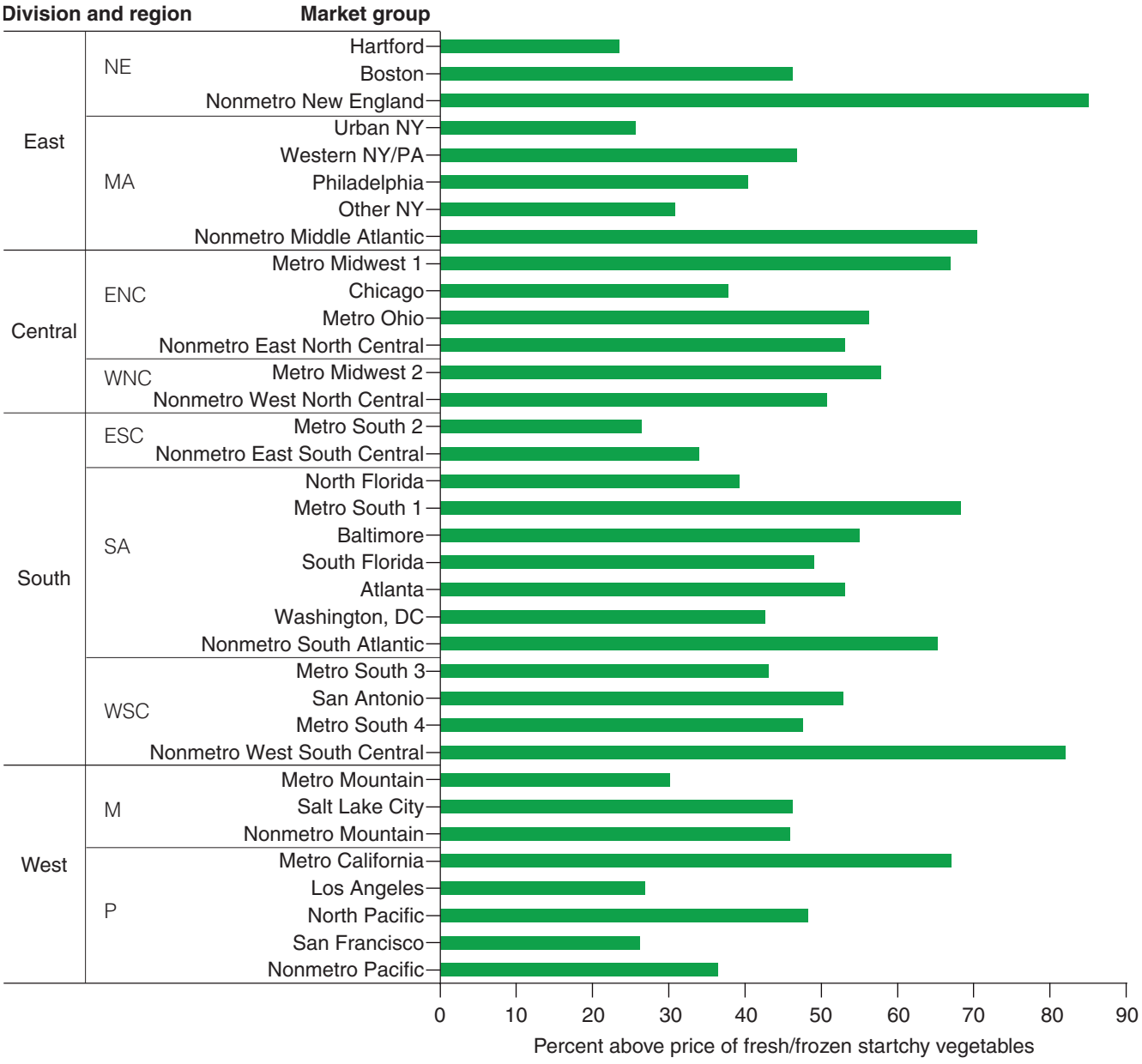
We compare the prices of nutrient-dense dark green vegetables with their starchy vegetable counterparts (fig. 7) and find that fresh/frozen dark green vegetables are more costly than fresh/frozen starchy vegetables, with relative prices ranging from about 23 percent higher than those for starchy vegetables in Hartford, CT, to over 85 percent higher in nonmetro New England. The relative price of fresh and frozen dark green vegetables has been lowest in the Pacific division, but there was no significant trend between 1999 and 2006 (fig. 8).[5] However, the share of expenditures has increased. Between 1998 and 2006, national expenditures on fresh/frozen dark green vegetables compared with fresh/frozen starchy vegetables grew from 20 percent to 25 percent. Similar to the previous comparison, we see greater volatility in relative prices before 2004, most likely due to the smaller sample sizes through 2003 and the lower frequency of purchases of dark green vegetables. The relative price of dark green vegetables also varies seasonally, but the timing of the relative price changes varies across the country (fig. 9).

In contrast to the results for dark green vegetables, we find that fresh and frozen orange vegetables were the same price or less expensive than starchy vegetables in over half of the market groups (18 out of 35, fig. 10). In 2006, the relative cost of orange vegetables ranged from 22 percent more than starchy vegetables (in Salt Lake City) to 20 percent less than starchy vegetables (in Nashville, Birmingham, Memphis, and Louisville). Our time series comparison shows a downward trend in the relative price of fresh and frozen orange vegetables between 1998 and 2006 and that the Mid-Atlantic and Pacific divisions generally had the lowest relative prices (fig. 11). On average, the relative price of orange vegetables fell 16 percentage points ($p<0.01$). While differences between orange and starchy vegetables tapered across time, national expenditure shares were fairly constant, with an average expenditure share of 23 percent. As with dark green vegetables relative to starchy vegetables, a smaller sample size through 2003 and lower frequency of purchases led to greater volatility in the relative prices prior to 2004. We also observed some seasonal variation in expenditures on orange vegetables (fig. 12).

[5]Results show that 1998 appears to be an outlier year. Regression indicates that the relative price of fresh and frozen dark green vegetables declined 21 percentage points ($p<0.05$) between 1998 and 2006, but no significant change occurred between 1999 and 2006.

Figure 7

Price of fresh/frozen dark green vegetables relative to fresh/frozen starchy vegetables, by market group, 2006

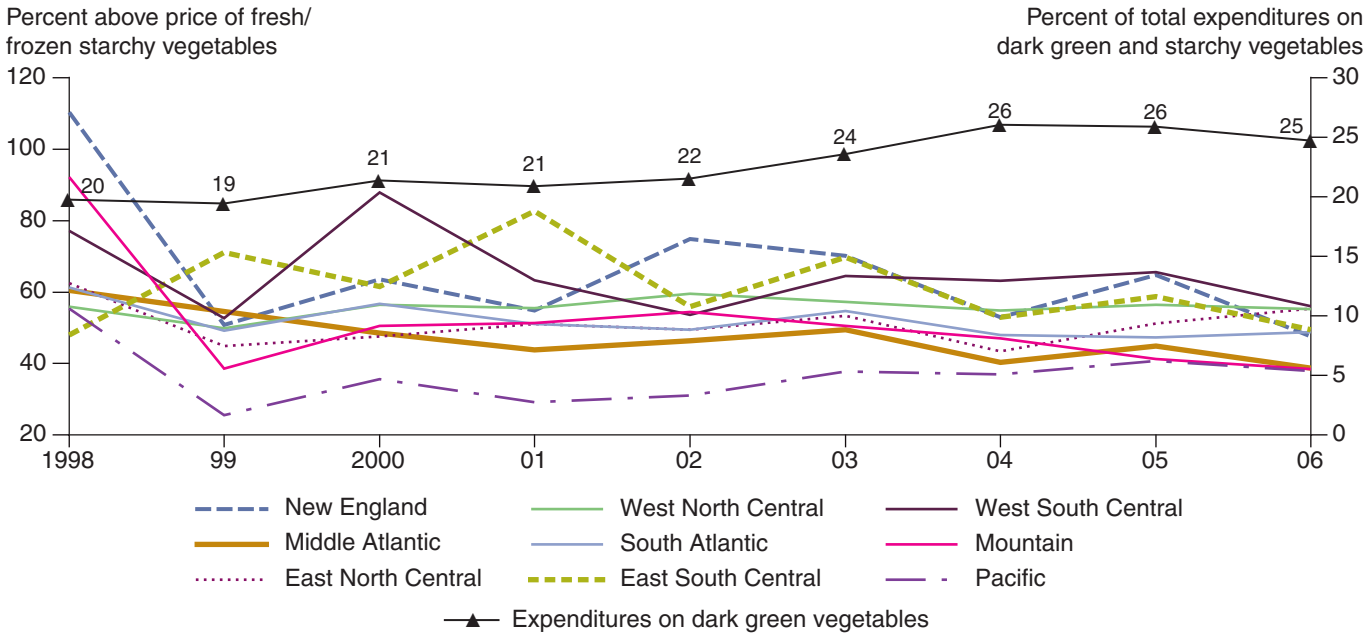


Notes: NE= New England, MA= Middle Atlantic, ENC= East North Central, WNC=West North Central, ESC=East South Central, SA=South Atlantic, WSC=West South Central, M=Mountain, and P=Pacific.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 8

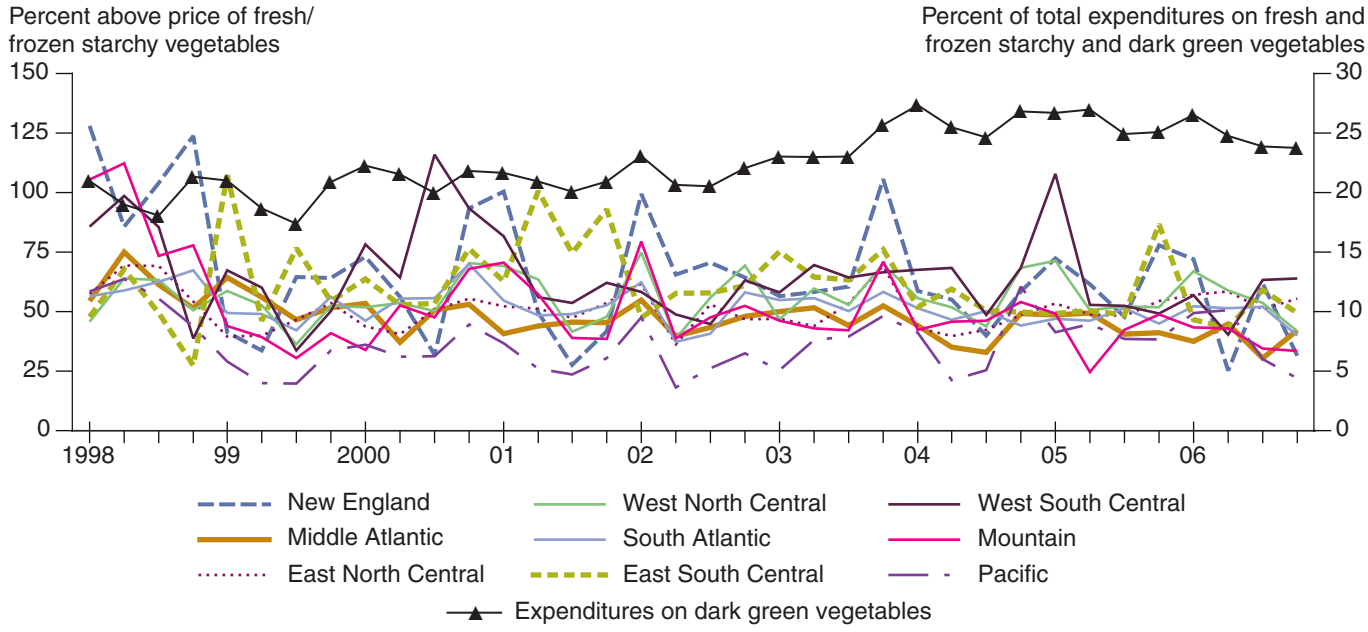
Annual average price of fresh/frozen dark green vegetables relative to fresh/frozen starchy vegetables, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 9

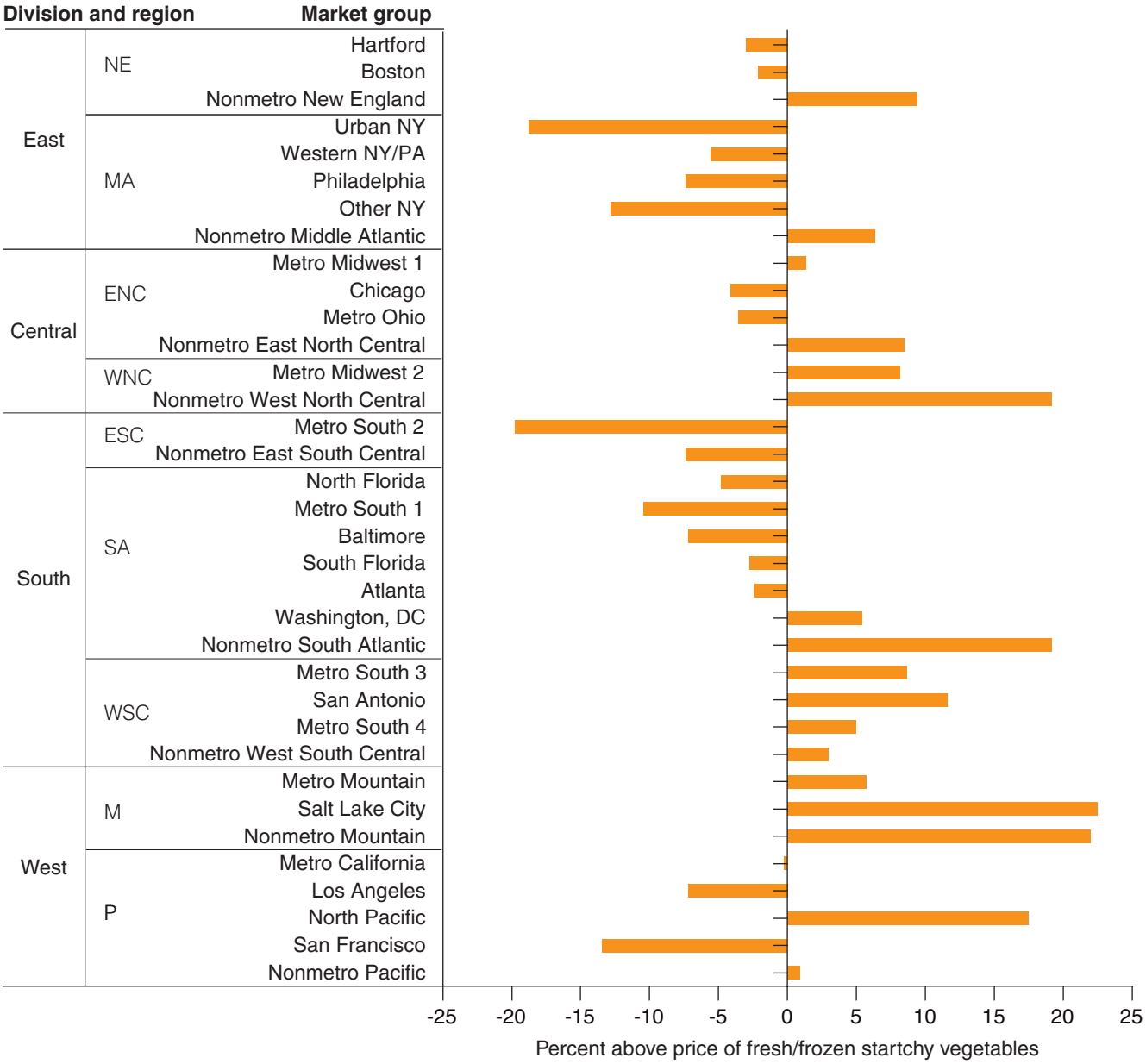
Quarterly price of fresh/frozen dark green vegetables relative to fresh/frozen starchy vegetables, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 10

Price of fresh/frozen orange vegetables relative to fresh/frozen starchy vegetables, by market group, 2006

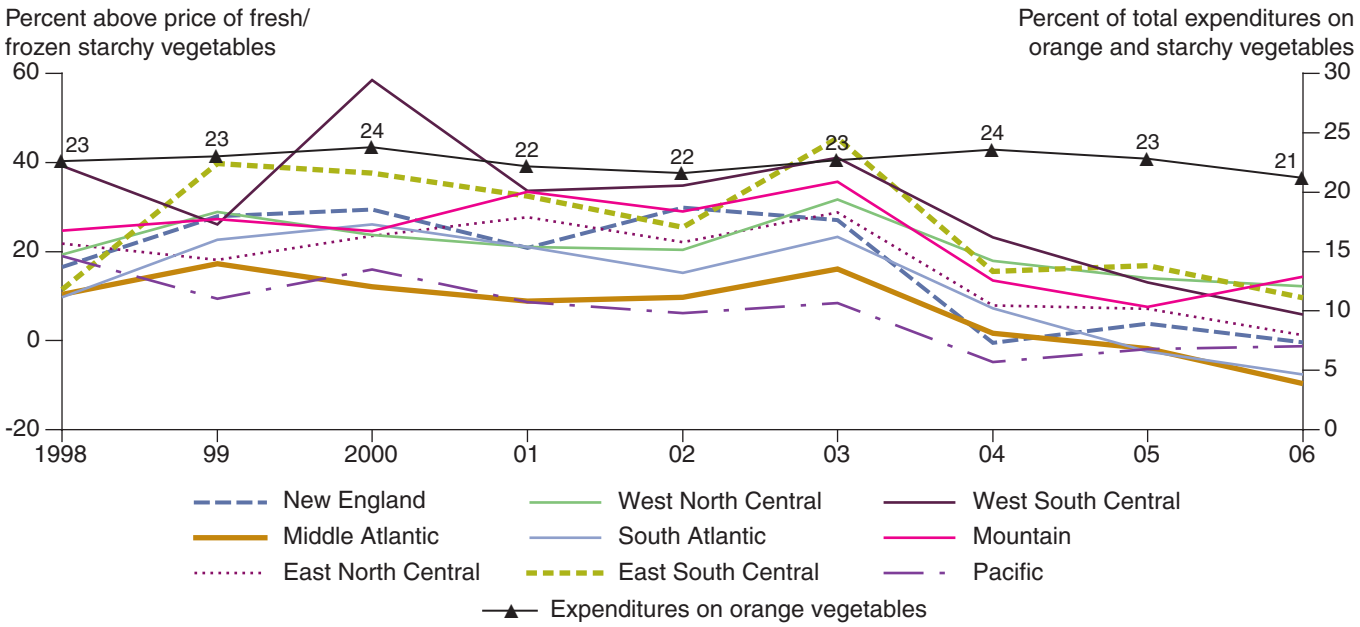


Notes: NE= New England, MA= Middle Atlantic, ENC= East North Central, WNC=West North Central, ESC=East South Central, SA=South Atlantic, WSC=West South Central, M=Mountain, and P=Pacific.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 11

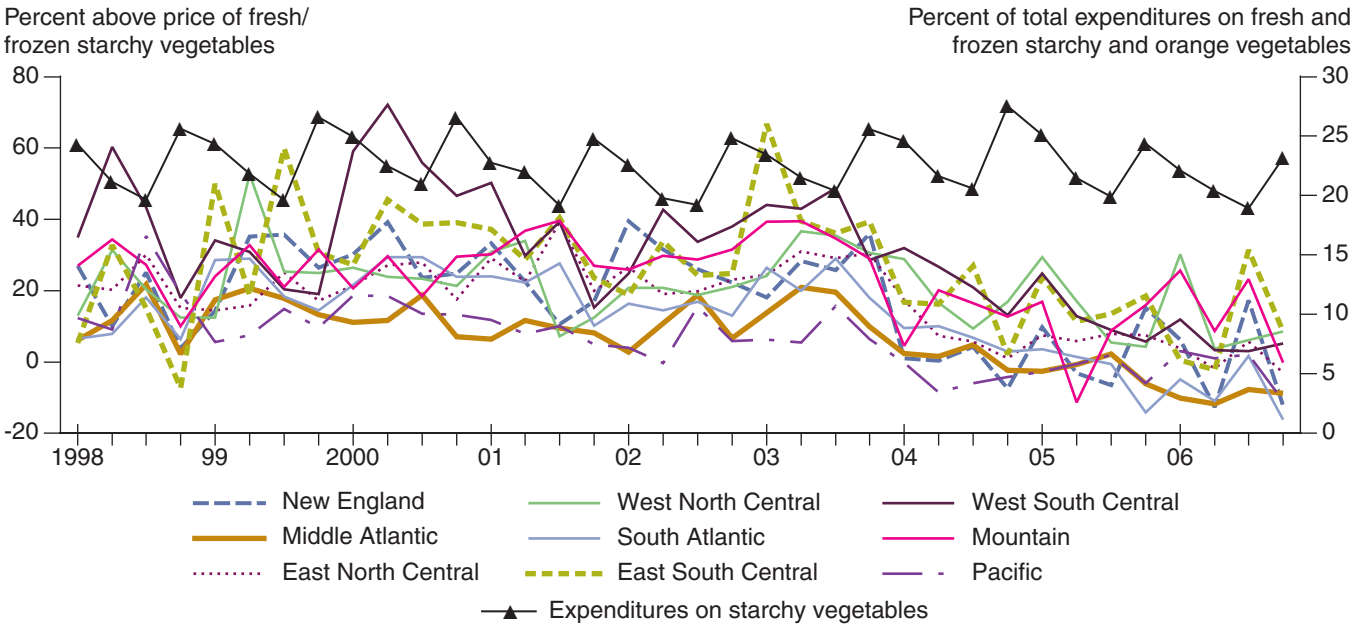
Annual price ratios of fresh/frozen orange vegetables relative to fresh/frozen starchy vegetables (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 12

Quarterly price of fresh/frozen orange vegetables relative to fresh/frozen starchy vegetables, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Whole Fruit versus Sweet and Salty Commercially Prepared Snacks

Whole fruits are often promoted as alternatives to commercially prepared snack foods. According to USDA's Economic Research Service loss-adjusted food availability data, Americans consumed only 0.84 cups of fruit per day in 2008, a figure far lower than the recommended amount of 2 cups for a 2,000-calorie-per-day diet (Wells and Buzby, 2008). On the other hand, the consumption of added fats, oils, sugars, and sweeteners, which are commonly derived from processed foods, surpassed recommended amounts in 2008. Expansions in the consumption, portion size, and even preference of snacks have contributed to increases in daily caloric intake from snacks, reaching 579 calories per day in 2003-06 for adults in the United States, or 29 percent of the daily energy intake of a person following a 2,000 calorie-per-day diet (Piernas and Popkin, 2010).

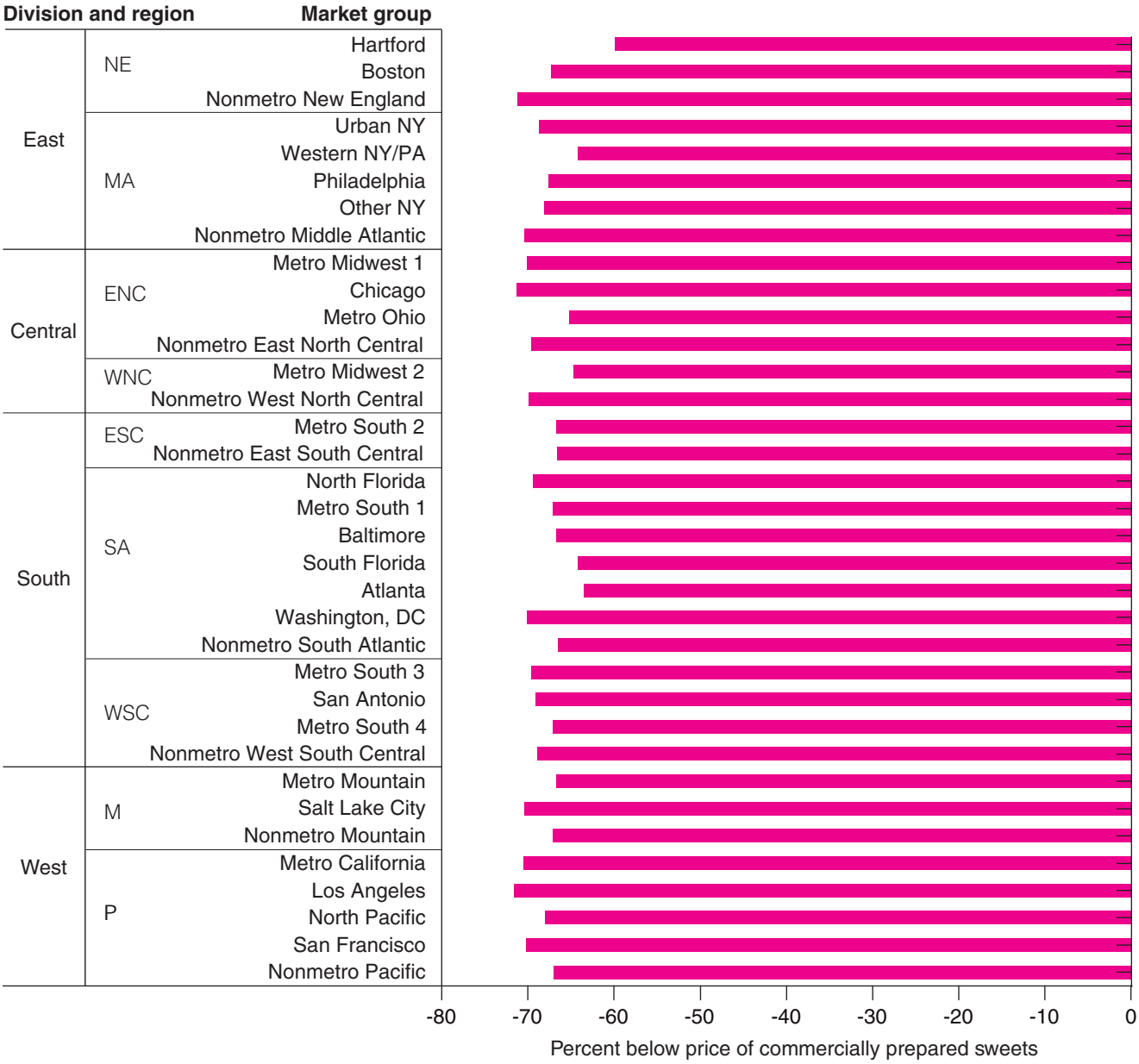
We find that in 2006 whole fruit was actually less expensive per 100 grams than commercially prepared packaged sweets, which include items like candy, cookies, ice cream cones, marshmallows, chocolate, and refrigerated pudding (fig. 13). We did not adjust the price of whole fruit for inedible shares. Adjusting for inedible shares would not affect across markets or time comparisons. Even assuming 50 percent loss of whole fruit, which would double the price of whole fruit, we would still find that whole fruit is cheaper. In contrast to some of the other comparisons, there is less variation in the relative price across market groups, with prices ranging from 60 to 70 percent of the price for sweets. The relative price of fruit increased over time (fig. 14), on average, by about 4 percentage points ($p<0.01$) between 1999 and 2006. Kuchler and Stewart (2008) found that once the increased availability of seasonal fruits was accounted for, the changes in prices for fruits and snack foods were similar between 1980 and 2006. Thus, the differences in the findings can be attributed to the nature of the prices compared. The QFAHPD fruit prices reflect the average price of fruits available and purchased, rather than prices for a fixed basket.

We also compare the price of whole fruit with commercially prepared savory packaged snacks (e.g., pork rinds, potato chips, pretzels, crackers, trail mix, and granola bars). The results are very similar, with the price of fruit ranging from about 55 to 68 percent below the price of the savory snacks (fig. 15). We also see an increase in the price of fruit relative to savory snacks (fig. 16), on average, of about 5.6 percentage points between 1999 and 2006 ($p<0.01$).

Interestingly, our analysis of the quarterly data shows that the relative price and national expenditure shares on whole fruit (compared with both sweet and savory snacks) follow a seasonal pattern (figs. 17 and 18).

Figure 13

Price of whole fruit relative to commercially prepared packaged sweets, by market group, 2006

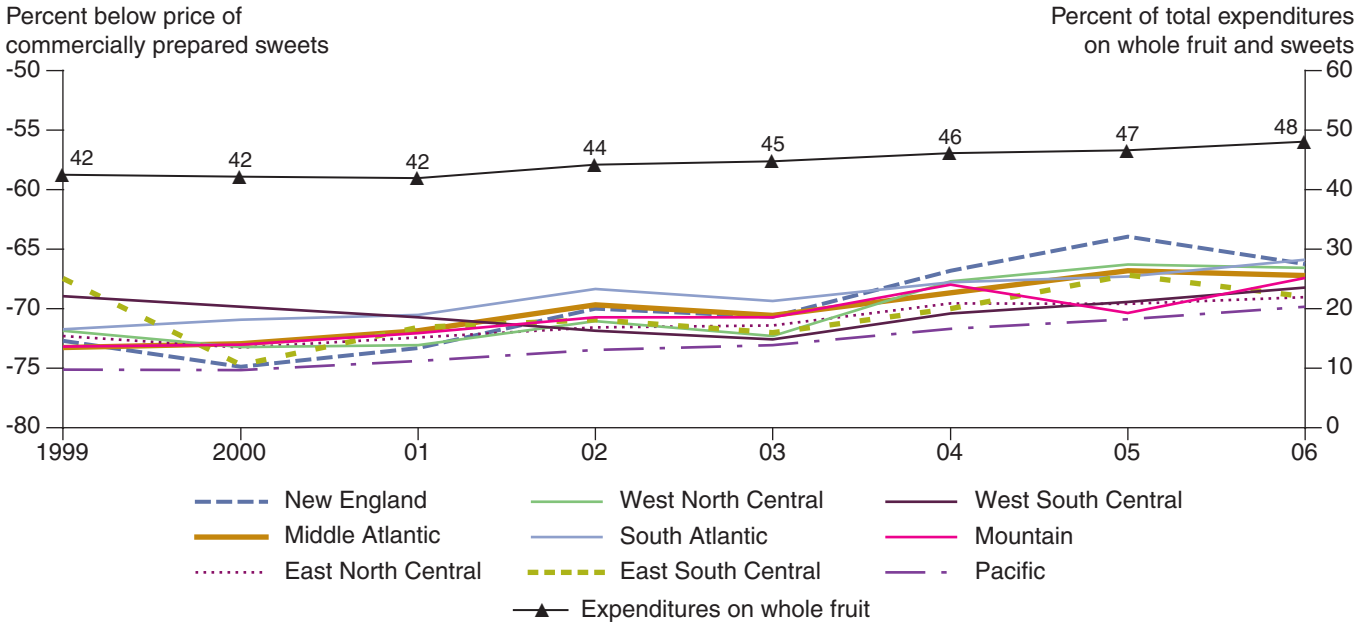


Notes: NE= New England, MA= Middle Atlantic, ENC= East North Central, WNC=West North Central, ESC=East South Central, SA=South Atlantic, WSC=West South Central, M=Mountain, and P=Pacific.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 14

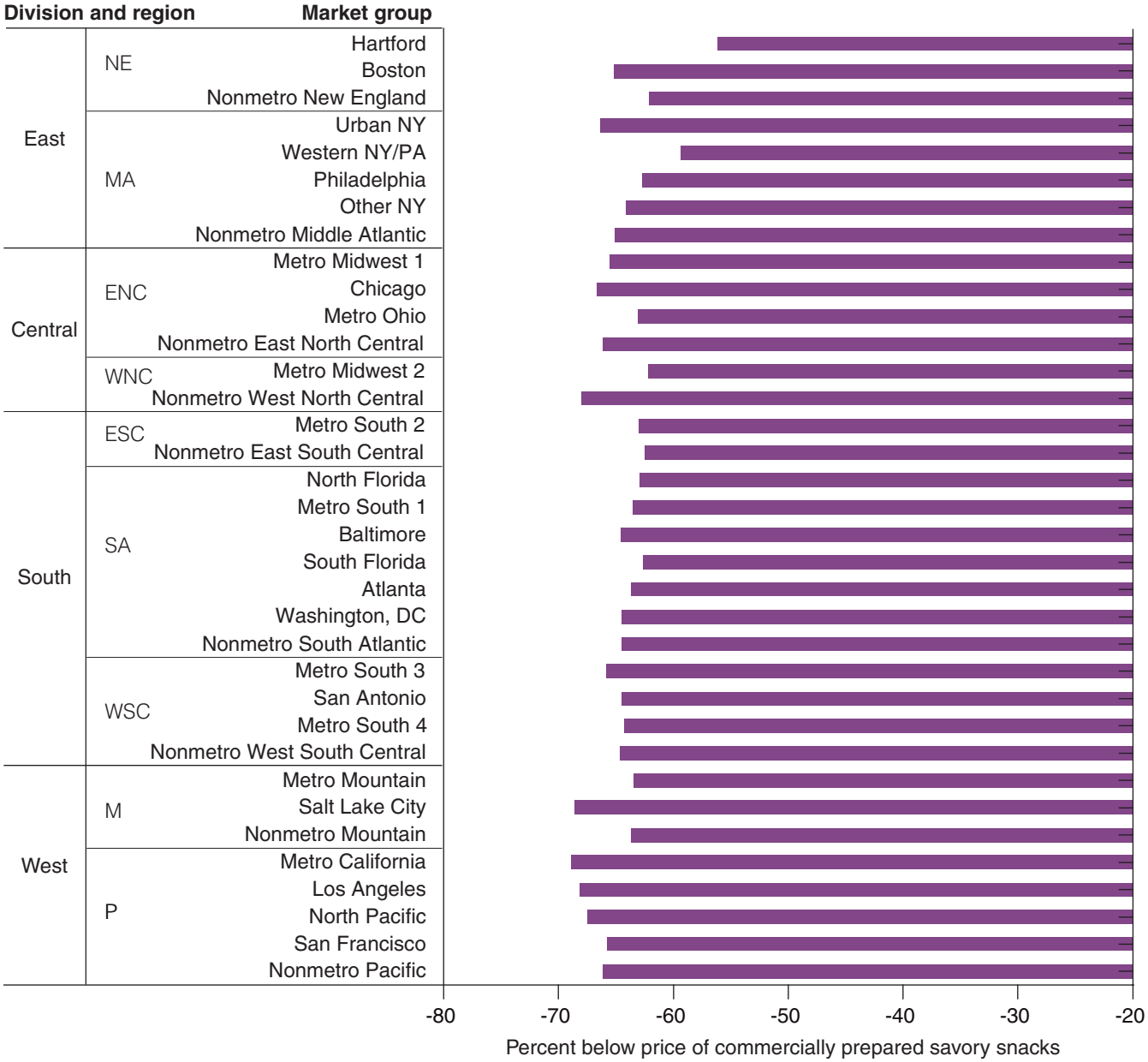
Annual average price of fresh/frozen whole fruit relative to commercially prepared packaged sweets, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 15

Price of whole fruit relative to commercially prepared packaged savory snacks, by market group, 2006

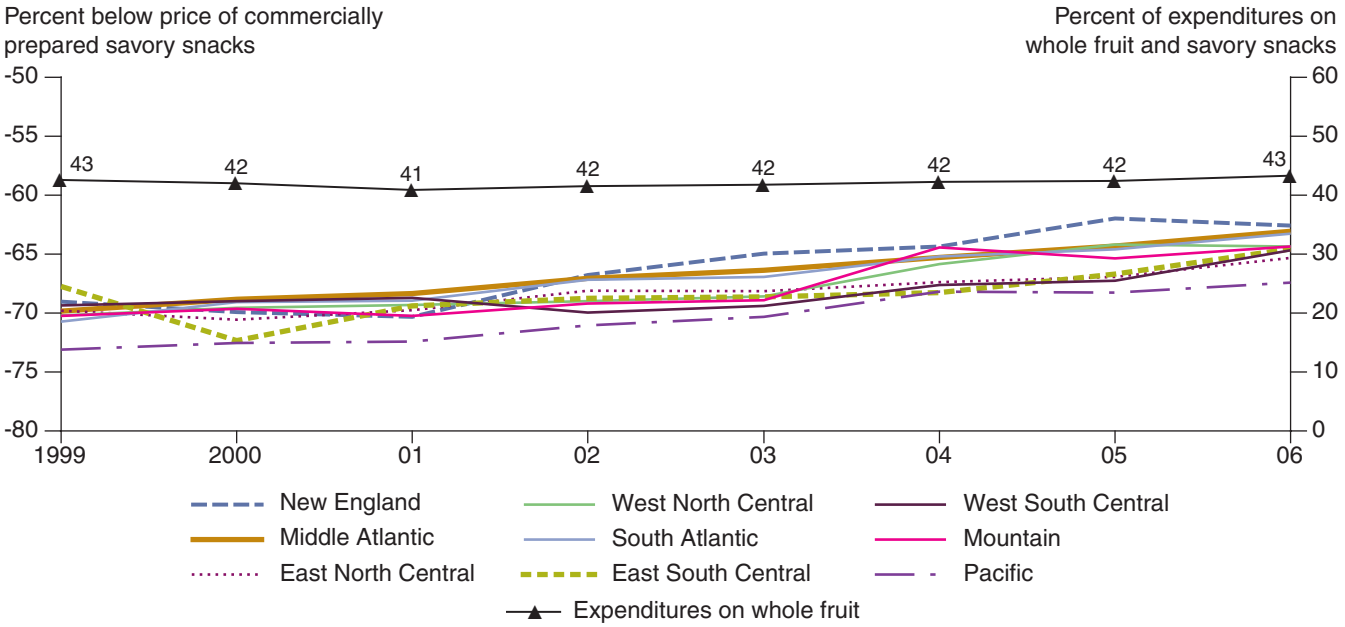


Notes: NE= New England, MA= Middle Atlantic, ENC= East North Central, WNC=West North Central, ESC=East South Central, SA=South Atlantic, WSC=West South Central, M=Mountain, and P=Pacific.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 16

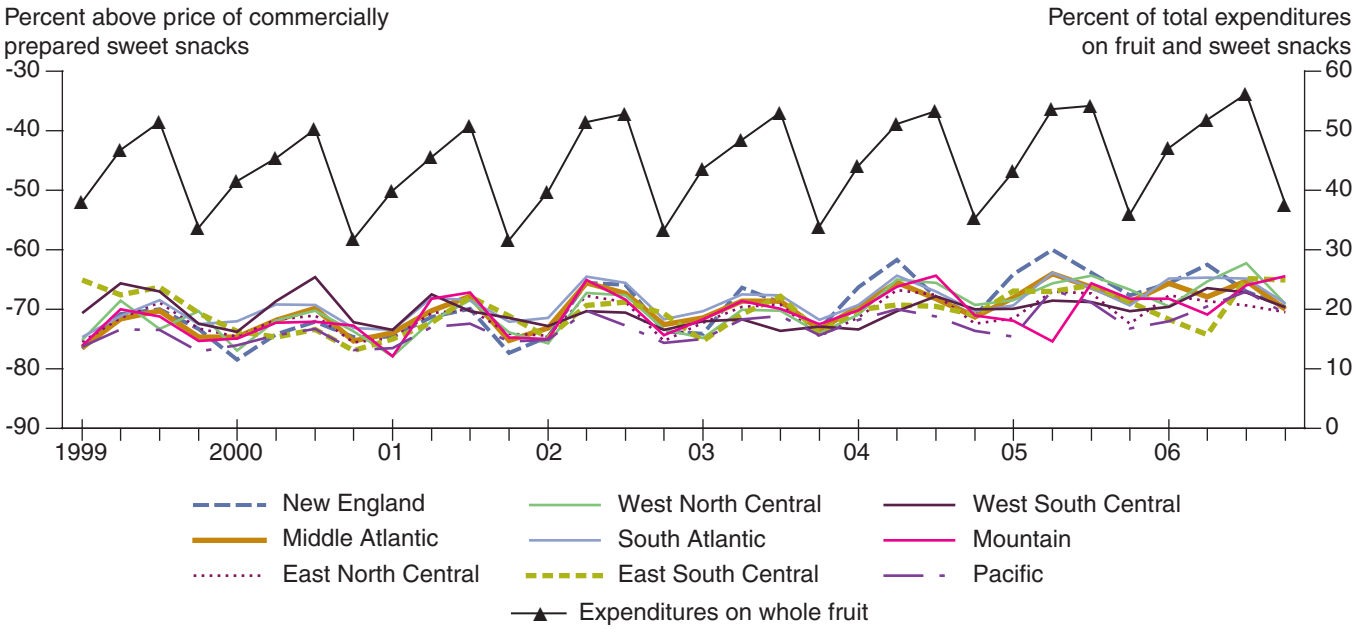
Annual average price of fresh/frozen whole fruit relative to commercially prepared packaged savory snacks, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 17

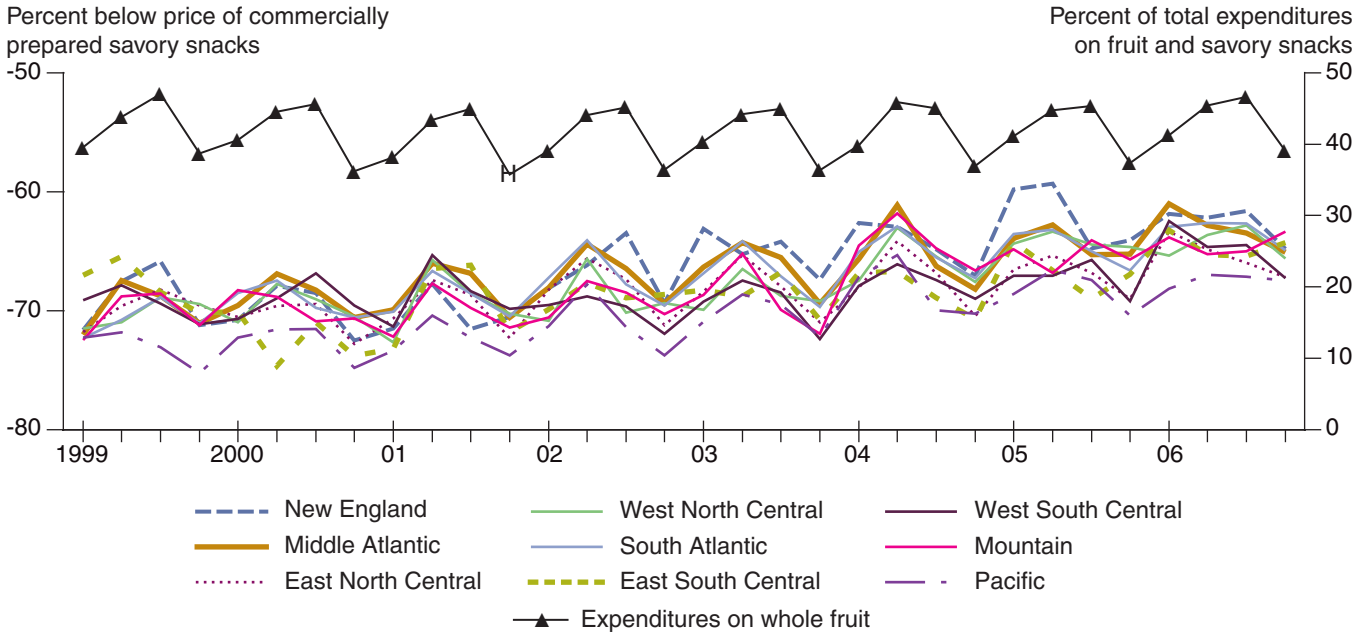
Quarterly price of fresh/frozen whole fruit relative to commercially prepared packaged sweets, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 18

Quarterly price of fresh/frozen whole fruit relative to commercially prepared savory packaged snacks, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Beverages

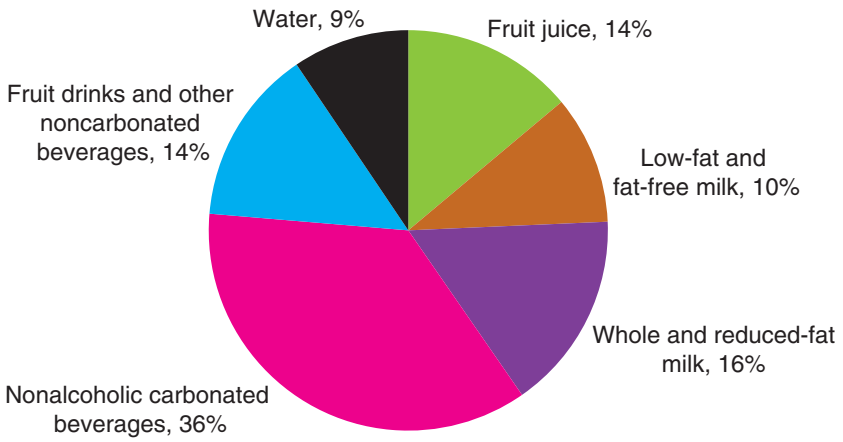
Beverages have become a significant part of the American diet, accounting for 21 percent of total caloric intake in 2002 compared with 14.2 percent in 1977 (Duffey and Popkin, 2007). According to the QFAHPD, nonalcoholic carbonated beverages (hereafter referred to as soda) constituted the largest portion (36 percent) of at-home beverage expenditures in 2006 (fig. 19). Whole and 2% milk represented 16 percent of beverage expenditures, while fruit juice and fruit drinks each accounted for 14 percent of the at-home beverage budget. Low-fat milk (skim and 1%) and water had the lowest shares of national beverage expenditures in 2006 (10 percent each). The ranking of beverages by expenditure share did not change between 1998 and 2006 (fig. 20), however, the share spent on bottled water increased—up from 3 percent in 1998 to 9 percent in 2006—and the share spent on soda declined.

We make four comparisons among beverage types: low-fat milk versus whole and 2% milk; low-fat milk versus soda; bottled water versus soda; and fruit juice versus fruit drinks.

Low-Fat Milk versus Whole and 2% Milk

Children and adults not only consume less-than-recommended amounts of dairy, but their actual intake is typically limited to whole-fat or 2% forms of dairy instead of the suggested low-fat or fat-free varieties. Low-fat milk (skim and 1%) offers the same amount of micronutrients as whole and 2% milk, but has less cholesterol, a lower fat content, and fewer calories per serving. We therefore compare the price of low-fat milk with whole and 2% milk.

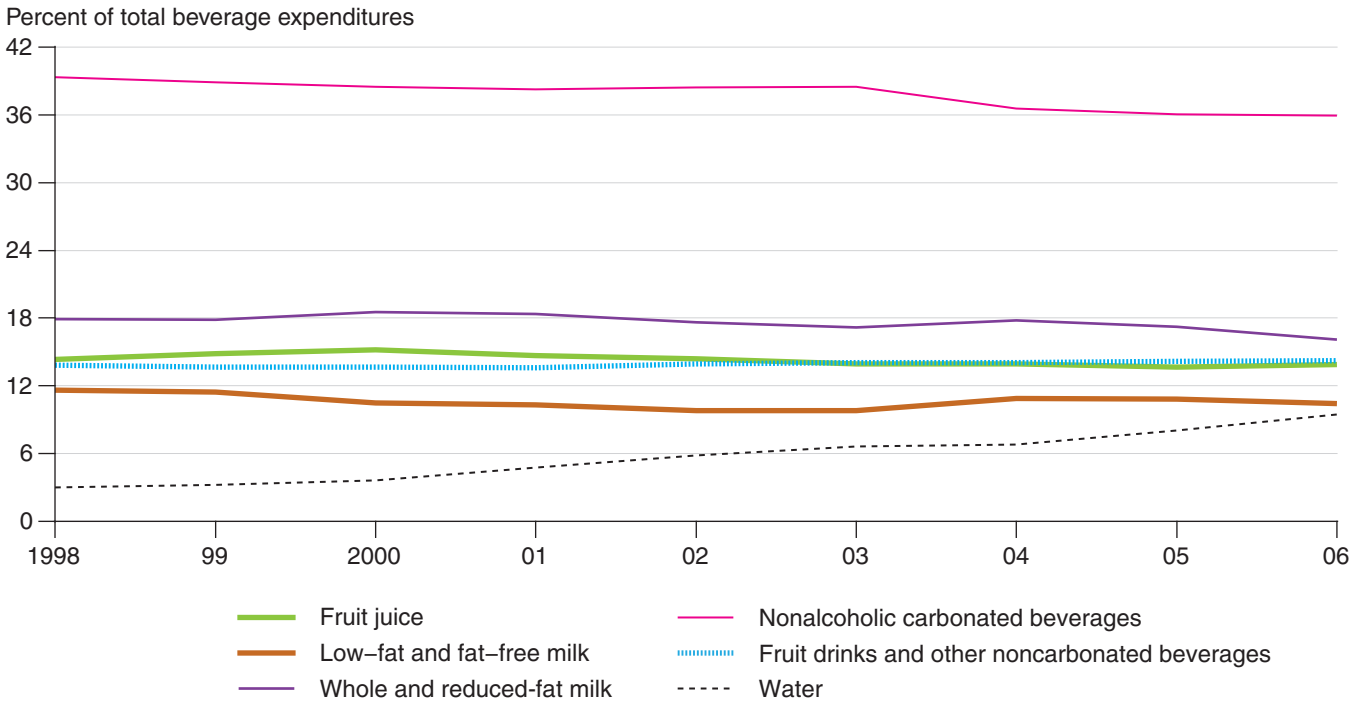
Figure 19
National expenditure share on food groups, 2006



Notes: Percentages may not add to 100 due to rounding. Expenditure shares calculated from total beverage expenditures on the six beverage groups in the Quarterly Food-at-Home Price Database (QFAHPD). The six beverage groups cover the vast majority of beverage-at-home expenditures.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 20
National expenditure share on beverages, 1998-2006

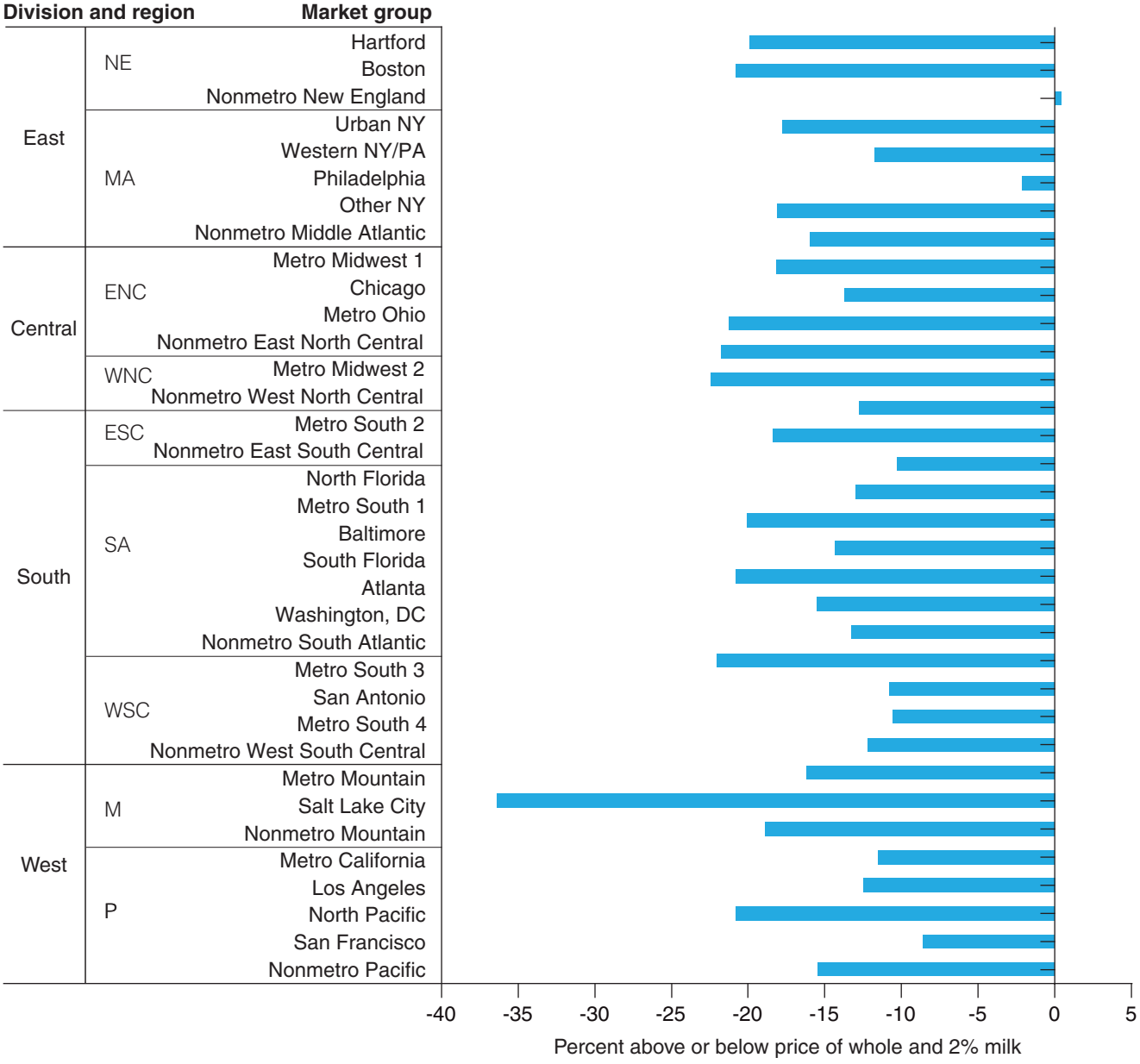


Notes: Percentages may not add to 100 due to rounding. Expenditure shares calculated from total beverage expenditures on the six beverage groups in the Quarterly Food-at-Home Price Database (QFAHPD). The six beverage groups cover the vast majority of beverage-at-home expenditures.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

With one exception (Urban New York), low-fat milk was less expensive than whole and 2% milk in every market group in 2006 (fig. 21). Part of this difference in milk prices is driven by the fact that whole milk is often purchased in smaller containers that are usually sold at a higher per unit cost. This average package size effect, however, is less of an issue in large metropolitan areas, such as urban New York, in which households purchase smaller package sizes of all milk products compared with other parts of the United States. The relative price of low-fat milk declined slightly, about 3.5 percentage points ($p<0.01$), between 1998 and 2006; the price was generally lowest in the West North Central (includes Kansas City, Minneapolis,

Figure 21
Price of low-fat milk relative to the price of whole and 2% milk, by market group, 2006



Notes: NE= New England, MA= Middle Atlantic, ENC= East North Central, WNC=West North Central, ESC=East South Central, SA=South Atlantic, WSC=West South Central, M=Mountain, and P=Pacific.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

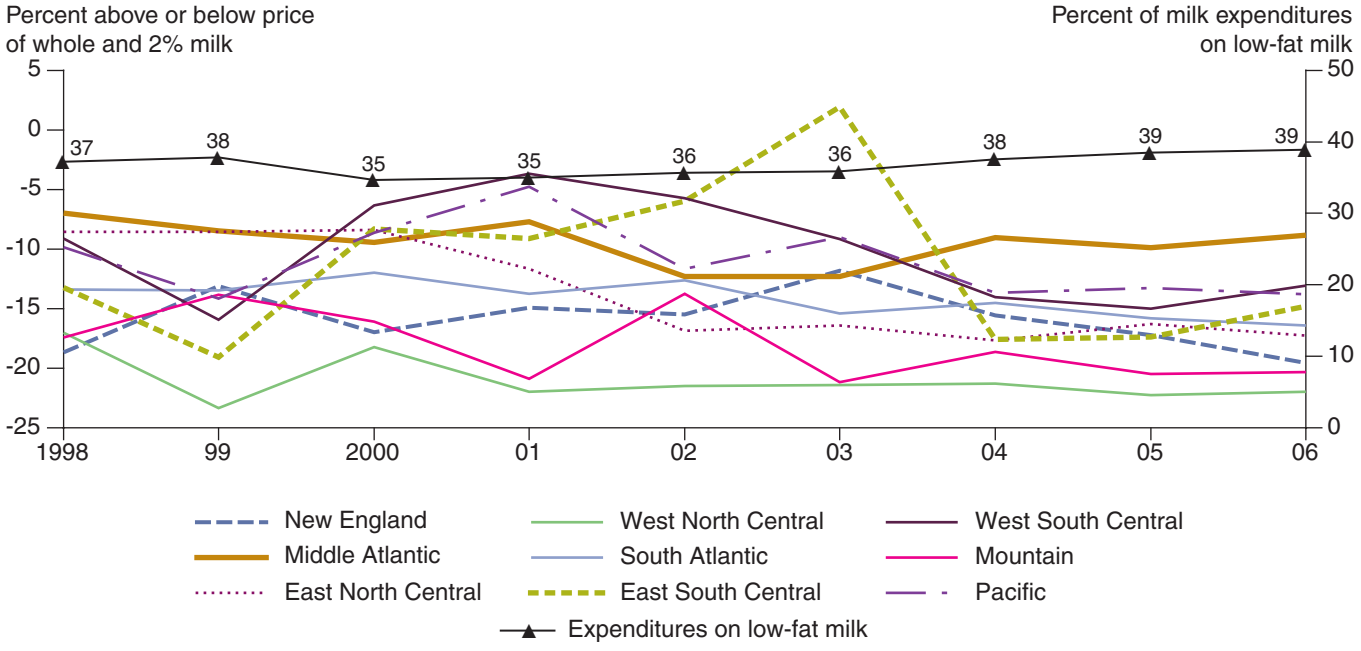
St. Louis, Des Moines, and Omaha) and Mountain (Denver, Phoenix, and Salt Lake City) divisions (fig. 22). The average national share of milk expenditures on low-fat milk fluctuated slightly, ranging from 35 to 39 percent, between 1998 and 2006.

The relative price of low-fat milk also varies seasonally somewhat (fig. 23). According to Stephenson (2010) the supply of milk was greatest in the spring due to calving patterns, with the most production occurring during the first two quarters of the year (March to June). Typically during this time, consumer demand is steady, leading to low dairy prices. When school begins in the fall and the holiday season ensues, the demand for milk is at its highest level. This excess consumer demand for dairy products and decreased supply leads to an increase in the price of whole milk and, to a much lesser extent, low-fat milk throughout the last half of each year. As a result, the relative price of low-fat milk is lower in the fourth quarter.

Low-Fat Milk versus Carbonated Nonalcoholic Beverages

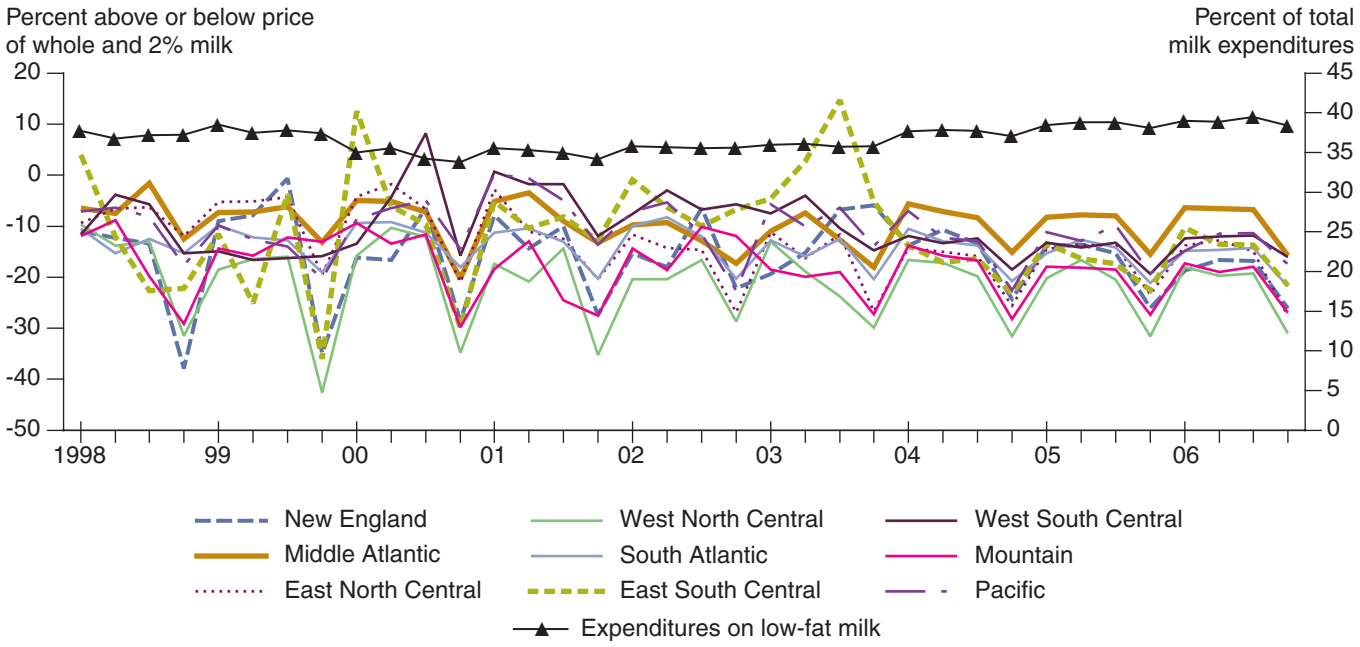
Soda consumption has risen substantially over the past several decades, increasing from 5 to 9 ounces per day among children 2-19 years old. Over the same period (1977-78 to 2003-06), milk consumption among children decreased from 15 to 9 ounces per day (Smith et al., 2010).

Figure 22
Annual average price of low-fat and fat-free milk relative to whole and 2% milk, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 23
Quarterly price of low-fat milk relative to whole and 2% milk, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

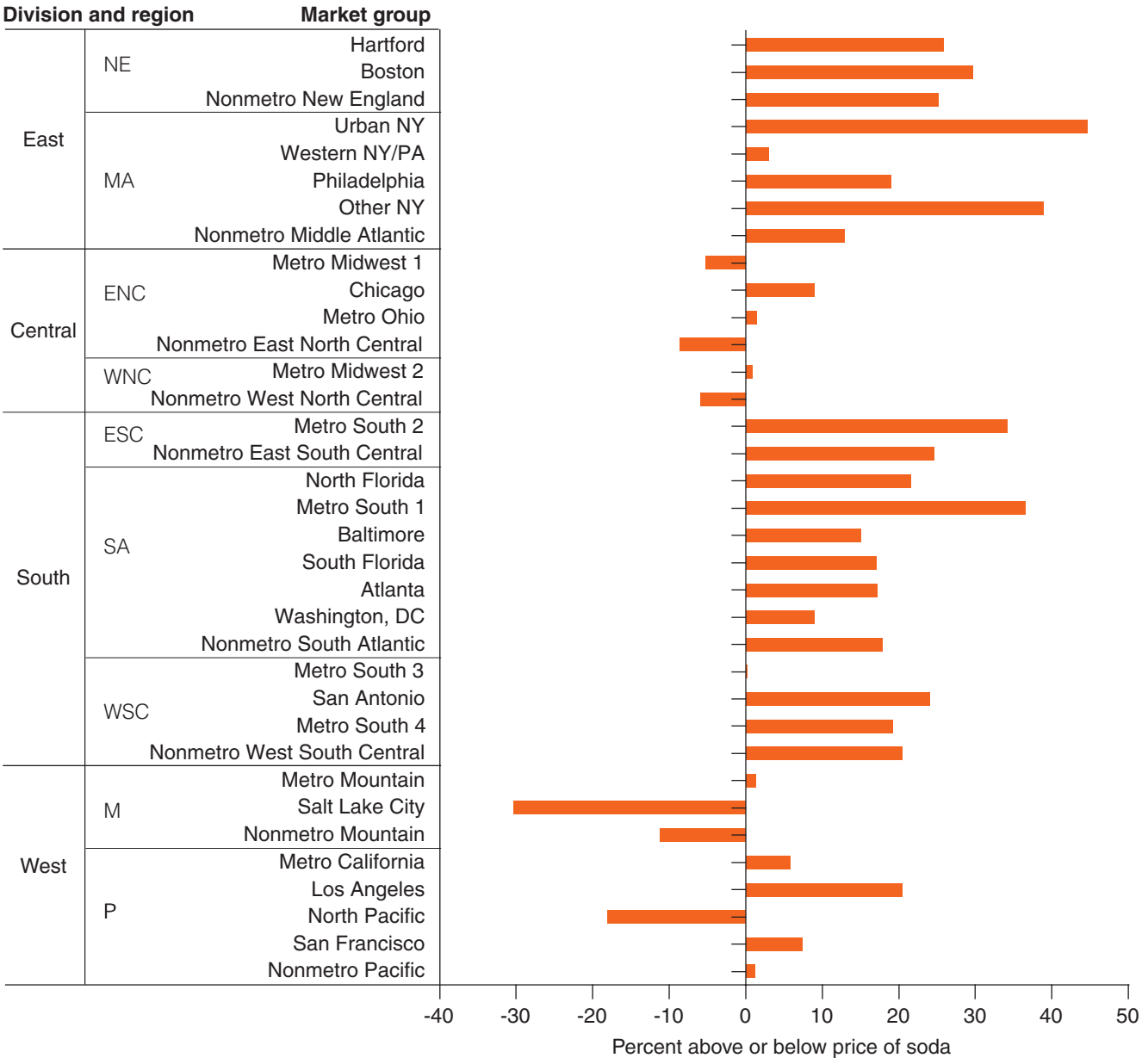
Such large increases in soft drink consumption are cause for concern, as many scientists suggest that soda is a key contributor to the obesity and overweight epidemic (Malik et al., 2006). Moreover, Guthrie and Morton (2000) show that the displacement of milk for soft drinks hinders calcium intake—a nutrient important in the maintenance of strong bones and teeth and the proper functioning of nerves, muscles, and blood clot defenses. Given the interest in reducing childhood obesity and the dramatic changes in beverage consumption, we compare the price of low-fat milk with carbonated soft drinks.

Low-fat milk was usually more expensive than carbonated nonalcoholic beverages (soda), but was less expensive in 6 out of the 35 market groups in 2006 (fig. 24). The relative price of low-fat milk was lowest in Salt Lake City, 30 percent less than soda; 10 markets had prices 20 percent or more higher than whole and 2% milk. Between 1998 and 2006, the relative price of low-fat milk declined 11.7 percentage points ($p<0.01$), on average, across divisions and, similar to when compared with whole and 2% milk, was generally lowest in the West North Central Mountain (Denver, Phoenix, and Salt Lake City) division (fig. 25). Over the same period, national expenditure shares on low-fat milk did not change.

The quarterly data show the same fourth-quarter spike in the relative price of low-fat milk as seen when comparing whole and reduced-fat milk with low-fat milk (fig. 26).

Figure 24

Price of low-fat milk relative to soda, by market group, 2006

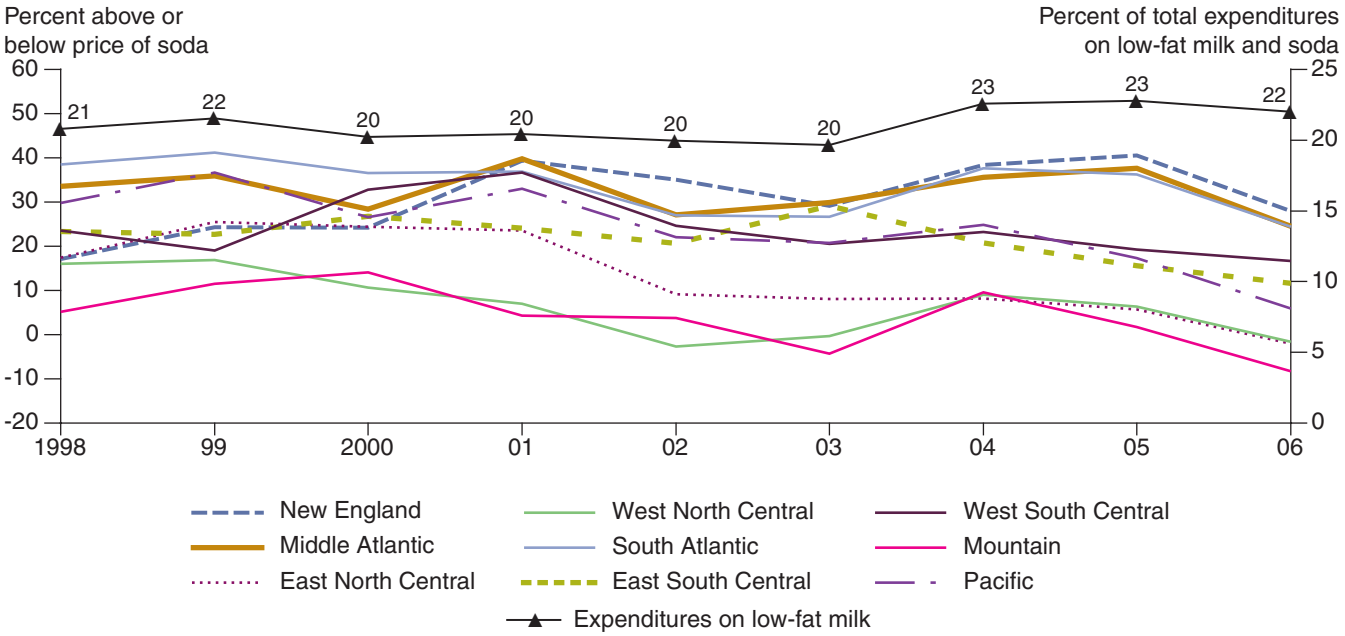


Notes: NE= New England, MA= Middle Atlantic, ENC= East North Central, WNC=West North Central, ESC=East South Central, SA=South Atlantic, WSC=West South Central, M=Mountain, and P=Pacific.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 25

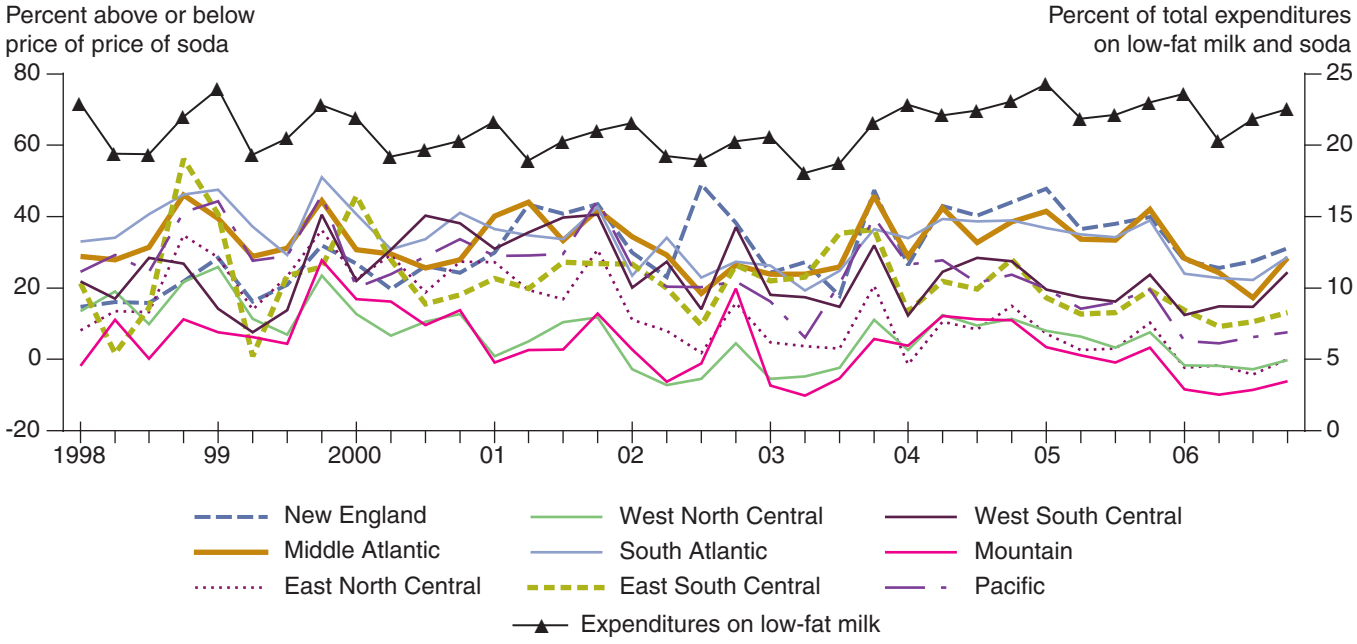
Annual average price of low-fat milk relative to soda, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 26

Quarterly price of low-fat and fat-free milk relative to soda, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Carbonated Nonalcoholic Beverages versus Water

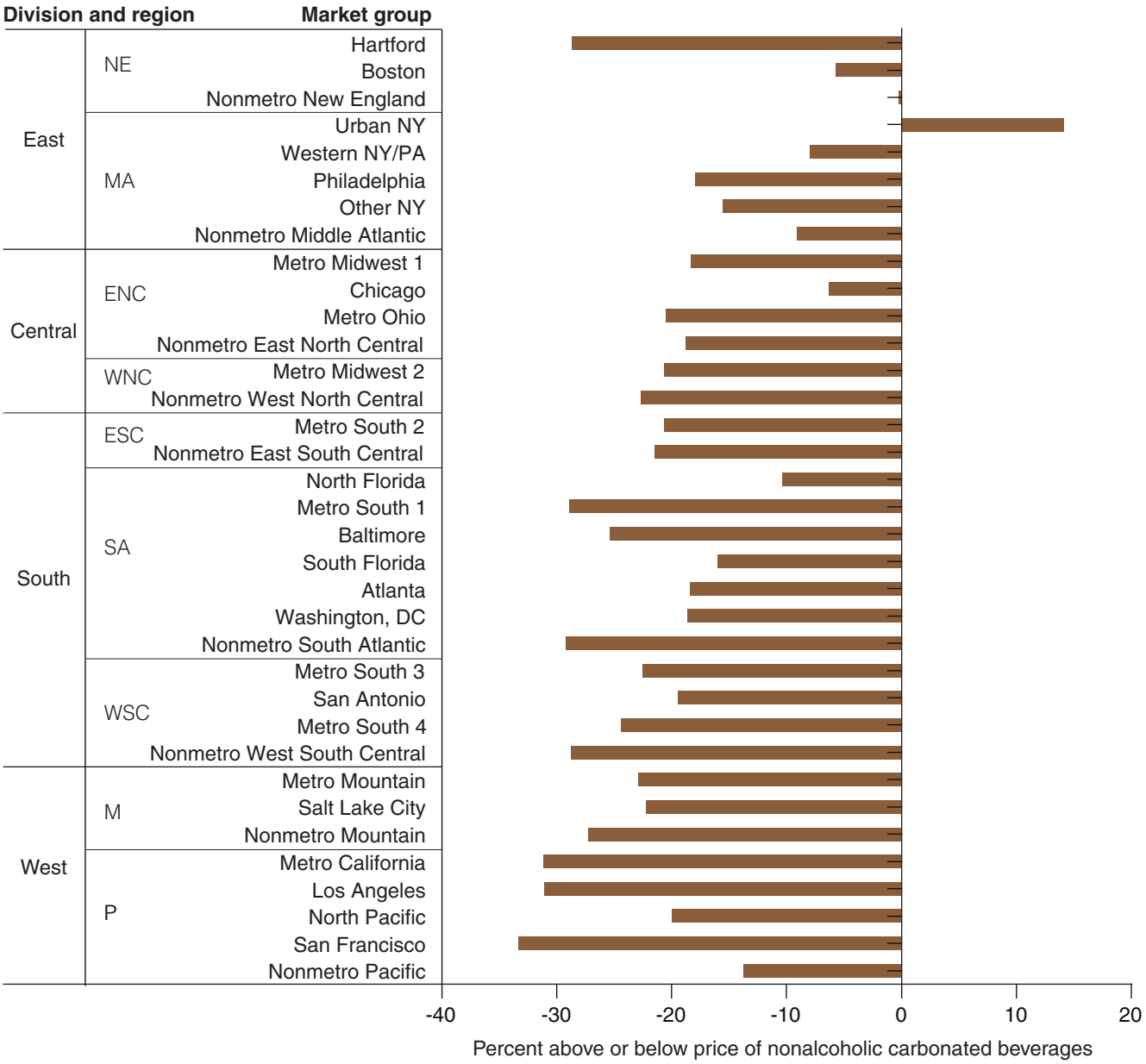
Bottled water is another substitute for nondiet soft drinks that is often promoted for reducing caloric intake. Research shows that replacing soda with water may lead to lower energy intake and facilitate weight management (Stookey et al., 2007). If bottled water is more expensive than nondiet soft drinks, budget-conscious consumers may find making the switch difficult.

We find that the price of bottled water was the same or less than soda in all but one market group (Urban NY) in 2006, with bottled water ranging from 6 percent (Boston) to over 33 percent (San Francisco) less expensive than soda (fig. 27).

Between 1998 and 2006, bottled water captured an increasing share of total expenditures on water and soda, rising from 7 to 21 percent (fig. 28). Over the same period, the relative price of bottled water fell 10 percentage points ($p<0.1$). How consumers allocate their budget between soda and bottled water shows some seasonality, with a smaller share of purchases going toward bottled water in the fall each year (fig. 29).

Figure 27

Price of bottled water relative to soda, by market group, 2006

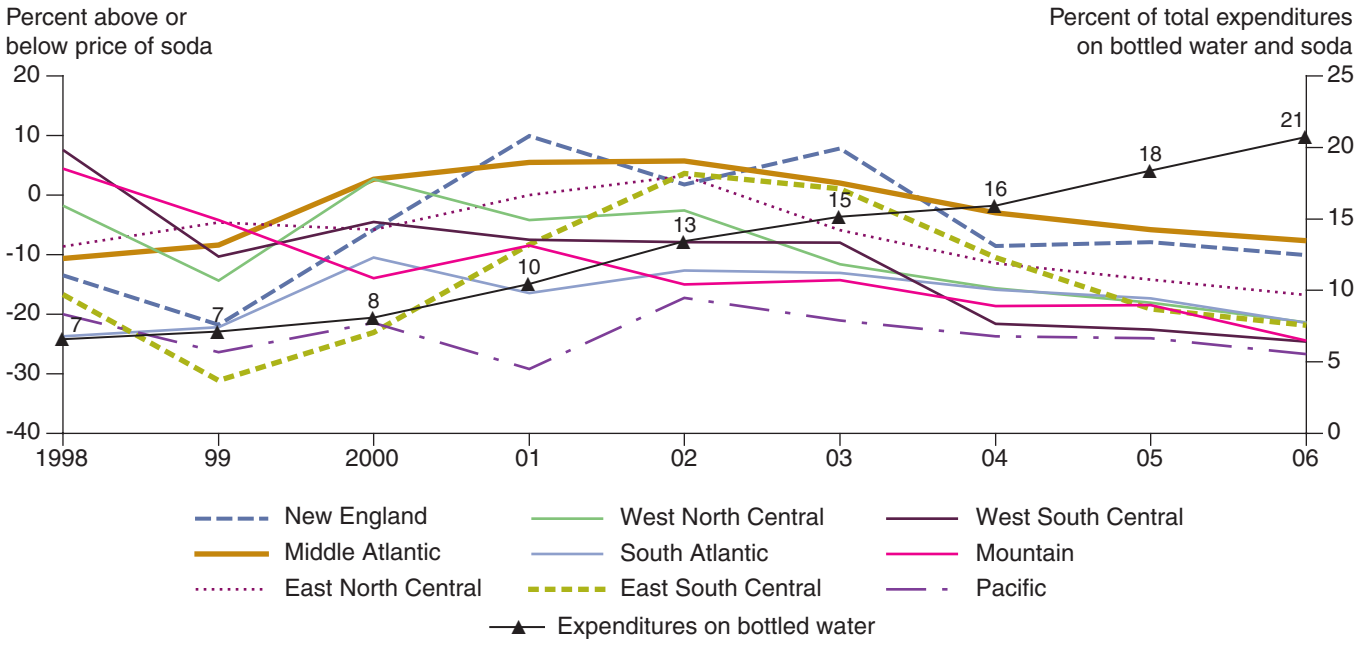


Notes: NE= New England, MA= Middle Atlantic, ENC= East North Central, WNC=West North Central, ESC=East South Central, SA=South Atlantic, WSC=West South Central, M=Mountain, and P=Pacific.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 28

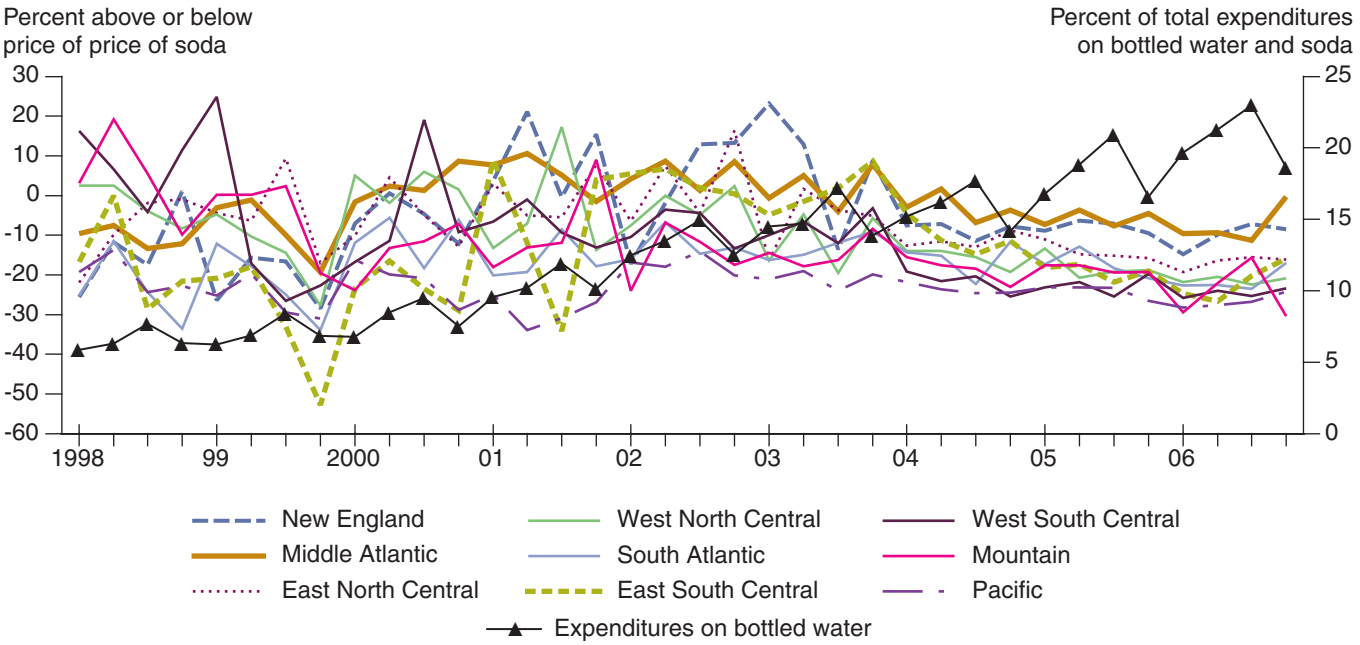
Annual average price of bottled water relative to soda, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 29

Quarterly price of bottled water relative to soda, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

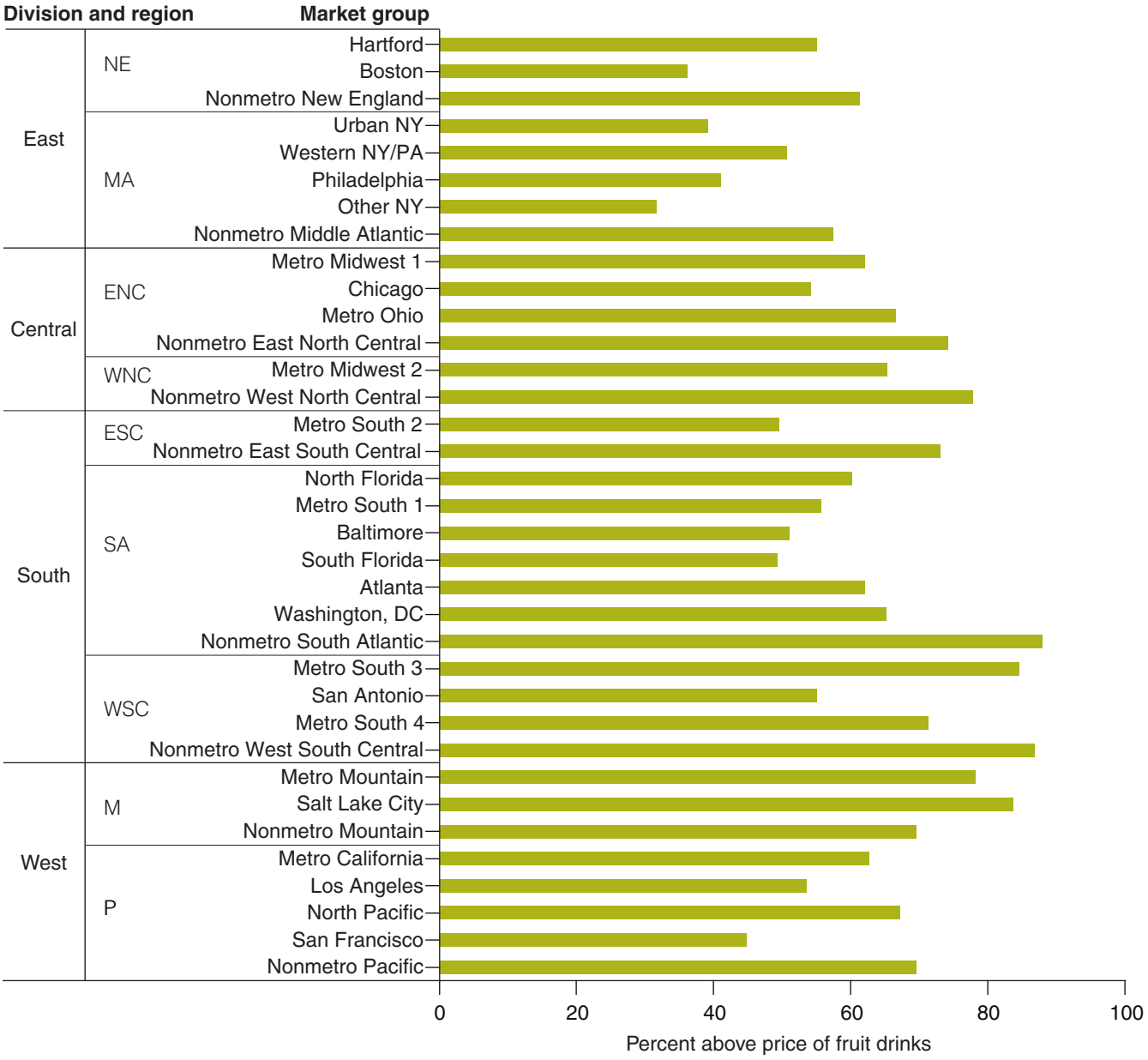
Fruit Juice versus Fruit Drinks

In addition to nondiet carbonated soft drinks, children also consume 100 percent fruit juices and nondiet fruit drinks. Smith et al. (2010) found that fruit drinks contribute 14.5 percent of added sugars in the diet of U.S. children ages 2-19. While the share of Americans who drink fruit juice is greater than those who consume fruit drinks, the difference in consumption of the two beverages has declined over time (Duffey and Popkin, 2007).

In 2006, the relative price of fruit juice ranged from 32 percent higher than fruit drinks in suburban and exurban New York to 90 percent higher in nonmetro Tennessee, Kentucky, and Alabama (fig. 30). In general, the relative price was lowest in the New England and Mid-Atlantic divisions. Between 1998 and 2006, fruit juice became relatively more expensive than fruit drinks—by 27 percentage points ($p<0.01$)—while the share of expenditures remained flat (fig. 31). This increase in the relative price of fruit juice may explain the change in consumption of these two beverages over time. We see that the allocation of expenditures between fruit juice and fruit drinks is rather seasonal, with a larger share devoted to fruit drinks in the spring and summer (fig. 32).

Figure 30

Price of fruit juice relative to fruit drinks, by market group, 2006

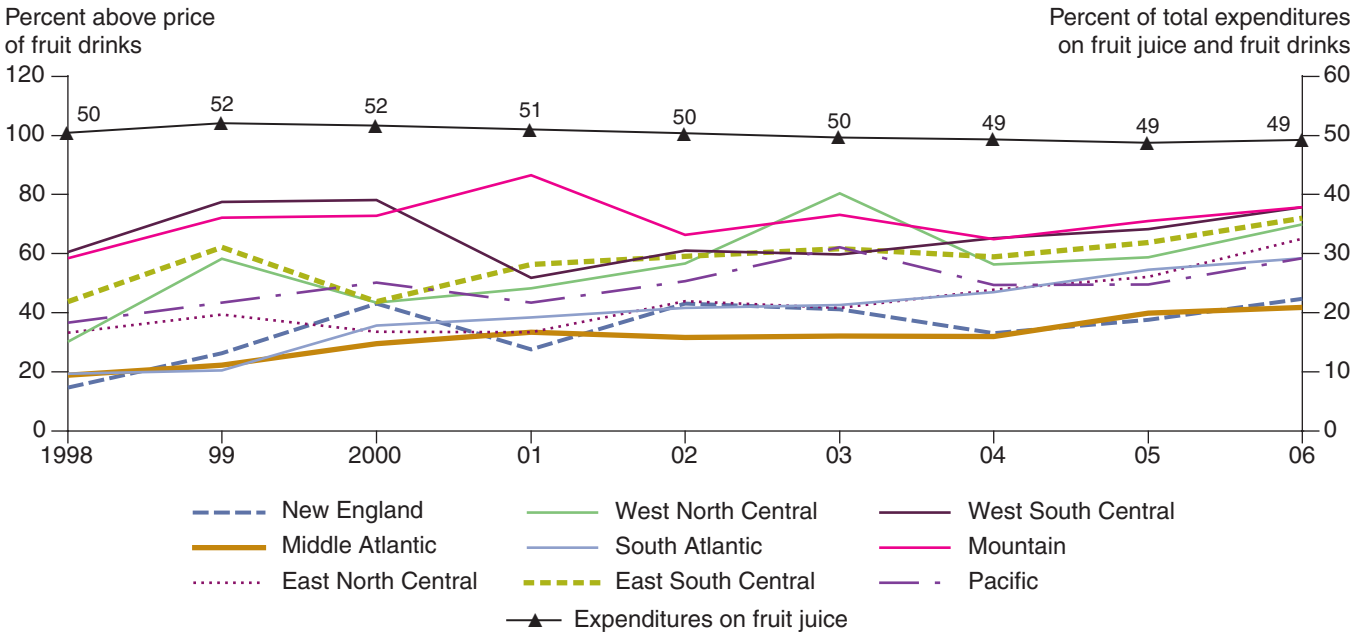


Notes: NE= New England, MA= Middle Atlantic, ENC= East North Central, WNC=West North Central, ESC=East South Central, SA=South Atlantic, WSC=West South Central, M=Mountain, and P=Pacific.

Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 31

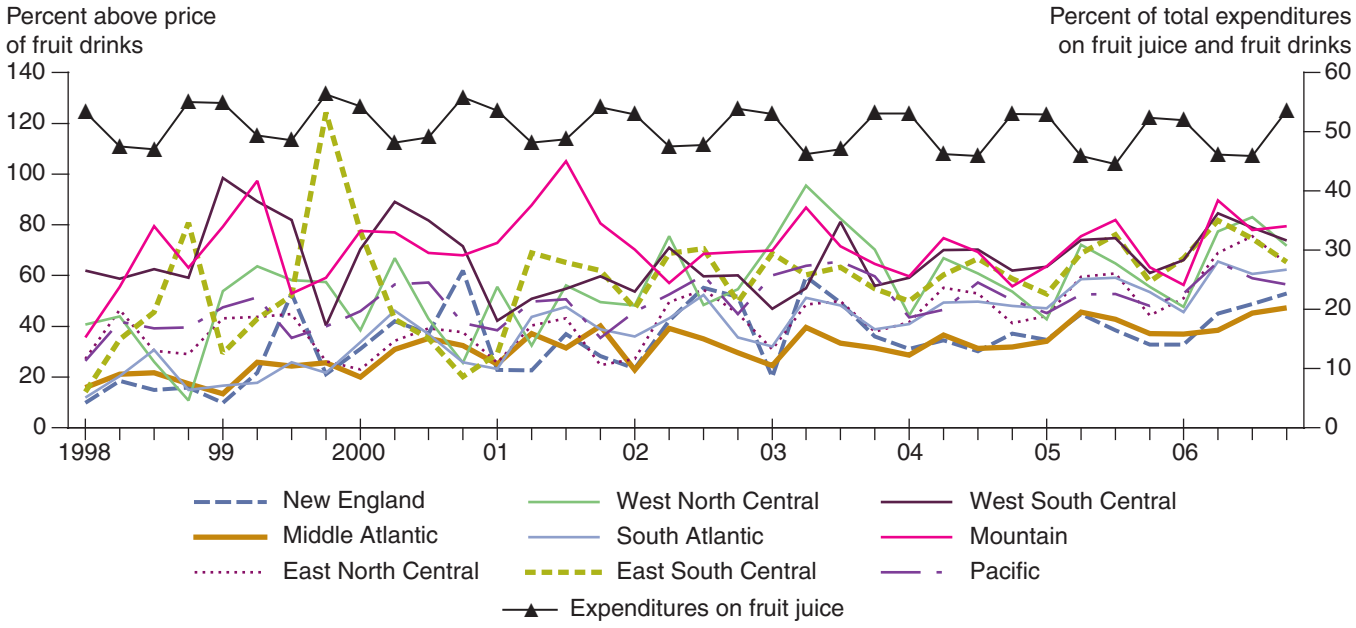
Annual average price of fruit juice relative to fruit drinks, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Figure 32

Quarterly price of fruit juice relative to fruit drinks and other noncarbonated sugary beverages, by division (metro areas only)



Source: USDA, Economic Research Service calculations based on the Quarterly Food-at-Home Price Database.

Discussion

Todd and Leibtag (2010) documented that average prices vary across geographic areas. Our analysis here shows that, in many cases, relative prices between healthy and less healthy foods also vary across the country. These differences may explain some of the geographic variation in dietary patterns and diet-related morbidities.

We find that some healthier foods are relatively less expensive across all market areas (e.g., low-fat milk compared with whole and 2% milk). In other comparisons, we find that the healthier version is universally more expensive (e.g., whole grains versus refined grains). However, the geographic variation in the relative price of the healthier option is large—ranging from 10 to 50 percent higher or lower than the price of the less healthy option, depending on the market area. These variations may have more of an effect on low-income households, whose share of income spent on food is higher than among households with greater income.

In recent years, the price of whole grains has declined relative to refined grains, which should make it easier for American's to meet recommended intake of whole grains. We were surprised to see a lack of geographic variation in the price of whole fruit relative to sweet commercially prepared snacks (cakes, cookies, and candy). This lack of price variation suggests that factors other than the relative cost of healthy foods may be more important in determining geographic differences in diet and related health outcomes than just the choice between fruit and other less healthy snack options.

Note that we have only examined one measure of price (price per 100 grams) and have not compared price per serving (by adjusting for inedible shares or differences in serving sizes) or price per calorie. The time required to prepare food was not controlled for in this study, which may be particularly important for fruits and vegetables. Knowing exactly which prices consumers compare when making food choices is difficult. This study offers one piece of information relevant to whether prices matter for diet quality and complements other research that compares other notions of price. Our research also did not explore the source of variation in relative prices, whether it is driven mainly by differences in the price of the healthy option, in the less healthy option, or both. Such absolute prices are also likely to be important to consumers when considering whether to buy any option at all.

This research documents the extent to which the relative price of healthy food varies. However, looking at relative prices between two food groups cannot, in itself, be used to draw any firm conclusion about the link between healthy food prices and consumption trends. Such causal effects would have to be determined in a model that includes other relative food prices and other control variables. Future research could test whether variation in relative prices helps predict geographic variation in diet quality and weight-related health outcomes.

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