

Online and Official Price Indexes: Measuring Argentina's Inflation

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June 17, 2011

Appendix A. Monthly and Annual Inflation using Daily Data

Formally, the monthly inflation rate π_t^m at time t is defined as the percentage change in the average of the index from t to $t - 29$ and the average from $t - 30$ to $t - 59$.

$$\pi_t^m = 100 * \left[\frac{\frac{1}{30} \sum_{x=0}^{29} I_{t-x}}{\frac{1}{30} \sum_{x=30}^{59} I_{t-x}} - 1 \right] \quad (\text{A.1})$$

On the last day of each calendar month, π_t^m is comparable to the monthly inflation reported in official statistics.

Similarly, annual inflation is computed as the percentage change in the index in the past 30 days over the same period 365 days ago,

$$\pi_t^y = 100 * \left[\frac{\frac{1}{30} \sum_{x=0}^{29} I_{t-x}}{\frac{1}{30} \sum_{x=365}^{394} I_{t-x}} - 1 \right] \quad (\text{A.2})$$

On the last day of each calendar year, π_t^y is comparable to the annual inflation rate reported in official statistics.

Appendix B. More Robustness Tests

This section provides additional indexes for Argentina constructed with other index methodologies and subsets of the data. In all cases there are large discrepancies with the official statistics.

Appendix B.1. Cell-Relative Imputation and unweighted Index

The first exercise uses a different approach to impute missing values within price series. The method used in the paper is to fill missing prices with the last available price for each product. This approach is reasonable because the gaps in the online data last only a few days. However, official statistical offices deal with missing values in their monthly series in different ways. The standard approach, also used in Argentina, is to impute missing prices with the average price change of similar products. Methods vary slightly across countries, so here I follow the "cell-relative" approach used by the Bureau of Labor Statistics (BLS): if a product is missing on a particular day, I do not use that product for the calculation of that day's inflation, but I impute a price for it equal to the previous price times the average price change for products in the same category that day. In theory, different methods to fill in price gaps should not impact long-term inflation estimates, but they could yield differences in some of the short-run dynamics. Indeed, Figure B.1 shows that the monthly inflation estimates are nearly identical for most of the sample, with the exception of March and November 2010. The overall differences are small, and not nearly strong enough to explain any of the differences between online and official estimates.

The second robustness test is to use an unweighted index, just as the one constructed for Venezuela in the paper. This index is a geometric mean applied to all price changes observed each day in the store, without any categories or relative weights. Naturally, the effect of a geometric mean is to reduce the impact of products that have relatively large price changes (either up or down). It is implemented by the BLS and other statistical offices at a sub-category level in order to approximate the effect of within-category substitution (for example, when the price of "McIntosh" apples goes up, consumers might tend to buy "Fuji" apples). In this data, we are pooling together goods from different categories, effectively allowing cross-category substitutions as well. In theory, we should expect to see less inflation when it is rising, and more inflation when it is falling. That is precisely what Figure B.1 shows. In particular, this

approach produces considerably less inflation in Argentina from 2010 onward, because of a lower impact of high-rising prices in March and November of that year. Still, the inflation rate is twice as high as the official estimates. So, in other words, even if INDEC were to be allowing for cross-category substitutions, the effect does not appear to be strong enough to explain their results. This exercise also suggest that the unweighted index for Retailer #2, presented in Section 5.3.2, might be underestimating inflation in the same period. This would move it even closer to the results for Retailer #1, and even further away from the official estimates.

Appendix B.2. Lowest-Inflation items

Could a selection of the goods included in the index help reduce the observed inflation rate? It is possible that the government is monitoring prices that it somehow knows are going to have lower inflation rates? This section uses an extreme assumption: that the government is able to select, within narrowly defined categories, only the goods that have the lowest inflation rate over this whole period. This would not be a realistic alternative for the INDEC, given that it is hard to know ex-ante which goods will have the lowest inflation rates, but at least it can provide a lower-bound inflation rate for a strategy that favors lower-inflation brands or items.

In this data the way to identify close substitutes is to use the URL where the product is located. Within these categories, the product with the lowest inflation rate for the whole period is selected and included in the index.

As expected, Figure B.2 shows that the observed inflation is much closer to official estimates, particularly in the first semester of 2010. However, the annual inflation rate is often twice as high as the official estimates reported. There is no subset of the data, however arbitrarily selected, that can yield the low rates of inflation reported by the government.

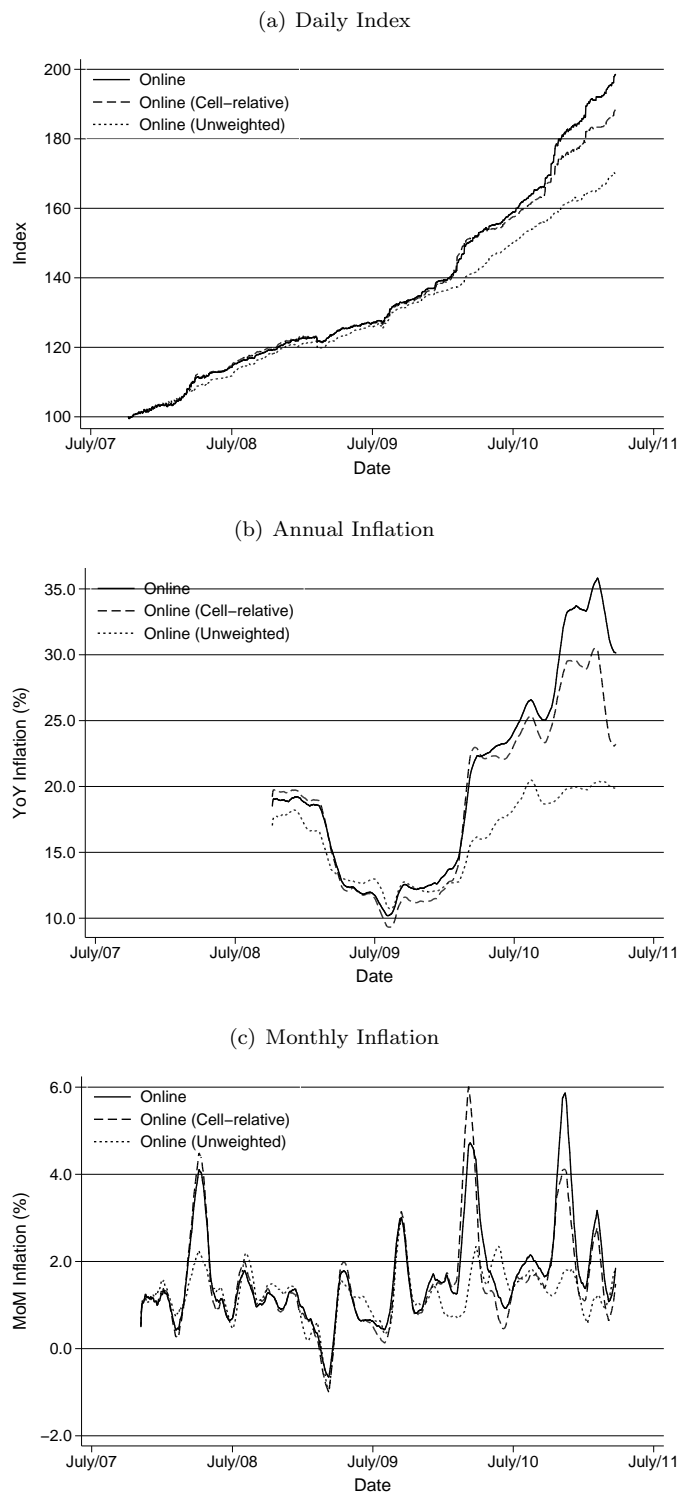


Figure B.1: Robustness: Cell-Relative Imputation

Notes: The “cell-relative” index uses the BLS method to impute missing prices within price series, using the average price change of similar non-missing products in the category. The un-weighted index in Argentina uses data from Retailer #1 without any category weights. It is a simple geometric average of all price changes in a given day.

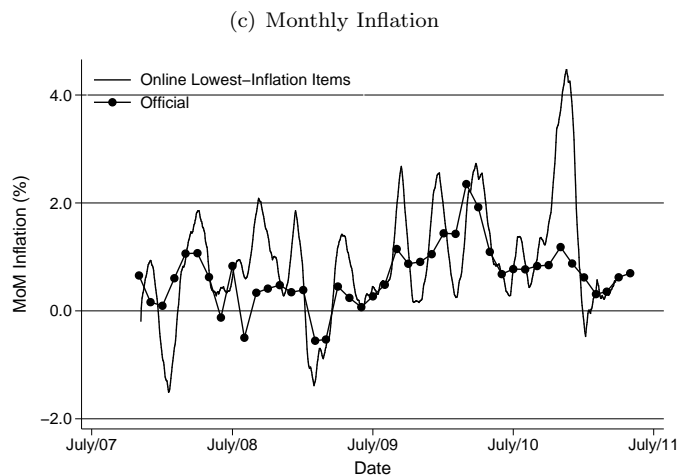
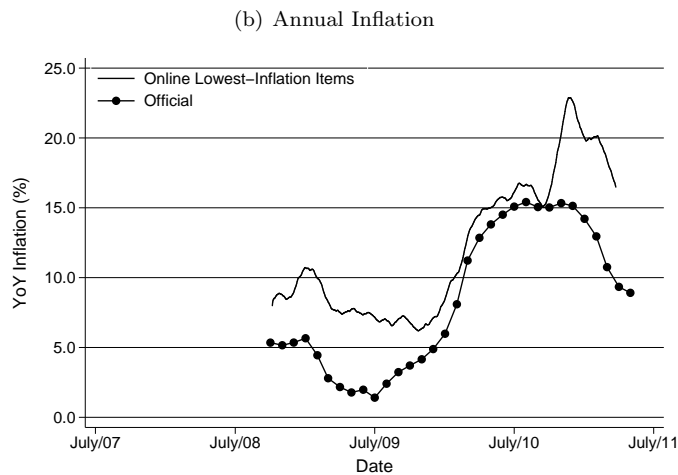
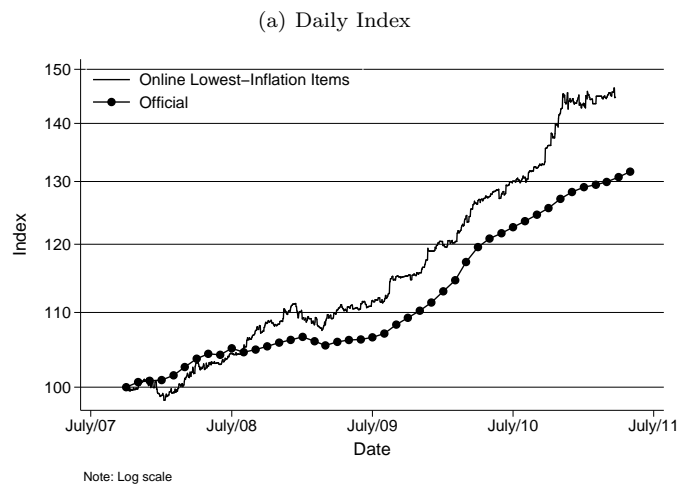


Figure B.2: Lowest-Inflation Items within URLs

Notes: This index includes 893 products that had the lowest inflation over the whole sample period within each URL. The URL is the lowest level of aggregation available, grouping together close substitutes like "Olive Oil" or "Milk". In this index there is only one product per URL. To select them, I first filtered products that had at least 2 years of data, then computed their total inflation rates from the first day they appear in the sample until their last day, and finally picked the good with the lowest inflation for each URL.

Appendix B.3. Additional Tables and Figures

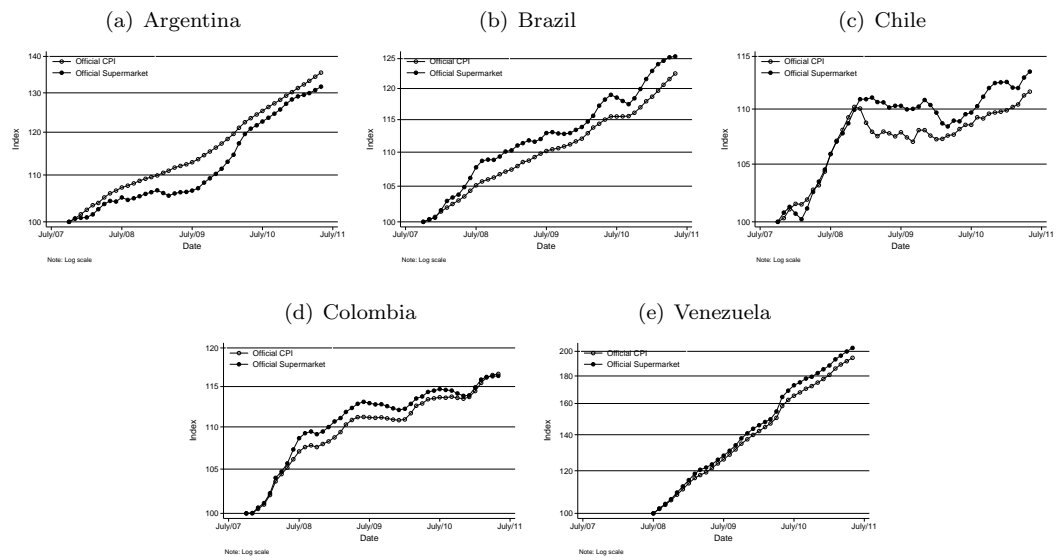


Figure B.3: Official CPI and Official Supermarket Indexes

Notes: The official supermarket index is constructed as a weighted average of the Food and Beverage and Household Product official price indexes in each country.

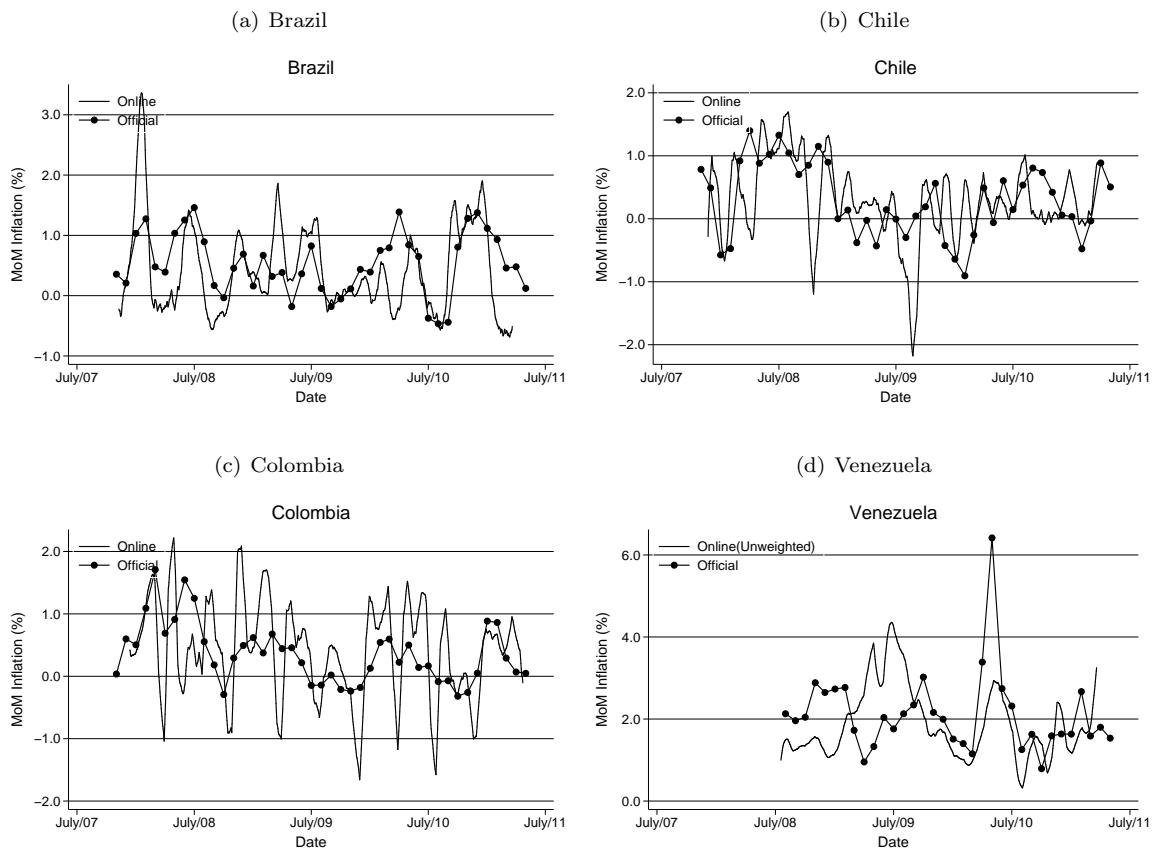


Figure B.4: Online and Official Indexes - Monthly Inflation Rate

Notes: The monthly inflation rate is the percentage change in the average of the index during the past 30 days with respect to the average of the index in the previous 30 days.

Appendix C. The CBA index

The CBA basket is constructed with a given number of grams per product. There are 45 products included in the index, detailed in Table C.2. These products and their respective grams are set by the INDEC to meet the minimum nutritional requirements for an adult male in the 30-59 age range. I calculated the daily cost of the basket using 45 items from the scraped data that were carefully chosen to match the products in the INDEC listing. Because these items come in package sizes which do not always coincide with the number of grams in the basket, I multiplied their prices by the ratio of grams in the official listing over the actual grams in the package. These weights are shown in Table C.2. Next, I added all these weighted prices to obtain the daily cost of the basket. Finally, the index value is simply the cost of the basket at time t over the cost of the basket at the initial date $t = 0$.

Table C.2: CBA Index Weights

| INDEC | | Scraped Data | | |
|--------------------------------|--------------|------------------------|------------------------------|-------------------------|
| Product (1) | Grams (2) | Product (3) | Package size in grams (4) | Index Weight (2)/(4) |
| Pan | 6,060 | Pan | 500 | 12.12 |
| Galletitas Saladas | 420 | Galletas Saladas | 1000 | 0.42 |
| Galletitas Dulces | 720 | Galletas Dulces | 160 | 4.50 |
| Arroz | 630 | Arroz Largo Fino | 500 | 1.26 |
| Harina De Trigo | 1,020 | Harina De Trigo | 1000 | 1.02 |
| Otras Harinas (Maz) | 210 | Harina Maiz | 500 | 0.42 |
| Fideos | 1,290 | Fideos | 1000 | 1.29 |
| Papa | 7,050 | Papa Negra | 1000 | 7.05 |
| Batata | 690 | Batata | 1000 | 0.69 |
| Azcar | 1,440 | Azucar | 1000 | 1.44 |
| Dulce De Leche | 80 | Dulce De Leche | 250 | 0.32 |
| Dulce De Batata | 80 | Dulce De Batata | 1000 | 0.08 |
| Mermeladas | 80 | Mermelada De Frutilla | 454 | 0.18 |
| Legumbres Secas | | | | |
| Lentejas | 80 | Lentejas | 500 | 0.16 |
| Porotos | 80 | Porotos | 500 | 0.16 |
| Arvejas | 80 | Arvejas Verdes | 350 | 0.23 |
| Cebolla | 655 | Cebolla | 1000 | 0.66 |
| Lechuga | 655 | Lechuga Francesa | 1000 | 0.66 |
| Tomate | 655 | Tomate | 1000 | 0.66 |
| Zanahoria | 655 | Zanahoria | 1000 | 0.66 |
| Zapallo | 655 | Zapallo | 1000 | 0.66 |
| Tomate En Lata | 655 | Tomate Perita | 400 | 1.64 |
| Manzana | 2,010 | Manzana | 1000 | 2.01 |
| Naranja | 2,010 | Naranja De Jugo | 1000 | 2.01 |
| Asado | 896 | Asado Centro Novillito | 1000 | 0.90 |
| Carne Picada | 896 | Carne Picada | 1000 | 0.90 |
| Carnaza | 896 | Carnaza Comun | 1000 | 0.90 |
| Cuadril | 896 | Colita De Cuadril | 1000 | 0.90 |
| Nalga | 896 | Nalga | 1000 | 0.90 |
| Paleta | 896 | Paleta De Cerdo | 1000 | 0.90 |
| Pollo | 896 | Pollo Sin Piel | 1000 | 0.90 |
| Huevos | 630 | Huevo | 300 | 2.10 |
| Leche | 7,950 | Leche Entera | 1000 | 7.95 |
| Fresco | 90 | Queso Crema | 200 | 0.45 |
| De Rallar | 90 | Queso Rallado | 210 | 0.43 |
| Crema | 90 | Queso Cremoso | 1000 | 0.09 |
| Aceite | 1,200 | Aceite Mezcla | 1000 | 1.20 |
| Bebidas Edulcoradas | 4,050 | Coca Cola | 2000 | 2.03 |
| Bebidas Gaseosas Sin Edulcorar | 3,450 | Soda | 2000 | 1.73 |
| Sal Fina | 150 | Sal Fina | 500 | 0.30 |
| Sal Gruesa | 90 | Sal Gruesa | 500 | 0.18 |
| Vinagre | 90 | Vinagre Alcohol | 1000 | 0.09 |
| Caf | 60 | Cafe Molido | 500 | 0.12 |
| T | 60 | Te | 50 | 1.20 |
| Yerba | 600 | Yerba | 500 | 1.20 |

Table B.1: CPI Category Weights (%)

| Category Name | Argentina | Brazil | Chile | Colombia |
|--|-----------|--------|-------|----------|
| Flour And Prepared Flour Mixes | 0.20 | 0.21 | 0.12 | 0.12 |
| Cereals | | 0.35 | 0.19 | 0.19 |
| Pasta | 1.31 | 0.36 | 0.28 | 0.26 |
| Rice | 0.32 | 0.53 | 0.20 | 1.73 |
| Bread | 2.50 | 1.20 | 2.19 | 0.87 |
| Fresh Biscuits, Rolls | 1.31 | 0.08 | 0.04 | |
| Cakes And Cupcakes | 0.30 | 0.10 | 0.56 | |
| Cookies | 0.58 | | 0.37 | |
| Crackers And Bread & Cracker Products | | 0.47 | | 0.58 |
| Sweetrolls, Coffee Cake & Doughnuts | 0.62 | 0.01 | | |
| Uncooked Ground Beef | 0.29 | 0.01 | 0.04 | |
| Uncooked Beef Steaks | 5.76 | 1.50 | 1.89 | 2.48 |
| Other Uncooked Beef And Veal | | 0.14 | | |
| Ham | 0.54 | 0.12 | 0.60 | |
| Pork Chops | 0.11 | 0.17 | 0.34 | 0.50 |
| Sausages | 0.48 | 0.57 | 0.29 | 0.49 |
| Lamb, Organ Meats, And Game | 0.14 | | 0.03 | |
| Chicken | 2.18 | 0.90 | 0.89 | 1.31 |
| Other Poultry Including Turkey | | | 0.07 | |
| Fresh Fish And Seafood | 0.41 | 0.25 | 0.31 | 0.60 |
| Processed Fish And Seafood | 0.11 | 0.70 | 0.17 | |
| Eggs | 0.57 | 0.20 | 0.31 | 0.74 |
| Milk | 1.27 | 1.48 | 0.89 | 2.03 |
| Cheese And Related Products | 1.68 | 0.48 | 0.62 | 0.51 |
| Ice Cream And Related Products | | 0.09 | 0.43 | |
| Other Dairy And Related Products | 1.47 | 0.24 | 0.36 | |
| Apples | | 0.09 | 0.12 | |
| Bananas | | 0.25 | 0.13 | 0.06 |
| Citrus Fruits | | 0.21 | 0.11 | 0.06 |
| Fresh Fruits | 1.24 | 0.28 | 0.37 | 0.88 |
| Potatoes | | 0.20 | 0.66 | 0.44 |
| Lettuce | | 0.08 | 0.16 | |
| Tomatoes | | 0.16 | 0.32 | 0.19 |
| Other Fresh Vegetables Including Fresh Herbs | 2.16 | 0.29 | 1.41 | 1.70 |
| Canned Fruits And Vegetables | 0.55 | 0.03 | 0.06 | 0.10 |
| Frozen Fruits And Vegetables | | | 0.07 | |
| Other Processed Fruits And Vegetables | | | 0.11 | |
| Carbonated Drinks | 1.79 | 0.70 | 1.48 | 0.82 |
| Nonfrozen Noncarbonated Juices And Drinks | 0.49 | 0.20 | 0.53 | 0.03 |
| Coffee | 0.17 | 0.36 | 0.15 | 0.31 |
| Tea - Mate | 0.49 | 0.02 | 0.16 | |
| Other Beverage Materials | 0.35 | | | 0.12 |
| Sugar And Artificial Sweeteners | 0.30 | 0.34 | 0.25 | 0.64 |
| Candy And Chewing Gum | 0.22 | 0.08 | 0.13 | |
| Other Sweets | | 0.11 | 0.05 | |
| Marmalade & Jams | 0.15 | | 0.15 | |
| Chocolate | 0.15 | 0.13 | 0.21 | 0.26 |
| Butter And Margarine | 0.04 | 0.04 | 0.24 | |
| Other Fats And Oils | 0.49 | 0.43 | 0.30 | 1.02 |
| Soups | 0.09 | 0.02 | 0.05 | 0.11 |
| Frozen And Freeze Dried Prepared Foods | | | 0.04 | |
| Snacks | | | | 0.16 |
| Salt And Other Seasonings And Spices | 0.10 | 0.10 | 0.14 | 0.08 |
| Olives, Pickles, Relishes | | 0.04 | | |
| Sauces And Gravies | | 0.18 | 0.24 | 0.25 |
| Other Condiments | 0.26 | 0.06 | | |
| Baby Food | | | 0.08 | |
| Beer At Home | 0.27 | 0.30 | 0.36 | 0.43 |
| Distilled Spirits At Home | 0.11 | | 0.32 | 0.20 |
| Wine At Home | 0.48 | | 0.37 | 0.50 |
| Cigarettes | | 0.83 | 0.95 | 0.12 |
| Dental & Nonelectric Shaving Products | 0.29 | 0.16 | 0.25 | 0.40 |
| Deodorant/Suntan Preparations | 0.29 | 0.45 | 0.17 | |
| Electric Personal Care Appliances | | | 0.05 | |
| Cosmetics Nail Preparations & Implements | 0.63 | 0.15 | 0.21 | 0.48 |
| Baby Care Products | 0.66 | 0.19 | 0.31 | |
| Sanitary/Footcare Products | 1.01 | 0.34 | 0.56 | 1.52 |
| Perfume | 0.35 | 0.88 | 0.27 | |
| Shampoo, Bath Products | 0.77 | 0.29 | 0.27 | |
| Lamps & Lighting Fixtures | | | 0.04 | 0.14 |
| Paint, Wallpaper Tools & Supplies | 2.01 | 1.44 | 0.16 | |
| Tools | 0.03 | | 0.10 | |
| Lawn & Garden Supplies & Insecticides | 0.30 | | 0.17 | |
| Cleaning Products | 2.06 | 0.42 | 0.60 | 0.64 |
| Laundry Products | | 0.36 | 0.43 | 1.10 |
| Household Paper Products | 0.32 | 0.16 | 0.10 | |
| Miscellaneous Household Products | 0.32 | | 0.28 | 0.37 |
| Tires | 0.23 | 0.18 | 0.05 | 0.04 |
| Vehicle Parts & Equipment Other Than Tires | 0.71 | 0.67 | 0.10 | |
| Toys, Games, Hobbies, & Playground Equipment | 0.52 | 0.48 | 0.42 | 0.31 |
| Pet Food | | | 0.42 | |
| Pet Supplies | | 0.07 | 0.04 | 0.11 |
| Over-The-Counter Drugs | 3.40 | 2.93 | 1.79 | 1.42 |
| Medical Topicals And Dressings | | | 0.04 | |
| Appliances | 1.05 | 1.21 | 1.38 | 0.51 |
| Books | 0.80 | 0.30 | 0.13 | 0.07 |
| Home Furniture | 0.73 | 1.33 | 1.44 | 0.46 |
| Bedroom And Bathroom Linens | | 0.27 | 0.32 | |
| TOTAL WEIGHT (% of CPI) | 48.51 | 27.93 | 31.00 | 28.44 |