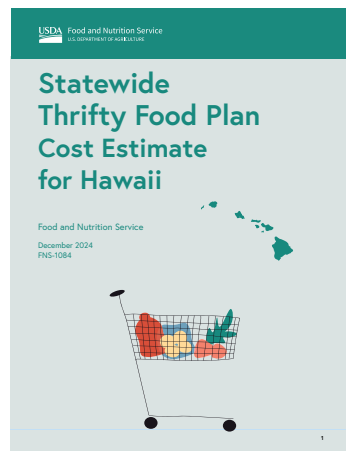


Statewide Thrifty Food Plan Cost Estimate for Hawaii

Introduction

The U.S. Department of Agriculture (USDA) reevaluated the Thrifty Food Plan (TFP) Market Basket and its associated cost in the 48 States and DC (hereafter referred to as the "mainland United States") in August 2021.¹ Statute (7 U.S.C. § 2012(u)) requires cost adjustments to the Thrifty Food Plan to reflect food prices in Alaska and Hawaii. USDA published new Thrifty Food Plan cost estimates for Alaska and Hawaii in a July 2023 report.² USDA included in its spring 2024 Regulatory Agenda a proposed rule that would change the price-of-food adjustment used to calculate the cost of the Thrifty Food Plan for Hawaii from an adjustment for the price of food in Honolulu to an adjustment for the price of food in the State of Hawaii. To accompany the proposed rule, USDA published the Statewide Thrifty Food Plan Cost Estimate for Hawaii report in December 2024, which describes the process used to calculate a Thrifty Food Plan cost for Hawaii that is based on food price data from throughout the State of Hawaii in alignment with the proposed rule.³

USDA is committed to scientific integrity, quality assurance, and transparency. As part of this commitment, USDA has released an online supplement to accompany the report, enabling the public to reproduce the final results of the analysis. The online supplement is made up of two components in addition to this user guide: the data file and the reproduction code, which are discussed in detail in the following sections.



The analyses detailed in the report, as well as the construction of the online supplement, were conducted by a team of economists at the USDA, Food and Nutrition Service (FNS) Center for Nutrition Policy and Promotion (CNPP). For quality assurance, all calculations and data file preparation steps were performed independently by two economists at CNPP using two different statistical computing packages (SAS⁴ and R⁵). Data management and analysis results were compared at each step. The economists worked collaboratively to identify and resolve any inconsistencies that emerged and confirmed that their final analyses yielded consistent results, that their final data files were identical, and that the data file and code successfully reproduce the results presented in the report. In addition, the reproduction code was reviewed by a third economist at CNPP who was not involved in its development. Code review included

¹ U.S. Department of Agriculture. Thrifty Food Plan, 2021. FNS-916. August 2021. Available at: <https://doi.org/10.52570/TFP2021>.

² U.S. Department of Agriculture. Thrifty Food Plan Cost Estimates for Alaska and Hawaii. July 2023. FNS-989. Available at: <https://doi.org/10.52570/TFP.AKHI.2023>.

³ U.S. Department of Agriculture. Statewide Thrifty Food Plan Cost Estimate for Hawaii. December 2024. FNS-1084. Available at: <https://doi.org/10.52570/TFP2024.HI>.

⁴ SAS Institute, Inc. SAS 9.4. Cary, NC.

⁵ R Core Team: R Foundation for Statistical Computing. R: A language and environment for statistical computing. Vienna, Austria; 2021. Available at: <https://www.R-project.org/>.

checks for program logic and output consistency, accuracy of calculations and formulas, handling of missing values, redaction of sensitive output (if applicable), errors and warning messages, logic errors, data modification, and appropriate implementation of methods. The completion of code review was documented in a checklist, which was reviewed for completeness and approved by the Nutrition and Economic Analysis Branch Chief.

The first section of this user guide summarizes the methodology USDA used to calculate the statewide Thrifty Food Plan cost estimate for Hawaii, and the second section provides instructions for accessing and utilizing the online supplement.

For technical inquiries about the online supplement or questions about how to reproduce the results using programs other than R, contact FNS.FoodPlans@usda.gov.

Methods

This section summarizes the methodology USDA used to calculate the statewide Thrifty Food Plan cost estimate for Hawaii, which is discussed in greater detail in the report, then describes how the data file was prepared.

Thrifty Food Plan Cost Estimate for Hawaii

The Thrifty Food Plan cost for Hawaii is subject to legal definitions, standards, and requirements. The statutory and regulatory language requires that Thrifty Food Plan cost for Hawaii be based on the fixed Thrifty Food Plan Market Basket for the reference family of four (i.e., a man and a woman twenty through fifty, a child six through eight, and a child nine through eleven years of age) and be adjusted for the price of food in Hawaii; current regulation further specifies Honolulu (7 U.S.C. § 2012(u), 7 CFR 273.10(e)(4)(i)) while the proposed rule included in USDA's spring 2024 Regulatory Agenda specifies Hawaii.

USDA previously identified a bilateral, fixed-basket price index as the best approach to calculate a Thrifty Food

Plan cost estimate for Hawaii. Such an index compares the average cost of purchasing exact amounts of specific products in the Thrifty Food Plan Market Basket for the reference family of four between the mainland United States and Hawaii. This approach holds constant as many factors as possible while capturing only the difference in food prices. The results of the price index can be applied as an adjustment factor to the cost of the Thrifty Food Plan in the mainland United States to yield a Thrifty Food Plan cost estimate for Hawaii.

USDA used the 2017 Circana retail scanner data, a more recent version of the same data used in the 2021 Thrifty Food Plan reevaluation and the same data used to estimate the cost of the Thrifty Food Plan in Alaska and Hawaii in the 2023 report, as the basis for the price index. USDA calculated inflation-adjusted average unit prices for over 12,000 products identified by Universal Product Codes (UPCs)⁶ in the scanner data from over 40,000 stores in the mainland United States and 97 stores in Hawaii, representing billions of transactions across the year. The average unit prices of the UPCs were compared between Hawaii and the mainland United States to calculate the price index. The result of the index was the average ratio of unit prices between Hawaii and the mainland United States, weighted to reflect the contribution of each UPC to the Thrifty Food Plan Market Basket for the reference family of four (see [Equation 1](#)).

Equation 1. Price Index

$$P_i = \sum_{v \in V_{m,i}} \left(\frac{p_{v,i}}{p_{v,m}} \right) c_v$$

Where P_i is the value of the price index; i refers to Hawaii; m refers to the mainland United States; $p_{v,i}$ and $p_{v,m}$ are the inflation-adjusted average unit prices of UPC v in Hawaii and the mainland United States, respectively; $V_{m,i}$ is the common set of UPCs in the Thrifty Food Plan Market Basket sold in both the mainland United States and Hawaii in 2017; and c_v is the cost share of UPC v in the Thrifty Food Plan Market Basket given the common set $V_{m,i}$.

⁶ UPCs are 12-digit codes that uniquely identify specific products and typically appear on products as barcodes.

As discussed in the accompanying report, the Thrifty Food Plan, 2021 is based on UPCs in the 2015–16 IRI InfoScan store-based scanner data linked to Ensemble Codes (ECs), which are food codes from the USDA nutrient databases (i.e., the Food and Nutrient Database for Dietary Studies (FNDDS) and the National Nutrient Database for Standard Reference (SR Legacy)), using the Purchase to Plate Crosswalk (PPC).⁷ The PPC links UPCs to ECs and their associated forms (e.g., refrigerated, ready-to-serve; frozen, not-ready-to-serve) and refuse status (containing or not containing inedible material). For example, a specific brand and container size of conventional, creamy, shelf-stable, ready-to-serve peanut butter is represented by a UPC, which is linked to the EC for peanut butter; the shelf-stable, ready-to-serve form; and the no-refuse status indicator in the PPC.

The 24 Thrifty Food Plan Market Basket Categories define food and beverage categories quite broadly (e.g., dark-green vegetables, seafood) and are comprised of 993 unique ECs, which can be further broken down into 1,342 unique EC-form combinations. The specificity of ECs and EC-form combinations varies. For example, the EC "peanut butter" comprises all types of peanut butter and is available in both shelf-stable and refrigerated forms. Other ECs might include a narrower set of underlying products. For example, many ECs that refer to ready-to-eat breakfast cereals using food codes from SR Legacy are brand-specific.

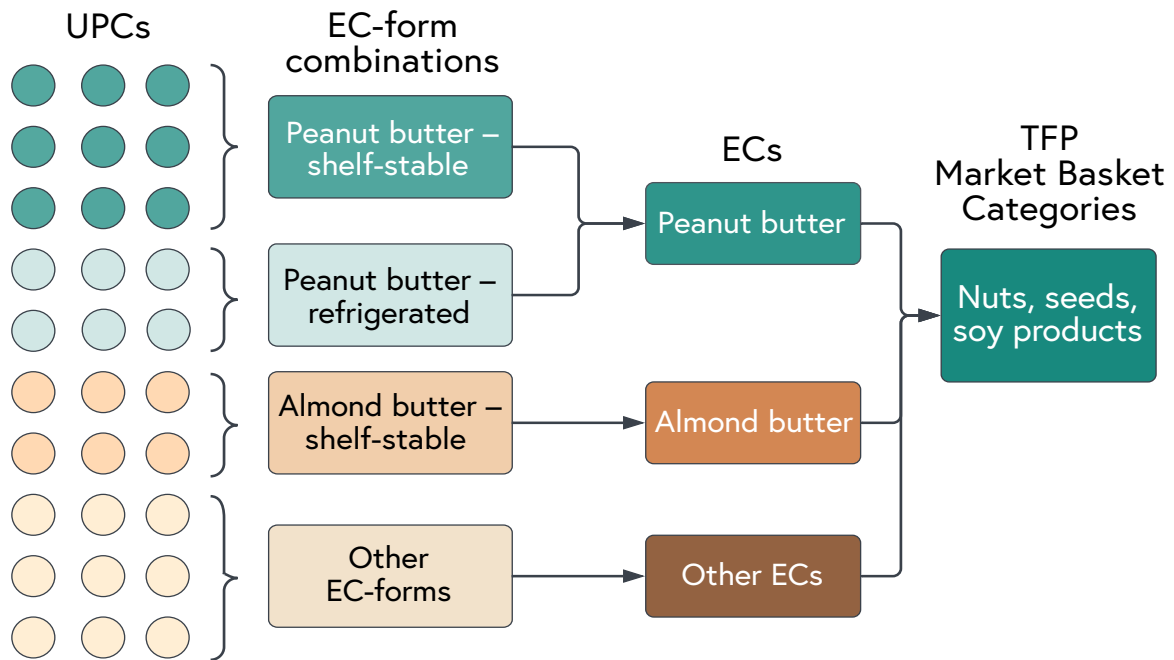
Underlying the 1,342 EC-form combinations in the Thrifty Food Plan are 96,642 unique products identified by specific UPCs. For example, an EC referring to a specific brand of ready-to-eat breakfast cereal might have multiple associated UPCs that all differ in package size. While the food itself is homogenous, the different package sizes constitute an important differentiating attribute. In other EC-form combinations, products are likely more heterogeneous. In the peanut butter example, all shelf-stable peanut butter products would be aggregated regardless of attributes such as package size, sugar content, consistency, or organic labeling. **Figure 1** provides an example of mapping UPCs to EC-form combinations, ECs, and Thrifty Food Plan Market Basket Categories using the "nuts, seeds, soy products" Thrifty Food Plan Market Basket Category.

Development of the data file for the online supplement

The calculation of the price index is based on proprietary Circana retail scanner data, precluding USDA from publishing the full dataset underlying this analysis. USDA aggregated the scanner data used to produce the statewide Thrifty Food Plan cost estimate for Hawaii in such a way that the final results can be reproduced while avoiding disclosure of proprietary information.

⁷ ERS publications related to the PPC use several terms to collectively describe food codes from the USDA nutrient databases, including "EC-8" for food codes from FNDDS, "EC-4/5" for food codes from SR Legacy, or "food codes" more generally. This report uses the term Ensemble Code (EC). See the following publications for additional information:
Carlson A, Page ET, Palmer Zimmerman T, Tornow CE, Hermansen S. Linking USDA nutrition databases to IRI household-based and store-based scanner data, TB-1952: U.S. Department of Agriculture, Economic Research Service; March 2019. Available at: <https://www.ers.usda.gov/webdocs/publications/92571/tb-1952.pdf?v=2385.7>.
Carlson AC, Tornow CE, Page ET, Brown McFadden A, Palmer Zimmerman T. Development of the Purchase to Plate Crosswalk and Price Tool: Estimating prices for the National Health And Nutrition Examination Survey (NHANES) foods and measuring the healthfulness of retail food purchases. *Journal of Food Composition and Analysis*. 2022; 106:104344. Available at: <https://www.sciencedirect.com/science/article/pii/S0889157521005445>.

Figure 1: Example of mapping UPCs to EC-form combinations, ECs, and TFP Market Basket Categories



Notes:

TFP = Thrifty Food Plan; UPC = Universal Product Code; EC = Ensemble Code.

The circles under UPCs represent an example of how individual UPCs might be grouped into their associated EC-form combinations and do not reflect the actual number of UPCs underlying these specific EC-form combinations. Likewise, there are additional EC-form combinations and ECs within the “Nuts, seeds, soy products” Market Basket Category that are displayed here under “Other ECs.”

Rather than release unit price ratios at the UPC-level, the data file in the online supplement provides average unit price ratios at the lowest level of aggregation available such that the average unit price ratios are based on at least three UPCs, three brands, and three retailer chains.⁸ Doing so ensured that the data file does not disclose product-, brand-, or retailer-specific proprietary information. For transparency purposes, EC-form combinations with no UPCs in the common set are included in the data file but do not have associated unit price ratios. Additionally, EC-form combinations with UPCs in the common set but aggregated to higher levels (i.e., the EC-level or the Thrifty Food Plan Market Basket Category-level) to prevent the disclosure of proprietary information are also listed in the data file, but their associated unit price ratios have been masked.

Using the online supplement

The online supplement is made up of two components: the data file and the reproduction code. These components are discussed in the sections that follow.

Data File

The data file is provided in comma separated value (CSV) format. Records in the data file are identified by a unique combination of EC, form, and location (i.e., Hawaii). The names, types, and descriptions of each variable in the data file are provided in [Table 1](#).

⁸ Average unit price ratios are released rather than unit prices in each location because unit definitions (e.g., pound, count, fluid ounce) vary by UPC, complicating the calculation of average unit prices at higher levels of aggregation.

Table 1. Data file codebook for the online supplement to the "Statewide Thrifty Food Plan Cost Estimate for Hawaii" report

Variable name	Type	Description
EC	Numeric	Ensemble codes (ECs) are food codes from the USDA nutrient databases, using the Purchase to Plate Crosswalk (PPC) ^a . Full descriptions for each EC are found in the EC_Description variable. Note that while "-99" appears as a value for this variable in the data file, it is not a food code in either of these databases. An EC of "-99" represents instances where USDA combined multiple ECs to prevent disclosure of proprietary information.
EC_Description	Character	Ensemble code description.
Form	Character	Form as defined by the 2015-16 PPC. ^a Full descriptions for each form are found in the Form_Description variable. Note that while "MULTI" appears as a value for this variable in the data file, it is not a form in the PPC. A form of "MULTI" represents instances where USDA combined multiple forms to prevent disclosure of proprietary information.
Form_Description	Character	Form description.
Market_Basket_Category	Character	Thrifty Food Plan (TFP), 2021 Market Basket Category. ^b
Weekly_TFP_Cost	Numeric	Weekly cost of the EC-form combination(s) in the 2021 Thrifty Food Plan Market Basket for the reference family of four.
TFP_Cost_Share	Numeric	Cost of the EC-form combination(s) as a share of the total cost of the 2021 Thrifty Food Plan Market Basket for the reference family of four.
Location	Character	Geographic area used in the numerator of the unit price ratio (i.e., Hawaii).
Unit_Price_Ratio	Numeric	Average inflation-adjusted unit price ratio between the location and the mainland United States. Ratios were calculated at the Universal Product Code (UPC) level and then combined at the lowest level of aggregation available such that the average unit price ratios are based on at least three UPCs, three brands, and three retailer chains. Missing values in this variable are due either to an empty common set (identified by the value "-999") or due to masking (identified by the value "-9999"). See Masked variable for additional information.
Index_Weight	Numeric	Relative importance of the unit price ratio in the overall price index. Reflects the contribution of the underlying UPCs to the cost of the Thrifty Food Plan Market Basket for the reference family of four after accounting for components of the Thrifty Food Plan that could not be included in the index because no UPCs were present in the common set.
Common_Set_UPC_Count	Numeric	Number of UPCs that are in the common set between the location of interest and the mainland United States. This is the sample size of UPCs used to calculate Unit_Price_Ratio. Missing values in this variable (identified by the value "-9999") are due to masking. See Masked variable for additional information.
EC_Form_Count	Numeric	Number of EC-form combinations underlying this record. If EC_Form_Count = 1, then no aggregation occurred. If EC_Form_Count > 1, then aggregation occurred to prevent disclosure of proprietary information. Missing values in this variable (identified by the value "-9999") are due to masking. See Masked variable for additional information.
Masked	Character	Indicator for whether the unit price ratio is masked to prevent the disclosure of proprietary information. In cases where the unit price ratio is masked, its sales data are included in a different record presented at a higher level of aggregation. "Yes" = the unit price ratio associated with this record is masked. "No" = the unit price ratio associated with this record is not masked.

^a For more information, see: Carlson AC, Tornow CE, Page ET, Brown McFadden A, Palmer Zimmerman T. Development of the Purchase to Plate Crosswalk and Price Tool: Estimating prices for the National Health And Nutrition Examination Survey (NHANES) foods and measuring the healthfulness of retail food purchases. Journal of Food Composition and Analysis. 2022; 106:104344. Available at: <https://www.sciencedirect.com/science/article/pii/S0889157521005445>.

^b For more information, see: U.S. Department of Agriculture. Thrifty Food Plan, 2021. FNS-916. August 2021. Available at: <https://fns.usda.gov/TFP>.

Reproduction Code

The online supplement contains R code that uses the data file to reproduce USDA's final results. The code enables the reproduction of the following results:

1. The overall value of the price index.
2. The estimated June 2022 cost of the Thrifty Food Plan.
3. The value of the price index for each Thrifty Food Plan Market Basket Category.
4. The number of UPCs underlying the price index.
5. The number of foods and beverages (EC-form combinations) underlying the price index.
6. The Thrifty Food Plan costs and cost shares represented by foods and beverages (EC-form combinations) underlying the price index.

As previously discussed, to prevent disclosure of proprietary information, the data file does not contain the full dataset underlying the analyses. As a result, the following results cannot be reproduced using the data file:

1. The number of stores in each location overall or by store type in the 2017 Circana retail scanner data.
2. The number of stores in each location overall or by store type in the price index, and therefore, coverage rates of the number of stores in each location.
3. The total sales value reported in each location by stores in the analytic sample, and therefore, coverage rates of the volume of sales in each location.
4. The share of sales of UPCs underlying the Thrifty Food Plan attributable to each store type.
5. The total number of UPC-week-store observations included in the analysis by store type and location.

Similarly, the process for disaggregating the cost of the Thrifty Food Plan Market Basket for the reference family of four into costs of ECs and EC-form combinations cannot be reproduced using the online supplement because it would require public access to the Purchase to Plate Ingredient Tool, which has not been published by the USDA Economic Research Service. The cost of the Thrifty Food Plan Market Basket at the EC and EC-form combination-level is available at: <https://www.fns.usda.gov/cnpp/thrifty-food-plan-2021>.

The R code that reproduces the final results is named "StatewideTFPCostEstimateforHawaii-OnlineSupplementRCode.R". The program imports the data file, reproduces the final results of the analysis, and outputs the results to an Excel file named "StatewideTFPCostEstimateforHawaii-ReproducedResults.xlsx". The output from the program includes three sheets: "TFP Cost 2022", which contains the price index and the cost of the Thrifty Food Plan for the reference family of four in June 2022; "Index values", which contains the index values by Thrifty Food Plan Market Basket Category presented in table 3 of the report, and "Other Summary Statistics", which contains the number of UPCs underlying the price index, the number of foods and beverages (EC-form combinations) underlying the price index, and the weekly Thrifty Food Plan costs and cost shares represented by foods and beverages (EC-form combinations) underlying the price index.