



Alternative Approaches for Reevaluating the Thrifty Food Plan

Final Report

December 20, 2024

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December 20, 2024

Christopher Jones, Alice Ann Gola, and Sarah Bardin

Submitted to:

U.S. Department of Agriculture (USDA)
Food and Nutrition Service
1320 Braddock Place
Alexandria, VA 22314
Project Officer: Mark Lino
Contract Number: 12319823F0054

Submitted by:

Mathematica
P.O. Box 2393
Princeton, NJ 08543-2393
Phone: (609) 799-3535
Fax: (609) 799-0005
Project Director: Sarah Bardin

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Executive Summary

The U.S. Department of Agriculture (USDA) produces food plans to illustrate how a healthy diet can be achieved at various price points. The lowest cost plan, the Thrifty Food Plan (TFP), must be reevaluated every five years (PL 115–334, the 2018 Farm Bill). The Center for Nutrition Policy and Promotion (CNPP) in the USDA’s Food and Nutrition Service (FNS) contracted with Mathematica (hereafter referred to as “the study team”) to identify alternative approaches for reevaluating the TFP. The purpose of this report is to describe potential options along with their advantages, disadvantages, and expected level of effort for implementation.

A. Background

The TFP is the lowest cost of the four food plans the USDA develops. The TFP outlines a market basket of nutrient-dense foods and beverages, their amounts, and associated expenses. The basket contents can support a healthy diet at home at a low cost (CNPP 2024). Per Federal law, the cost of the TFP serves as the basis for the maximum Supplemental Nutrition Assistance Program (SNAP) benefit amounts for the following Federal fiscal year.

The USDA must reevaluate the TFP every five years, and each reevaluation must be based on current food prices, food composition data, consumption patterns, and dietary guidance (PL 115–334, the 2018 Farm Bill). The TFP market basket and cost must be for a reference family of four, which is defined by law as a man and a woman ages 20 to 50 and two children—one between ages 6 and 8 and one between ages 9 and 11. The most recent reevaluation used an optimization model, similar to previous TFP reevaluations, to identify the foods that make up the TFP and their cost. The optimization model selected quantities of foods and beverages in different categories to represent a nutritious diet and then subjected the entire selection to a set of constraints, including dietary needs, consumption patterns, and food prices. However, given advancements in data availability, data quality, and modeling techniques, along with recommendations from the Government Accountability Office (GAO) to examine other feasible methodological approaches (GAO 2022), CNPP sought to understand the feasibility of alternative approaches for future TFP reevaluations.

B. Approach

To identify alternative approaches, the study team convened a panel of qualified researchers with diverse methodological and subject matter expertise. The study team met with the panelists four times over a period of 5 months to develop a set of options. Each panelist provided information and opinions in response to questions from the study team related to data and methodological considerations and advantages and disadvantages of each option. The panelists provided the study team with individual rankings of the various alternative approaches in order of their preference. This report reflects the study team’s synthesis of the information provided by the panelists.

C. Options for reevaluating the TFP

Using information provided by the panelists, three potentially feasible alternative options for reevaluating the TFP were identified that each use a different methodological approach from the current optimization

model. Ranking the alternative approaches in order from the one most often preferred to the one least often preferred by the panelists, these alternative approaches included (1) a purchase-based option, (2) a menu-based option, and (3) an econometric-based option. Exhibit ES.1 summarizes these options. By making certain reasonable assumptions, all three options meet the TFP reevaluation criteria. Using information provided by the panelists, three potential revisions to the existing optimization model were also identified and are included in Exhibit ES.1. Revisions to the optimization-based approach was the second most commonly preferred option among the panelists (after the purchase-based approach and above the menu-based approach), with panelists noting that the optimization-based approach, as currently used, works well in practice and meets all requirements of the TFP reevaluation.

Exhibit ES.1. Potential options for reevaluating the TFP, as chosen by the expert panel

Overview	Advantages	Disadvantages	Assumptions required to meet TFP reevaluation criteria	Level of effort
Option 1: Purchase-based				
<p>Based on household food purchase data, identify households that purchase foods making up a healthy diet. The TFP cost would be calculated based on the cost and composition of the foods purchased by the selected households.</p>	<p>This approach is grounded in revealed preferences and reflects choices made by consumers that incorporate practicality, palatability, affordability, cultural preferences, food preparation time, household cooking equipment, and food waste (assuming the households in the data report food-at-home purchases that exceed their dietary needs).</p>	<p>There are likely few observed households that purchase foods comprising “healthy” diets, making this approach potentially infeasible without reconsidering how to define a healthy diet.</p>	<p>Fully meets TFP reevaluation criteria. Makes reasonable assumption that household food purchase data reflect consumption patterns. If the purchase data include the age and sex of the household members, a market basket and associated cost for the reference family could be calculated.</p>	<p>Moderate</p>
Option 2: Menu-based				
<p>Nutritionists develop healthy, lower-cost menus that meet current dietary guidance to serve as the basis for the market basket. The TFP cost would be calculated by averaging the costs of the individual menus.</p>	<ul style="list-style-type: none"> • This approach implicitly accounts for important factors that are difficult to measure, such as time needed to prepare food, available kitchen equipment, palatability of menus, and cultural preferences. • It also leverages nutritionists’ knowledge about healthy foods and experience working with SNAP and other populations with low incomes, particularly if nutritionists are drawn from existing efforts like the SNAP-Ed program. 	<ul style="list-style-type: none"> • There is no existing infrastructure for this approach (that is, the procedures to collect and process the menu data and develop a market basket would need to be developed, even if drawing on efforts like SNAP-Ed). • The nutritionists would need guidance to ensure the process was standardized and transparent. 	<p>Fully meets TFP reevaluation criteria. Makes reasonable assumption that nutritionists will take community consumption patterns and preferences into account as they design the menus. A market basket and associated cost for the reference family could be calculated.</p>	<p>High</p>

Overview	Advantages	Disadvantages	Assumptions required to meet TFP reevaluation criteria	Level of effort
Option 3: Econometric-based				
Model the cost of purchasing a healthy diet based on household food purchase data at varying levels of healthfulness. A <i>demand model</i> would maximize utility based on preferences for food items, subject to cost and nutrition constraints. A <i>stochastic production frontier model</i> would minimize the cost needed to produce a diet of a certain level of healthfulness.	<ul style="list-style-type: none"> Models can find unobserved solutions in data to reflect choices and outcomes that are difficult to find in the real world (overcoming a limitation of the purchase-based option). Straightforward approach that draws on well-understood practices applied to many topics in economics. 	This approach is sensitive to modeling assumptions; modeling decisions can have a large influence on the results.	Fully meets TFP reevaluation criteria. Makes reasonable assumption that household food purchase data reflect consumption patterns. If the purchase data includes the age and sex of the household members, a market basket and associated cost for the reference family could be calculated.	High
Revise existing optimization model				
<p>Potential revisions include one or more of the following:</p> <p>(1) Modify the current food waste parameter of 5 percent to reflect new research and data on household food waste</p> <p>(2) Replace existing nutrient-based constraints with constraints based on HEI component scores</p> <p>(3) Switch from the current high-level food categories to a more detailed unit of analysis</p>	<ul style="list-style-type: none"> Revising the current optimization model would be simpler than implementing a completely new approach. Revisions would address different issues with the optimization model, including reducing the complexity of some steps. 	This approach is sensitive to modeling assumptions; modeling decisions can have a large influence on the results.	Meets all requirements of the TFP reevaluation and results in a market basket and associated cost for the reference family.	<p>Food waste parameter: High^a</p> <p>Constraints based on HEI scores: Low</p> <p>More detailed unit of analysis: Moderate</p>

^a Level of effort for developing new methods and collecting new data to determine an updated food waste parameter is high. Updating the parameter using existing research would involve a low level of effort.

HEI = Healthy Eating Index; SNAP = Supplemental Nutrition Assistance Program; TFP = Thrifty Food Plan.

I. Introduction

The U.S. Department of Agriculture (USDA) has provided food plans since 1894 to illustrate how a healthy diet consumed at home can be achieved at various price points. USDA food plans are made up of two components:

1. **Market baskets** defining weekly quantities of food categories in their purchasable forms that, together, make up a healthy, practical diet for 15 age-sex groups
2. **Cost levels** defining the dollar value of each market basket given national average food prices

The USDA currently produces four food plans at successively higher cost levels: the Thrifty, Low-Cost, Moderate-Cost, and Liberal Food Plans. The Thrifty Food Plan (TFP) outlines nutrient-dense foods and beverages that allow a family to achieve a healthy diet on a limited budget (CNPP 2024). Federal law specifies that the cost of the TFP serves as the basis for setting the maximum Supplemental Nutrition Assistance Program (SNAP) benefit allotments in the Federal fiscal year beginning on the following October 1 (Food and Nutrition Act of 2008). This allotment is based on a **reference family** of four, consisting of a male and a female between the ages of 20 and 50, one child between the ages of 6 and 8, and one child between the ages of 9 and 11. The amount is then adjusted downward or upward for households of varying sizes.

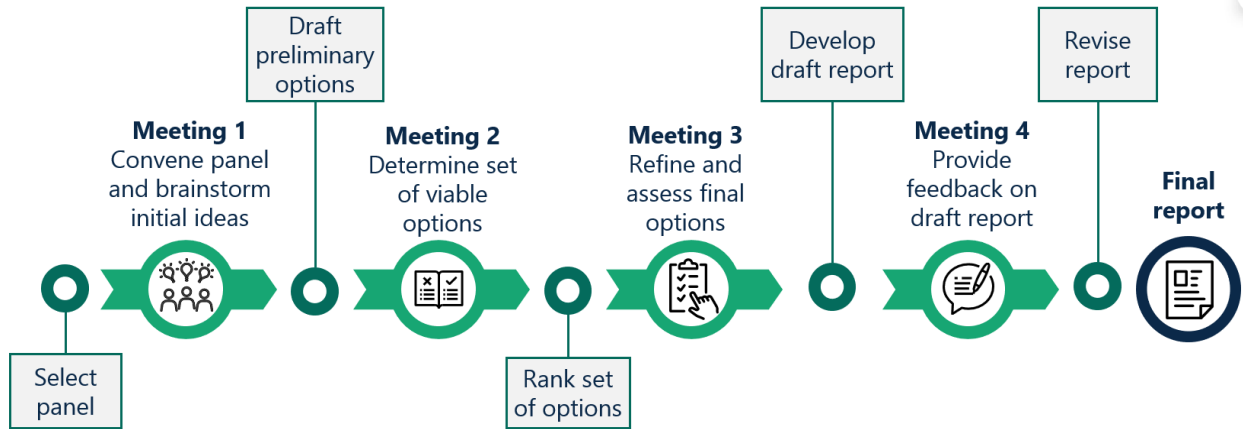
As stipulated in the Agriculture Improvement Act of 2018 (PL 115–334, the 2018 Farm Bill), the USDA must reevaluate the TFP every five years; the most recent reevaluation was completed in 2021 (USDA 2021). The USDA is committed to continuous quality improvement for future reevaluations of the TFP. Given advancements in modeling approaches, data availability, and data quality, it is possible that alternative methodological approaches to reevaluating the TFP are feasible and superior to the current approach. Furthermore, a recent Government Accountability Office report recommended examining other feasible methodological approaches for reevaluating the TFP (GAO 2022). As part of a larger study, the USDA’s Food and Nutrition Service (FNS) Center for Nutrition Policy and Promotion (CNPP) contracted with Mathematica (hereafter referred to as “the study team”) to carry out a task that convened a panel of diverse methodological and subject matter experts to identify and assess potential alternatives.

A. Task approach

To identify potential alternative approaches, the study team convened four meetings with the expert panel between February and June 2024 (Exhibit I.1). These meetings focused on brainstorming alternative options to reevaluating the TFP (Meeting 1), discussing details of each option (including advantages and disadvantages), identifying which options seemed most promising (Meeting 2), discussing additional questions and details (including potential data sources and feasibility) of the options considered by panelists as most promising (Meeting 3), and providing feedback on the draft of this report (Meeting 4). Following Meeting 2, the study team conducted a short poll that asked each panelist to individually rank potential options in order of most to least promising. The study team then aggregated the results of the poll to identify which options, on average, tended to be more highly ranked by the panelists than others. Following Meeting 4, the study team conducted a follow-up survey that again asked each panelist to rank the potential options in order from most to least promising. In addition, the follow-up survey asked panelists to rate each option individually on a 4-point scale of “not very promising” to “very promising.”

The survey also asked each panelist to provide a brief rationale for their assessment of these options. Using these responses in addition to feedback provided during Meeting 4, the study team determined the final ordering of alternative approaches for reevaluating the TFP as presented in this report.

Exhibit I.1. Overview of task approach



B. Report organization

This report summarizes the TFP reevaluation options that arose out of the discussions with the expert panel. After providing background on the TFP reevaluation requirements and previous approaches (Chapter II), the next three chapters describe the alternative approaches to the current optimization model presented in order of most frequently to least frequently preferred by the panelists. These options include a purchase-based option (Chapter III), a menu-based option (Chapter IV), and an econometric-based option (Chapter V). Chapter VI summarizes information about these three options, including whether and how each option meets the TFP reevaluation criteria, the level of effort, and other considerations about the options. The final chapter (Chapter VII) discusses potential revisions to the current optimization model and ends with a comparison of this option to the alternatives discussed in previous chapters. More details about the task approach and the background and qualifications of expert panel members are provided in Appendix A. Appendix B describes additional reevaluation options that were considered but ultimately ruled out, along with a summary of the rationale for excluding these options from further consideration.

II. TFP Reevaluation: Existing Approach and Overview of Potential Alternative Approaches

The TFP must take the form of a single **market basket**, or weekly amounts of food and beverage categories, along with the **associated costs** of the items in the basket. The maximum benefit allotment for SNAP is based on a market basket for a **reference family** of four, which is defined by law as a man and a woman ages 20 to 50 and two children—one between the ages of 6 and 8 and one between the ages of 9 and 11. The cost of the market basket is calculated based on this reference family and then adjusted downward for smaller families or upward for larger families.

Box II.1. TFP reevaluation must be based on current:

- Food prices
- Food composition data
- Consumption patterns
- Dietary guidance ▲

The 2018 Farm Bill stipulated that each five-year TFP reevaluation be based on four key considerations (Box II.1). However, the legislation does not specify how these considerations must be implemented. It also does not specify how the market basket must be determined, including its costs and how it is calculated for the reference family.

A. Current optimization model

USDA's first reevaluation under the new Farm Bill requirement was published in 2021. It used an optimization model that selected quantities of foods and beverages in different categories to represent a nutritious diet and then imposed a set of constraints on the entire selection, including dietary needs, consumption patterns, and food prices. The model organized individual food and beverage items into broader categories, which were converted from foods that were consumed into items for purchase. The model was run separately for 15 groups of people defined by age range and sex. The food category amounts for the four groups corresponding to the reference family were then added together to form the TFP market basket, and the costs of those food category amounts formed the TFP cost, which met the legislative requirements. For more information, see the technical report, Thrifty Food Plan, 2021 (USDA 2021).

Although CNPP has historically used an optimization model to determine the TFP, the 2021 reevaluation used more recent data and included updated model parameters (Exhibit II.1). In addition, CNPP made several choices regarding the calorie levels, range of food choices, and the definition of "thrifty" for the 2021 reevaluation.

CNPP used the following data sources to address the legislative requirements for the 2021 TFP:

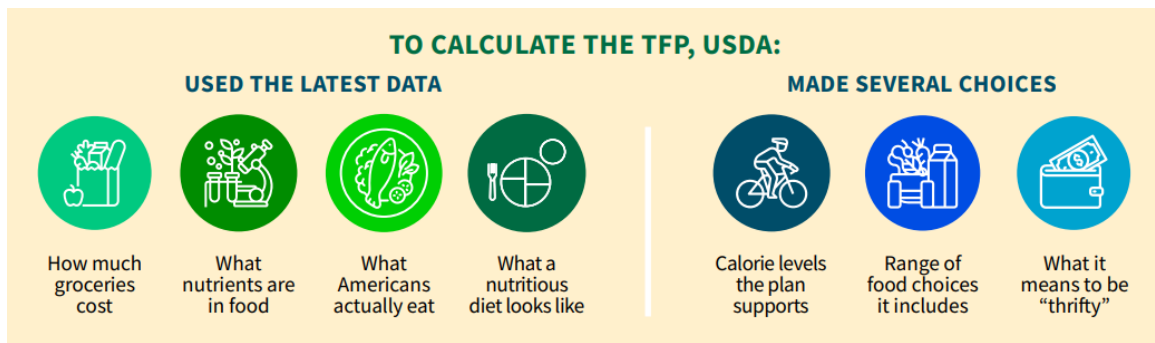
- **Food prices** came from Information Resources Inc. Retail Scanner Data (IRI InfoScan),¹ which contains weekly transaction data based on scanned product codes from a large number of retailers selling food products (Levin et al. 2018).
- **Food composition data** came from two USDA-developed databases with information on the food groups and subgroups, nutrients, and calories of individual food and beverage items: the Food and

¹ Now referred to as the Circana Retailer Data.

Nutrient Database for Dietary Studies (FNDDS) and the Food Patterns Equivalents Database (FPED) (Agricultural Research Service 2022a, 2023).

- **Consumption patterns** came from the 2015–2016 What We Eat in America (WWEIA), the dietary component of the National Health and Nutrition Examination Survey (NHANES) (Agricultural Research Service 2022b). WWEIA uses in-person, 24-hour dietary recalls to measure intakes among a nationally representative sample of Americans. The sample was divided into groups based on age and sex, and consumption patterns were calculated for each group.
- **Dietary guidance** came from the 2020–2025 Dietary Guidelines for Americans (DGA), which contain evidence-based recommendations on levels of food groups, nutrients, and calories included in healthy diets across a range of calorie levels (1,000 to 3,200 for individuals ages 2 and older) (USDA and HHS 2020). Dietary guidance differed for specific groups based on age and sex.

Exhibit II.1. Summary of the 2021 TFP reevaluation



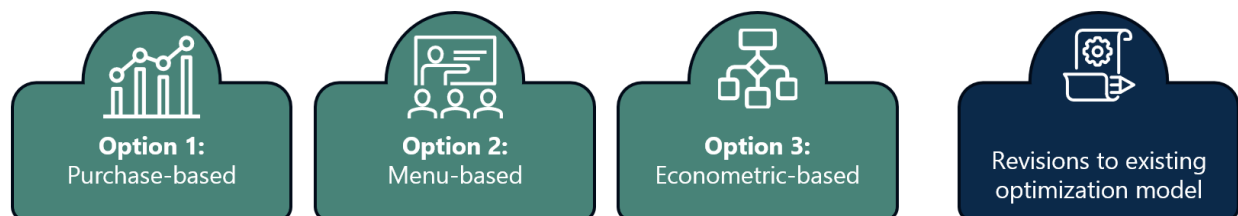
Source: Food and Nutrition Service, USDA. "At a Glance: The Thrifty Food Plan Reevaluation." <https://www.fns.usda.gov/TFP/evaluationinfographic>.

TFP = Thrifty Food Plan; USDA = U.S. Department of Agriculture.

B. Overview of potential options for reevaluating the TFP

Although the TFP historically has been reevaluated using an optimization model, the goal of this task was to identify other methodologies for determining a TFP market basket and cost. This included alternative analytical approaches as well as adjustments that could be made to the existing optimization modeling. The expert panelists identified three alternatives to the optimization model for potential use in TFP reevaluations, which are presented in Exhibit II.2, in the order of most frequently to least frequently preferred by the panelists. In addition, the panelists identified three potential revisions to the existing optimization model.

Exhibit II.2. Overview of potential options for reevaluating the TFP



- **Option 1: Purchase-based.** Use existing food purchase data to identify households that purchase a healthy mix of foods; the purchased foods and associated costs would be used to define the TFP.
- **Option 2: Menu-based.** Have nutritionists develop healthy, lower-cost menus that serve as the basis for determining the TFP market basket and associated cost.
- **Option 3: Econometric-based.** Use economic modeling to calculate the TFP based on criteria such as maximizing utility or finding the most efficient (least expensive) method of producing a healthy diet.
- **Revisions to existing optimization model.** Modify the current optimization model by incorporating up to three potential revisions:
 1. Increase the food waste parameter from its current level of 5 percent.
 2. Replace existing nutrient-based constraints with constraints based on the Healthy Eating Index (HEI).
 3. Change the unit of analysis to individual foods and beverages rather than food categories.

These options are discussed in more detail in the chapters that follow. Each chapter gives an overview of the option and considerations for implementation, including an estimated level of effort. The study team used the following broad categories to estimate level of effort, drawing on the expert panel discussions, its members' own experience with similar tasks, and its members' knowledge of how these methods have been used in related research:

- a. **Low level of effort.** The option is well defined and has been implemented before or has a high probability of being successfully implemented.
- b. **Moderate level of effort.** The option is relatively well defined, but certain details related to implementation require further consideration. The option is likely feasible but might involve some trial and error to reach successful implementation.
- c. **High level of effort.** The option requires new primary data collection, or the option involves methods that have not been applied to existing data sources before, lowering the probability of successful implementation.

Each chapter briefly describes how the option would meet each of the four TFP reevaluation criteria related to the use of current: (1) food prices, (2) food composition data, (3) consumption patterns, and (4) dietary guidance; and how the option would produce a market basket and cost for the legislatively required reference family of four. These descriptions are provided at the end of each chapter and indicate when the option may not directly meet the criteria or when there is a potential issue with producing a market basket and cost for the reference family. However, because the legislation does not prescribe how the criteria must be met or how the reference family must be incorporated, these assessments are provisional.

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III. Option 1: Purchase-Based Approach

The purchase-based approach would use existing data sources on household food purchases to identify subsets of households that purchase foods that meet the definition of a healthy diet. The TFP would then be calculated based on the cost and composition of the foods in the food purchases of the selected households. This option is grounded in the actual purchasing behavior of households in the United States. Economists typically call this a “revealed preferences” approach and emphasize that using real-world behavior can increase the validity and utility of findings and the decisions that are made based on them. This approach accounts for factors that are difficult to explicitly include in a statistical model, such as practicality, palatability, affordability, cultural preferences, food preparation time, and household cooking equipment. It would also implicitly account for food waste, which CNPP adjusts for in the current optimization model, assuming the households in the data report food-at-home purchases that exceed their dietary needs.² However, given that households are unlikely to purchase diets that align with nutritional guidance, it may be difficult to identify enough households to compute the TFP cost using this approach. The purchase-based approach was the most frequently preferred alternative approach among the expert panelists, ahead of the optimization model with revisions. Other considerations for implementing this option are discussed below.

A. Considerations for implementing this option

1. Selecting the data source(s)

Several sources for data on household food purchases could be used to support this option, including (1) the National Consumer Panel (NCP), jointly run by Nielsen and Circana (formerly IRI) (NCP 2024; Muth et al. 2016); (2) the National Household Food Acquisition and Purchase Survey (FoodAPS), co-sponsored by the Economic Research Service (ERS) and FNS (ERS 2022); and (3) data from grocery store chains and other food retail companies that include detailed information about purchases by their customers.³ Exhibit III.1 describes these data sources and their strengths and weaknesses. Despite its limitations, the NCP was identified as the strongest of these options in discussions with the expert panelists.

² The reasonableness of this assumption was not considered as part of discussions with the expert panelists.

³ The expert panelists also considered using consumption data rather than purchase data. However, panelists more frequently preferred purchase data, because it aligns better with the primary purpose of the TFP, which is to calculate levels of SNAP benefits for purchasing foods and beverages. The expert panelists also discussed alternative data sources containing information on food prices, such as PriceStats and retail scanner data; however, these sources were ruled out as they do not contain information on food purchases at the household level.

Exhibit III.1. Description, strengths, and weaknesses of purchasing data sources

Data source	Description	Strengths	Weaknesses
National Consumer Panel	<ul style="list-style-type: none"> • Data on food products purchased from retail establishments to be consumed at home • Recorded by a panel of about 120,000 households; about 60,000 report enough data to be part of the primary annual data set (known as the static panel) • Includes information on individual products purchased and linked information on their nutrition information and other characteristics • Includes household demographics and other household-level information 	<ul style="list-style-type: none"> • Designed to be nationally representative, including use of weights • Large sample • Tracks purchasing over time • Continuous data • Connected to USDA nutrition characteristics data sets • USDA has experience using this data source • USDA has easy access to this data source 	<ul style="list-style-type: none"> • Households that are underrepresented in static panel are those with: one person, head of household younger than age 35, Black and Hispanic members, children, and the lowest incomes. • Static panel might differ from U.S. population in other, unobservable ways that cannot be adjusted by weights and could affect purchasing behavior • Payment method (use of WIC and SNAP benefits) is only included for overall transactions, not individual items purchased, and is not always consistent with self-reported program participation • Lacks quantities for items whose price varies by weight (produce, meats, etc.); without quantities, food composition calculations cannot be made • Lacks data on purchases of food consumed away from home^a • Consistent underreporting compared with other government data sources (Sweitzer et al. 2017)
FoodAPS	<ul style="list-style-type: none"> • Data collection was conducted primarily in 2012 and included approximately 4,800 households • Includes household-level characteristics and other factors potentially related to food purchasing and demand, food security, and health and well-being • Second round is in progress 	<ul style="list-style-type: none"> • Nationally representative • Oversamples low-income populations • Connected to USDA nutrition characteristics data sets • Contains complete data on food purchases, including foods consumed away from home^a • USDA has experience using this data source • USDA has easy access to this data source 	<ul style="list-style-type: none"> • Small sample size • Limited to one week of purchases • Data are 12 years old; FoodAPS-2 is in progress, with no current plans for regular data collection • Dropoff in purchase events reported throughout the week of data collection, indicating potential underreporting

Data source	Description	Strengths	Weaknesses
Retail chain proprietary data	<ul style="list-style-type: none"> Chains use loyalty or reward cards to track purchases of specific people or households over time Academic researchers have partnered with chains to use their data sets for research on topics such as fruit and vegetable purchases by WIC participants 	<ul style="list-style-type: none"> Large data sets Tracks purchasing over time Shows payment method (breaking out WIC and SNAP) Continuous data 	<ul style="list-style-type: none"> Not nationally representative Permission required, likely restrictions on use Lacks data on purchases of food consumed away from home^a Lacks data on purchases from other retail chains of food for consumption at home

^a Many households purchase foods away from home (for example, at restaurants) in addition to purchasing foods for at-home consumption. Using a data source that only includes information on foods purchased for at-home consumption could lead to an underestimation of the cost of the TFP market basket, as these purchases may not reflect a family's total caloric needs.

FoodAPS = National Household Food Acquisition and Purchase Survey; SNAP = Supplemental Nutrition Assistance Program; USDA = U.S. Department of Agriculture; WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

2. Defining a healthy diet

The purchase-based option requires finding households whose food purchases are consistent with a healthy diet. HEI scores (CNPP 2023) for the food purchases of each household in the data set could be used to identify these households. The HEI assigns a score from 0 to 100 to a set of foods (in this case, household purchases) based on how well they align with the DGA. Using this approach, a specific score could be used as the minimum score for a healthy diet. Expert panelists described several approaches for determining this threshold. For example, healthfulness could be defined as households with food purchases that achieve an HEI score of 80 or above.⁴ Although an HEI score of 80 is much lower than the HEI scores achieved by the current TFP market baskets (which range between 93 and 98, depending on the reference family member), this score could be considered an achievable score that approaches a healthful diet in alignment with current dietary guidance.

Alternatively, households could be ranked based on their HEI score, and healthfulness could be defined by the proportion of households with the highest scores. For example, households with purchases in the top third of the HEI distribution could be defined as having healthy diets. Similarly, the distribution could be divided into quintiles with the top quintile being used to determine which households had sufficiently healthful purchases.

3. Calculating the cost of the TFP market basket

The expert panelists discussed various methods for calculating the cost for this option, with a weighted average being more frequently preferred among the panelists compared to the minimum cost, as the minimum cost may be associated with a narrow range of purchases including foods that are not practical or palatable for many SNAP participants. In addition, if households with the least expensive food purchases are in regions of the country with lower food prices, these same foods might be unaffordable in more expensive regions. Although using an average or median cost would be less effective for minimizing

⁴ Such a threshold could be based on the HEI total score as well as HEI component scores (for instance, requiring component scores to be at least 80 percent of the maximum score).

costs, it would allow for more variation in terms of potential food purchases and would be easier for all SNAP participants throughout the country to obtain.

After computing the weighted average cost, an additional adjustment may be required depending on the data source used to implement this approach. Specifically, for food purchase data sources such as the NCP that do not include information on food purchased for consumption away from home, it is likely that the weighted average cost of food purchased for at-home consumption would underestimate the true costs of the TFP, because these purchases may not fully reflect a family's total caloric need. The expert panelists discussed two potential solutions. One, adjust the average cost based on the proportion of the household's caloric needs that are met given the household's food purchases. Or two, use FoodAPS data to calculate an adjustment factor based on the share of total calories acquired for food-at-home consumption among all foods reported by households. This adjustment factor could then be applied to the weighted average cost.⁵ However, in both cases, a separately calculated food waste factor would be required, similar to the current optimization model—although this would be true whenever using food purchase data to reflect dietary intake for any household whose food purchases do not exceed the recommend caloric target (to account for the fact that it is unlikely 100 percent of the food purchases are consumed without waste).

4. Converting the composition of the healthy diets into a single TFP market basket

The expert panelists discussed multiple ways of converting the observed healthy diets into a TFP market basket. For example, one approach would involve aggregating items into modeling categories for each healthy diet, and then calculating averages of the modeling categories across all the selected diets to obtain a market basket. An alternative would be to average item quantities across all the healthy diets to create a market basket comprising amounts of individual food items.

B. TFP reevaluation criteria and application to reference family

Overall, the purchase-based option meets all four reevaluation criteria by making a reasonable assumption that households' purchased foods reflect their consumption (Box III.1).

Box III.1. Meeting the TFP reevaluation criteria: Option 1, Purchase-based

- **Food prices** would be included from the purchase data, which reflects actual prices paid by consumers.
- **Food composition data** would be incorporated in estimation of HEI scores.
- **Consumption patterns.** This option assumes that foods purchased reflect consumption.
- **Dietary guidance.** This would be captured through the HEI score or an alternative measure of healthfulness. ▲

Assuming the purchase data include the age and sex of each household member, the purchase-based option can produce a market basket and cost for the reference family. The most straightforward approach would be to only include households with the same composition as the reference family. Because relatively few households are likely to meet the criteria for a healthy diet, however, there is a risk that too

⁵ Underreporting in FoodAPS could lead to an inaccurate adjustment factor, because the total number of calories consumed may be too low. However, the panel members did not think underreporting would substantially affect the calculation of this adjustment factor.

few households would remain if the sample were further restricted to the subset that also matches the description of the reference family. An approach that uses all individuals in the age range and sex of at least one reference family member, regardless of their household, might not face the same limitation. However, purchase data are at the household level, not the individual level, so this approach would require additional assumptions to translate observed purchases into purchases by the reference family members. Another approach would be to include households that are similar to the reference family (for example, households with children who are slightly younger or older than the reference family's children). Comparing the costs from a broader sample of households to costs from a narrower sample of only households that match the reference family would allow CNPP to assess how sensitive the cost estimate is to the definition of the reference family.

C. Level of effort

This approach involves some effort to prepare the data sources, including linking the purchase data to nutrition databases to calculate HEI scores. The remaining steps are theoretically straightforward. However, the process of identifying the appropriate set of households with sufficiently healthy purchases will involve making analytic decisions from a set of potential options. Given that this approach has not been implemented before, CNPP will likely need to conduct sensitivity analyses to determine how much these decisions influence the cost of the TFP. It is also possible that when implementing this option, CNPP might determine that the sample size is insufficient. Additional assumptions and analysis might be required to overcome this issue. Given these considerations, the study team estimates this approach would involve a **moderate** level of effort.

D. Summary of advantages and disadvantages

The key advantages of the purchase-based option are:

- It is a relatively simple option that draws on one or more existing sources of food purchase data that are designed to be nationally representative, including data that have previously been used to reevaluate the TFP. These data sources, particularly the NCP, include a large sample of households that track purchases over time, and are updated regularly.
- It reflects the revealed preferences of households and implicitly incorporates several factors that are important to the TFP reevaluation but are difficult to model. These include practicality, palatability, affordability, cultural preferences, food preparation time, household cooking equipment, and food waste, assuming the households in the data report food-at-home purchases that exceed their dietary needs.⁶

This approach also has important limitations:

- There is wide disparity between nutritional guidelines and actual food consumption patterns in the United States (Wilson et al., 2026; USDA and HHS 2020), meaning there may be few households whose food purchases meet the dietary guidelines. To ensure an adequate sample of households whose food purchases are consistent with a healthful diet, CNPP could use an HEI threshold of 80

⁶ The reasonableness of this assumption was not considered as part of discussions with the expert panelists.

(which is lower than the current TFP market basket score). However, relaxing the standard used to define healthy food purchases risks compromising the requirement that the TFP reevaluation reflect current dietary guidance. One potential solution discussed by the expert panelists would involve constructing synthetic households. The synthetic households would combine multiple households whose food purchases are “healthier” along a particular dimension, such as a food category, even if the rest of their food purchases are “less healthy.” In other words, decisions about including or excluding households from the data source would not be binary yes/no decisions; only the relevant parts of a household’s data would be used in constructing a TFP. However, in moving away from observed household purchasing behavior, assumptions that the synthetic household approximates a realistic household become less tenable.

- Although HEI components were designed such that consuming the ideal level of each component should lead to a diet that meets nutrient requirements, they do not directly account for all individual nutrients. Therefore, if HEI scores were to be used to define a healthful diet, the panelists discussed the potential need to investigate whether levels of individual nutrients in the final market basket met dietary recommendations.
- The panelists’ most frequently preferred option for food purchase data, the NCP, has several limitations. Despite having weights that allow for the calculation of nationally representative estimates, following households are underrepresented: those with one person, with heads of households under age 35, with Black and Hispanic members, with children, and with the lowest incomes. The data set also lacks information on purchases of food for consumption away from home, so it likely does not reflect all of the foods and beverages needed to meet the full caloric needs of households who supplement their at-home food purchases with food-away-from-home purchases. Two potential adjustments (described above in Section A.3) could be made to account for a family’s total caloric needs.

IV. Option 2: Menu-Based Approach

Under the menu-based option, nutritionists would develop healthy, lower-cost menus that meet current dietary guidance. The nutritionists would be asked to develop menus that include a complete list of meals and the ingredients and food items needed for each meal for a reference family of four. The frequency with which foods and beverages appear on the menus would be the basis for defining the market basket. To calculate the cost of the TFP, the menus would be linked to price databases to determine the cost of each menu. Ultimately, a TFP cost would be calculated by averaging the costs of the individual menus.

This option implicitly accounts for variables that are difficult to measure and model, such as time needed to prepare foods, available kitchen equipment, and the palatability of menus. In addition, this approach leverages nutritionists' knowledge about healthy diets and takes advantage of their experiences working with SNAP or other populations in their community with low incomes.

A. Considerations for implementing this option

1. Selecting the nutritionists

The expert panelists discussed the possibility of identifying the nutritionists or dietitians for this work through USDA's SNAP-Ed program. These nutritionists will have experience working with SNAP recipients and other families with low incomes to develop affordable, healthy diets. Nutritionists from around the country could be included to ensure that the needs and preferences of a variety of communities are considered. However, CNPP would need to decide on the number of nutritionists needed to represent the country (for example, one from each county, State, or region), which has implications for the cost of implementing this option.

2. Developing a standardized system for collecting menus

To help them develop menus that incorporate current dietary guidance, the nutritionists would need to be given meal planning software that included the nutrient content of foods, along with guidance for creating the menus. For instance, the nutritionists would need to ensure their menus included the recommended amounts of foods for each age/sex group of the TFP reference family. Similarly, the nutritionists would need to be given systematic guidance on developing the menus, such as using items and ingredients that are available and palatable to their local community and accounting for different cultural and dietary restrictions. To better account for consumption as required by the TFP reevaluation criteria, the nutritionists could be asked to include frequently consumed foods and beverages (based on consumption patterns from nationally representative sources, such as the NHANES, WWEIA). However, one expert panelist cautioned that the nutritionists would need to weigh this consideration against their knowledge of local dietary patterns that might not be well reflected in nationally representative data.

This menu development process could take advantage of similar approaches and existing resources. For example, the SNAP-Ed Connection website (<https://snaped.fns.usda.gov/>) contains nutrition education and resources, including a library of healthy and inexpensive recipes. USDA's Shop Simple with MyPlate app (<https://www.myplate.gov/app/shopsimple>), including the MyPlate Kitchen component, also has

nutrition education and resources along with an extensive, searchable collection of recipes and recipe resources.

3. Ensuring palatability and practicality of menus

SNAP participants could rate the resulting menus on palatability and practicality. This process for gathering feedback on the menus could be informed by feedback in similar surveys used in the past to assess consumer food or menu preferences (Cardello et al. 2000). For example, a questionnaire could be developed that asks about the likability of the menus and whether the respondent could easily purchase the ingredients at the stores where they shop. The survey could also ask how time-consuming or difficult they expect preparing the meals to be. Based on this feedback, nutritionists could revise the menus as needed. Importantly, this feedback process provides an opportunity for CNPP to engage SNAP participants who are directly affected by the decisions of the TFP reevaluation.

4. Calculating TFP cost and market basket

The frequency with which food and beverage items and ingredients appear on the menus would be the basis for defining the market basket. To calculate the cost of the market basket, the menus that the nutritionists create would need to be linked to a price database to calculate the cost of purchasing the ingredients and items that make up the meals.⁷ The expert panelists discussed several potential price databases that could be used, including household food purchase databases (described in greater detail in Chapter III) and Circana retailer scanner data, which were used in the 2021 TFP reevaluation. These costs would then be averaged to calculate the cost of the TFP. To help with this process, the nutritionists should receive standardized guidance on how to devise inexpensive plans. Initially, nutritionists could be instructed to develop menus that would be affordable for the populations they work with.

5. Accounting for food waste

Nutritionists could be instructed to account for food waste by including more items in their menus than a family would need to meet their needs. However, this approach would be difficult for nutritionists to estimate, even if they had information on food waste statistics. Nutritionists could be instructed to use strategies to reduce food waste, such as including more frozen and shelf-stable items for the menus, something that the experts noted those with experience working with the SNAP population may already do but could be informed further by SNAP-Ed guidance. Even so, CNPP would likely need to use a food waste adjustment factor to adjust the cost of the TFP to account for food waste, as the current optimization model does.

B. TFP reevaluation criteria and application to reference family

Overall, the menu-based option meets all four evaluation criteria by realistically assuming the nutritionists will take community consumption patterns into account when designing the menus (Box IV.1).

⁷ Decisions around any missing price data would need to be made before implementing this approach.

Box IV.1. Meeting the TFP reevaluation criteria: Option 2, Menu-Based

- **Food prices** would be included. Food prices from an existing data source would be linked to the expert-developed meal plans to calculate costs.
- **Food composition data** would be incorporated into meal planning software used by the experts.
- **Consumption patterns.** This approach does not directly use a consumption data source and realistically assumes the nutritionists will take community consumption patterns and preferences into account as they design the menus.
- **Dietary guidance** would be provided to experts to follow while developing the menus. ▲

The nutritionists could design menus for a family of four to ensure this approach adequately accounts for the reference family. For example, the guidance provided to the nutritionists could specify the age range and sex of each reference family member and require that the menus meet their collective nutritional needs.

C. Level of effort

This option would involve extensive effort, both to develop and manage the process of identifying and engaging nutritionists and to facilitate the collection and coding of menus. CNPP would need to develop procedures, criteria, and guidance for each stage. Separately, the process of getting input from SNAP recipients or others could be intensive, as CNPP would need to identify and recruit respondents, obtain their feedback, and compensate them for their time and effort. The study team estimates this option would involve a **high** level of effort.

D. Summary of advantages and disadvantages

The key advantages of the menu-based approach are:

- It takes advantage of human expertise, judgment, and knowledge about SNAP recipients to overcome many of the limitations of other approaches. This approach implicitly accounts for important factors that are difficult to measure, such as time needed to prepare food, available kitchen equipment, palatability of menus, and cultural preferences. It also leverages nutritionists' knowledge about healthy foods and experience working with SNAP and other populations with low incomes, particularly if nutritionists are drawn from the SNAP-Ed program or another program focused on those populations.
- By developing menus to base the market basket on, this approach would make the TFP more intuitive and easier to understand. Currently, the TFP market basket consists of food categories and amounts that are hard to interpret, because they are based on averages derived empirically from large numbers of 24-hour dietary recalls in existing data sets.
- Importantly, if SNAP recipients are surveyed about the acceptability and palatability of the nutritionist-created menus, this approach provides an opportunity to incorporate feedback from the population directly affected by the TFP reevaluation—an important step in equity-based research.

This approach also has important limitations:

- There is no existing infrastructure for this approach, which could result in a high level of effort to ensure the market basket is palatable and practical for the SNAP population. (For example, detailed procedures for collecting and processing the menu data to construct a market basket would need to be developed.)
- Guidance would need to be provided to the nutritionists to ensure the process is standardized and transparent.
- It does not account for food waste. As a result, the cost of the market basket would need to be adjusted, similar to the current TFP methodology, to account for food loss.

V. Option 3: Econometric-Based Approach

The econometric-based option would use household food purchase data (similar to the data used in the purchase-based option), but instead of basing the TFP on the observed food purchases, this option would use economic modeling to calculate an ideal solution based on maximizing (or minimizing) a model element while using other elements as constraints. One option is a *demand model* that maximizes utility based on preferences for food items subject to cost and nutrition constraints, and another is a *stochastic production frontier model* that minimizes the cost needed to produce a diet of a certain level of healthfulness. Results from the demand model would be the diet that maximizes utility subject to constraints. Results from the stochastic frontier model would be the most cost-efficient way to achieve a sufficiently healthy diet or related goal. The resulting as-purchased diet from both models would be used as the basis for the TFP market basket and associated cost.

Compared with the purchase-based approach, both of these economic models have the advantage of enabling CNPP to make estimates about solutions representing ideal ways of meeting certain criteria or fitting within certain constraints. These models also allow for the identification of unobservable outcomes; that is, the models can arrive at solutions reflecting choices that are not actually made by any household in the underlying data. In other words, if there are not enough households whose food purchases make up healthy diets, this approach could result in a model that predicts the cost of a healthier diet based on household purchase data at varying levels of healthfulness.

In this way, the econometric-based approach is similar to the current optimization model. However, the experts emphasized that these alternative models are also relatively straightforward approaches that draw on well-understood practices that have been applied to many similar topics in economics. By using purchasing data, these models have some of the advantages of the purchase-based option; for example, they implicitly account for food waste, assuming the households in the data report food-at-home purchases that exceed their dietary needs.⁸ However, these kinds of economic models have some drawbacks. They depend on the underlying assumptions and parameters about how consumers behave, which might be inaccurate or overly simplistic. Decisions about how to structure the model can have a large impact on the model results. Also, models with a large number of assumptions and parameters can become overly complex or have difficulty generating feasible solutions.

A. Considerations for implementing option

1. Developing a model framework

Using purchasing data, a *demand model* would have a utility function with parameters to translate food items purchased into utility, and a cost function based on prices of the purchased food items. The model could include constraints around nutrition, such as a minimum HEI score. Food items could be treated individually or combined into categories. The demand model assumes the consumer will maximize utility within any constraints. For example, if the food purchase data show that certain food items are frequently purchased, the model would assume these items provide a large amount of utility, and it would include

⁸ The reasonableness of this assumption was not considered as part of discussions with the expert panelists. As with the purchase-based approach, an adjustment to account for the family's total caloric need may be needed if this assumption is not met.

them in the diets produced by the model. The nutrition constraints would prevent the model from selecting only commonly purchased items that collectively would not support a healthy diet. With these parameters in place, the model could determine what diets the consumer would choose, and then calculate the costs of those diets.

The *stochastic production frontier model* would consist of a parameterized “diet quality production function,” using observed HEI as the output from the production process and purchase data as the inputs to the production process. As with the demand model, food items could be incorporated individually or combined into broader food categories. The model would include two error terms: One term would reflect random variation, and a one-sided term would reflect inefficiency in the process of using the model inputs (purchase data) to produce the model output (a diet with an HEI score). Maximum likelihood or similar techniques would estimate the parameterized production function and the inefficiency error term. This approach would result in a parameterized frontier that reflects the lowest-cost solution for producing diets of varying healthfulness and also notes how far each household in the data is from the frontier—in other words, how “inefficient” they are.

B. TFP reevaluation criteria and application to reference family

Overall, the alternative modeling option meets all four evaluation criteria if one makes the reasonable assumption that households’ purchased foods reflect their consumption (Box V.1).

Box V.1. Meeting the TFP reevaluation criteria: Option 3, Econometric-Based

- **Food prices** would be included from the purchase data, which reflect actual prices paid by consumers.
- **Food composition data** would be used to calculate alignment with any nutrition constraints.
- **Consumption patterns.** This option assumes that foods purchased reflect consumption.
- **Dietary guidance** would be used to define any nutrition constraints. ▲

Assuming the purchase data source contains the age and sex of household members, a market basket and associated cost could be calculated for the reference family, without being limited to data from households that match the reference family exactly. However, when building the model, one would need to consider how to attribute food purchase data at the household level to the individual household members. One option is to build age and sex into the model’s assumptions and calculations.

C. Level of effort

This kind of modeling approach is complex and novel. As a result, it may require considerable time and effort to design and implement a new econometric model. The study team estimates this option would involve a **high** level of effort.

D. Summary of advantages and disadvantages

The key advantages of the econometric-based approach are:

- It has the strengths of a traditional modeling approach. It can find an efficient solution even if the solution is not directly observed in the data, meaning it can reflect choices and outcomes that are difficult to find in the real world. This overcomes a limitation of the purchase-based option.

- This approach is built on well-understood practices that are frequently used in economics.
- It avoids some of the challenges of the current optimization model, such as the large number of individual constraints required.
- By using food purchasing data, these models contain some of the advantages of the purchase-based option, such as implicitly accounting for food waste and thus removing the need for a food waste adjustment factor, assuming the households in the data report food-at-home purchases that exceed their dietary needs.⁹

This approach also has important limitations:

- This approach is sensitive to modeling assumptions, meaning that decisions on how to structure the model can have a large impact on the results.
- These kinds of models have not been used for this specific purpose before, so it is uncertain how well they would perform at leading to a feasible solution.

⁹ The reasonableness of this assumption was not considered as part of discussions with the expert panelists.

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VI. Summary of Alternative Approaches to Optimization Modeling

Overall, three alternative approaches for reevaluating the TFP were identified. Based on the study team's discussions with the expert panelists and the results of the final survey, where each panelist provided their individual rankings of the various options, these approaches in order from most to least often preferred were (1) a purchase-based option, (2) a menu-based option, and (3) an econometric-based option. Exhibit VI.1 provides estimates of the level of effort for each option, summarizes whether the options meet each of the four TFP reevaluation criteria, and notes how the option would account for the reference family.

- All three approaches involve an estimated moderate or high level of effort.
- All of the alternative approaches require a reasonable assumption to meet the requirement related to current consumption patterns. This is because the menu-based option is based on the development of menus, and the purchase-based and econometric-based options are based on purchase data.¹⁰
- A market basket and associated cost could be calculated for the reference family using each of the three options. Under the menu-based option, the experts would need to design menus for the reference family. Under the purchase-based and econometric-based options, the approach would need to use information on household size and the age and sex of household members (available in the purchase data) to calculate a market basket and cost for the reference family. This could be challenging if there are few households in the purchase data that exactly match the reference family, or if many assumptions are needed to attribute purchases to individual family members.

Other considerations for these options include the following:

Considerations applicable to more than one option. There are some considerations for reevaluating the TFP, regardless of the approach used. For example, any approach should account for food waste, either by assuming foods purchased exceed the dietary needs of the household (to implicitly account for food waste) or by applying an adjustment factor. Another consideration is the threshold for healthfulness if using an HEI score to define a healthy diet.

Finally, expert panelists discussed using SNAP participants to assess the practicality and palatability of the menus resulting from the menu-based option. However, this step could be implemented across any of the options to infuse equity into the TFP reevaluation process. For example, once the healthy, low-cost menus from the purchase-based option are realized, the menus could be assessed for practicality and palatability before they are converted into a market basket. This might be more difficult to implement for the econometric-based option, which, like the current optimization model, will produce a market basket composed of small amounts of food categories.

Developing new or updated data sources. Aside from the menu-based approach, discussions with the expert panel focused on reevaluation options that used existing data sources. Future TFP reevaluations could consider whether a new data source collected specifically to meet TFP reevaluation requirements

¹⁰ The purchase-based and econometric-based options could also meet the consumption patterns requirement by using intake data, like the optimization model does. However, this would lose the strengths of purchase data: that the purchase data align better with TFP's purpose of calculating SNAP benefit levels for purchasing foods and beverages.

would be useful. Continued FoodAPS studies would present an opportunity to collect these data. The length of data collection for each household would be an important consideration. Many past studies have used a period of one week (like FoodAPS) or two weeks (like the Food Expenditure Survey in Canada [Statistics Canada 2007] and the Living Costs and Food Survey in the United Kingdom [Office for National Statistics 2023]). It may be advantageous to collect at least two weeks of data from each household, and ideally four weeks because SNAP recipients' purchasing is often affected by the monthly timing of when benefits are received. However, according to discussions with the expert panelists, existing studies have had difficulty collecting complete data over even a two-week period, so a four-week period might not be feasible.

Exhibit VI.1. Estimated effort, TFP reevaluation criteria, and application to reference family for each option

Element	Purchase-based option ^a	Menu-based option ^b	Econometric-based option ^c
Estimated level of effort	Moderate ^d	High ^e	High ^e
TFP reevaluation criteria			
Food prices	From food purchase data	Linked from existing source to food items in the menus	From food purchase data
Food composition data	Considered when rating healthfulness of purchases	Built into menu planning software	Used to calculate alignment with nutrition constraints
Consumption patterns	Assumes foods purchased are consumed	Assumes nutritionists take community consumption patterns and preferences into account when designing menus	Assumes foods purchased are consumed
Dietary guidance	Captured through HEI score or alternative measure	Given to experts to follow while developing menus	Used to define nutrition constraints
Application to the reference family	Only use data from households or individuals with same age and sex as reference family; feasibility is unclear	Develop menus specifically for reference family	Use model assumptions and parameters to calculate solution for reference family; feasibility is unclear

^aThe Purchase-based option would identify households that purchase foods making up a healthy diet, based on household food purchase data. The TFP cost would be calculated based on the cost and composition of the foods purchased by the selected households.

^bThe Menu-based option would involve nutritionists developing healthy, lower-cost menus that meet current dietary guidance to serve as the basis for the market basket. The TFP cost would be calculated by averaging the costs of the individual menus.

^cThe Econometric-based option would model the cost of purchasing a healthy diet based on household food purchase data at varying levels of healthfulness. A *demand model* would maximize utility based on preferences for food items, subject to cost and nutrition constraints. A *stochastic production frontier model* would minimize the cost needed to produce a diet of a certain level of healthfulness.

^dModerate level of effort means that the option is relatively well defined, but certain details related to implementation require further consideration. The option is likely feasible but might involve some trial and error to reach successful implementation.

^eHigh level of effort means that the option requires new primary data collection, or the option involves methods that have not been applied to existing data sources before, lowering the probability of successful implementation.

Future work. This report provides a high-level overview of several alternative approaches to the TFP reevaluation and includes careful considerations of how each option might be implemented and their

respective advantages and disadvantages, but it is not a complete assessment. Therefore, this report is a starting point. Before implementing any of these options, more work would be required to fully assess the option's feasibility and implications. Several details would require further examination and consideration before full-scale implementation, including the following:

- The details of any criteria, thresholds, and other steps for defining a diet or market basket as healthy and low in cost
- Trade-offs and other considerations regarding which data sources to use
- Estimates of the cost of implementing the option: although this report includes estimates for the level of effort, and options with higher levels of effort tend to be more expensive, additional investigation would be needed to estimate the total cost of each option.
- Assessments of how well the option meets the TFP reevaluation criteria

The options with higher estimated levels of effort—due to greater methodological complexity, the scale of the option, or both—would likely be more difficult and would take more time to investigate. However, if more information were gathered, it would support CNPP's goal of selecting the strongest option for reevaluating the TFP in a way that meets legislative requirements and resolves other considerations.

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VII. Revisions to the Current Optimization Model

If CNPP continues to use the optimization model, the panelists identified three potential revisions: (1) adjusting the food waste parameter, (2) replacing the current nutrition constraints with constraints based on HEI scores, and (3) using a more detailed level of analysis than the current higher-level food categories. Potential revisions (1) and (2) were most frequently preferred in a poll of the expert panelists. This chapter describes these three proposed revisions.

A. Update food waste parameter

The TFP's optimization model currently includes a food waste parameter of 5 percent of edible components,¹¹ meaning that the average consumption of each food category is adjusted upward by 5 percent to account for foods that were purchased but not consumed. In practice, this increases the cost of the TFP to account for purchasing an additional 5 percent worth of foods. The current food waste parameter of 5 percent is based on research from the early 1980s. The parameter could be revised to reflect new research and data on food waste.

1. Updating parameter based on research

At the time of the 2021 reevaluation, CNPP determined there was not enough evidence to support a specific alternative to account for food waste. However, this is an evolving area of research, and more studies on food waste have been published since the 2021 reevaluation (for example, Li et al. 2023). CNPP is also conducting an evidence scan for existing evidence on household food waste (Pannucci et al. 2024). After gathering existing evidence, an updated food waste parameter would need to be decided on, and the expert panelists agreed this parameter could vary widely. Even so, updating the food waste parameter may be important given that even widely varying estimates suggest the current 5 percent parameter is too low. Using existing evidence would likely lead to a parameter closer to 15 to 25 percent,¹² with food waste parameters for the other USDA food plans potentially requiring revision as well.

The panelists were asked to consider if an increase to the food waste parameter might be seen as a recommendation from the USDA that households, and SNAP households in particular, should waste more food. Although none of the responses from panelists indicated concerns regarding this point, one panelist was uncertain whether this change would influence food waste behavior, while another raised concerns about the infeasibility of achieving the current 5 percent level.

2. Future research

FNS has initiated a study to classify and measure different types of household food waste (FNS 2023). Importantly, this study will develop a methodology that measures food waste by food category. For example, diets that have more fresh ingredients tend to have higher food waste than diets with many processed or packaged foods that have a longer shelf life (Buzby et al. 2014; de Gorter et al. 2023), so a

¹¹ The model separately accounts for inedible components such as banana peels or pre-cooking weights.

¹² Deciding on a specific updated parameter would require review of the existing evidence, which was outside the scope of this task. As with the other approaches discussed, further work would be needed to determine a more exact methodology for updating the parameter.

new food waste measure could account for those differences. Although food waste data from the resulting new measure will not be available for the next TFP reevaluation in 2026, it would be advantageous to apply food waste factors by food category once available.

3. Level of effort

Relying on the development of a new food waste measure to determine an updated food waste parameter would involve a **high** level of effort. Aside from those activities, deciding on an updated percentage of food waste (based on existing research) and updating the existing TFP optimization model would be a low level of effort. Although using specific percentages for different food categories would be more complex, it likely would not substantially add to the level of effort.

B. Use dietary constraints based on HEI scores

The current optimization model uses many constraints for the minimum or maximum amount of food groups and subgroups (such as dark green vegetables, whole grains, or dairy) and individual nutrients (such as fiber, potassium, or Vitamin A) that must be reflected in the foods that make up the TFP market basket. These constraints ensure that the resulting TFP market basket meets current dietary guidance.

An alternative to the many different nutrition constraints included in the model could involve using the 13 HEI component scores as the constraints. HEI scores have been through a rigorous process to establish their validity (CNPP 2023). Using HEI categories is theoretically simpler than food group, subgroup, and individual nutrient categories, as there are considerably fewer HEI categories. Although it is unclear whether the market basket would meet all the nutrient requirements if the HEI component scores were used as the constraints, this approach may still present advantages to using the food group and individual nutrient categories because the HEI categories are simpler and easier to understand.

1. Structure of HEI-based constraints

The HEI is constructed to reflect key recommendations in the DGA and rates diets based on the presence or absence of specific food groups, subgroups, and dietary elements. As shown in Box VII.1, the HEI includes nine *adequacy components*, which assess foods and dietary components encouraged in the DGA, and four *moderation components*, which are related to foods and dietary components that the DGA recommends limiting. Each component is worth a maximum of five or 10 points, adding up to a 100-point overall score. Using this alternative approach, CNPP would replace the

Box VII.1. HEI components

Adequacy components (number of points)

- Total Fruits (5)
- Whole Fruits (5)
- Total Vegetables (5)
- Greens and Beans (5)
- Whole Grains (10)
- Dairy (10)
- Total Protein Foods (5)
- Seafood and Plant Proteins (5)
- Fatty Acids (10)

Moderation components (number of points)

- Refined Grains (10)
- Sodium (10)
- Added Sugars (10)
- Saturated Fats (10)

Source: CNPP 2023 ▲

many different nutrition constraints surrounding food groups, subgroups, and individual nutrients with constraints based on these 13 HEI components.¹³

2. Determining thresholds for HEI score components

To use HEI scores as constraints in the optimization model, a threshold (such as an HEI score of 80) would need to be decided on, similar to the discussion in the Chapter III related to the purchase-based approach. An iterative process would aid in an examination of how the model is affected by this decision.

3. Level of effort

CNPP would need to engage in a process to select HEI-based thresholds and conduct an iterative process to determine how they affect the model. This would result in a higher level of effort than retaining the current optimization model, but likely not by a large amount. Given this, the study team estimates a **low** level of effort.

C. Consider alternatives to food categories in optimization model

Currently, the unit of analysis for the optimization model is the food category. Each food category is an aggregate or average of many individual foods and ingredients. CNPP has found that, when reevaluating the TFP, developing the aggregated food categories is one of the steps that requires the most time and effort. The WWEIA food categories provide a useful starting point, but CNPP has to carefully consider how to combine or split those categories to feasibly structure them for the model (CNPP 2021). In addition, decisions about how to group foods into broader categories could affect the composition and cost of the market basket. An alternative is to use a more detailed unit of analysis, such as individual foods and beverages, when constructing the optimization model. This approach might create a more efficient TFP (by increasing the specific contributions of low-costs foods and beverages that contribute to a healthy diet). A strength of this approach is that it would streamline the modeling process for CNPP (by eliminating the step for developing aggregated food categories).

1. Using a more detailed unit of analysis

The most granular approach would be to use individual products or ingredients as defined by their Universal Product Codes (UPCs). Other approaches would involve an intermediate level of aggregation, such as individual foods and ingredients as defined by food codes from the FNDDS.¹⁴

Switching to a more detailed unit of analysis that uses individual foods or products based on identifiers that already exist could save considerable time and streamline the modeling process, particularly because a primary reason for running the model with aggregated food categories as opposed to individual foods was due to limited computing power when the TFP was first evaluated. Given advancements in

¹³ HEI scores would be included as constraints, meaning that the TFP market basket would need to meet minimum scores. The model would not treat HEI scores as an element to directly optimize (that is, to maximize the scores).

¹⁴ The final TFP market basket and cost can be presented at the same level as the unit of analysis or by aggregating the results into broader categories. How to describe and present the TFP market basket and cost involves several important considerations, such as the ease of understanding and using the market basket information, or what the information implies about flexibility around the foods that make up the market basket. Importantly, these considerations are separate from the decision regarding the unit of analysis for reevaluating the TFP.

computational power in the decades since, it is likely that an optimization model using individual foods or possibly individual products could now be estimated. Using UPCs specifically would also have a benefit of using actual prices in the model instead of aggregated higher-level prices.

2. Elements that the model would need to address

Although the greater computing power now available makes calculations based on individual foods or products more feasible, this would still be much more computationally intensive and require more computing resources. The model would need to account for how all the individual items are combined into the model. For example, the model would need to address substitutions between a larger number of more specific items. Also, the model is likely to prioritize large amounts of a small number of items that are especially healthy and low-cost. Constraints or other adjustments might be needed to ensure the market basket includes a variety of items, which is both recommended by dietary guidelines and preferred by most people.¹⁵ It would take some time and effort to build this change into the model and test it, as CNPP has not used it before. If CNPP were to make this change, it may be most feasible to use an intermediate level of aggregation, instead of trying individual products through UPCs.

3. Level of effort

Once adopted, this approach should streamline the optimization modeling process, ultimately saving time and resources. However, it would be time-intensive at first because CNPP would need to consider the factors discussed above when designing and testing the model. The study team estimates this would be a **moderate** level of effort.

D. Summary and comparison to alternative approaches

Although the optimization model is complicated, the numerous constraints and other elements reflect carefully established solutions. Many of the constraints are in place to ensure the model produces a market basket that meets dietary guidance and is practical for SNAP recipients to consume. The optimization model with revisions was the option preferred second most commonly by the panelists (after the purchase-based approach and above the menu-based approach), with panelists noting that the optimization-based approach, as currently used, works well in practice and meets all requirements of the TFP reevaluation

¹⁵ The model would also need to retain a continuous approach, even if it produces results that are difficult to interpret (for example, having 0.1 units of an item that can realistically only be bought in increments of 1). Introducing nonlinear components would make the model much harder to solve.

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Appendix A.

Task Approach and Expert Panel Members

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Section A provides more detail on the task approach that was first discussed in Chapter I, and Section B provides the names, affiliations, and backgrounds of the expert panel members.

A. Task approach

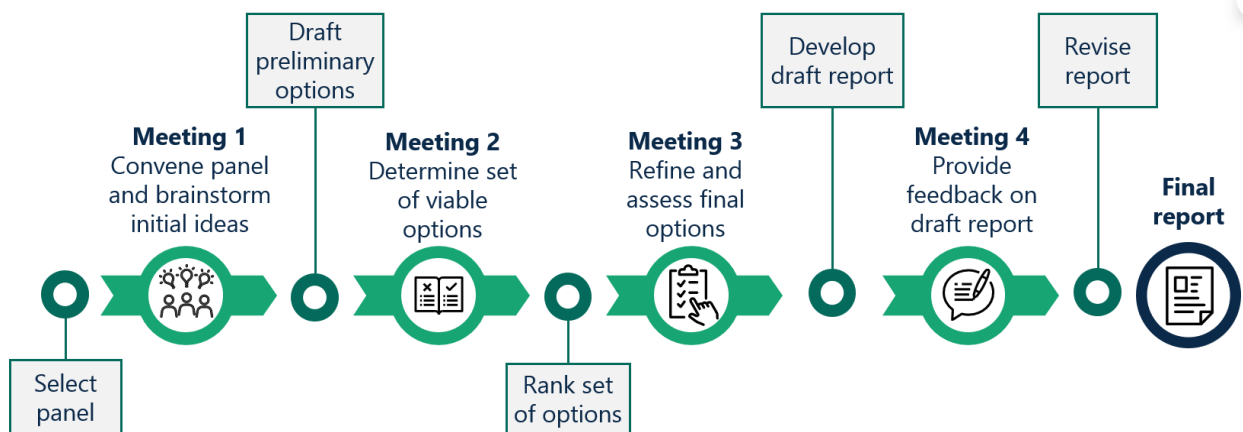
A critical component of the task was convening an expert panel. The study team put together a list of 21 potential expert panel members, including nutritionists, economists, and general methodologists. CNPP had two requirements for selecting expert panelists:

- Panelists should be academics in order to promote objective, neutral viewpoints.
- Current members of the 2025 Dietary Guidelines Advisory Committee should not be included because the Guidelines are used in developing the TFP.

The study team selected six experts for the panel. The study team reached out to these experts, screened them for any conflicts of interest, and secured agreements to participate.

After the expert panel was assembled, the study team convened four meetings between February and June 2024 (Exhibit A.1).

Exhibit A.1. Overview of task approach



Meeting 1. After task kickoff, the study team discussed criteria with CNPP and assembled the list of potential expert panelists, then CNPP and the study team agreed on which experts to reach out to. Once the panel members had all agreed to participate, the study team scheduled the first meeting for late February 2024. After introductions and a presentation by CNPP about the TFP methodology, the study team led a brainstorming activity to come up with options for reevaluating the TFP.

Meeting 2. After the first meeting, the study team prepared an informal summary of the ideas mentioned at the first meeting, along with some potential new options. The study team sent those to the expert panel and scheduled the second meeting for early April. For this meeting, the expert panelists discussed each option in more detail, responding to specific questions from the study team. The panelists also provided initial information about the advantages and disadvantages of the options and which options seemed most promising from each of their perspectives.

Meeting 3. To prepare for the third meeting, the study team sent a summary of the options discussed to the expert panelists and asked each panelist to rank the options from most to least promising. The study team scheduled the third meeting for early May. On this call, the expert panelists answered additional questions from the study team and provided additional details about the options they had each ranked as most promising, including considerations around data sources and feasibility.

Meeting 4. Following the third meeting, the study team used the information gathered during discussions with the expert panelists to draft this options report. The study team sent the draft report to the expert panelists to review before the fourth meeting, which was scheduled for mid-June. During this meeting, the expert panelists provided their respective feedback on the report. Following this meeting, a short survey of the expert panelists was conducted. This survey solicited feedback from each panelist regarding their preferred ranking of options, the extent to which they considered each option to be promising, along with their rationale for their ratings.

Final report. After receiving feedback from the expert panelists, the study team updated the report and submitted it to CNPP for review. After revising it in response to CNPP's comments, the study team finalized the report.

B. Expert panel members

Exhibit A.2 lists the name, affiliation, and relevant background of each of the six experts who participated in the panel.

Exhibit A.2. Expert panel members

Name	Affiliation	Relevant background
<p>Dr. Tatiana Andreyeva Ph.D., policy analysis</p>	<p>Department of Agricultural & Resource Economics, University of Connecticut</p>	<ul style="list-style-type: none"> • Director of Economic Initiatives at the Rudd Center for Food Policy and Health • Expertise in food choices and diet, including food prices and taxation • Leads the Rudd Center's work to evaluate the effects of federal food assistance programs on food insecurity, diet quality, and access to healthy food in at-risk communities
<p>Dr. Timothy Beatty Ph.D., agricultural and resource economics</p>	<p>Department of Agricultural and Resource Economics, University of California, Davis</p>	<ul style="list-style-type: none"> • Expertise in empirical analysis of human consumption behavior • Research focus includes food consumption and the demand for nutrition and health, at both the household and aggregate levels • Former co-editor of the <i>American Journal of Agricultural Economics</i>
<p>Dr. Andrew Gelman Ph.D., statistics</p>	<p>Department of Statistics, Columbia University</p>	<ul style="list-style-type: none"> • Current Higgins Professor of Statistics, professor of political science, and director of the Applied Statistics Center • Expertise in Bayesian data analysis, hierarchical models, and estimating small effects • Broad research interests spanning quantitative methods in surveys, experimental design, statistical inference, and computation

Appendix A Task Approach and Expert Panel Members

Name	Affiliation	Relevant background
<p>Dr. Lisa Harnack Dr. of Public Health, public health, nutrition</p>	<p>School of Public Health, University of Minnesota</p>	<ul style="list-style-type: none"> • Director of the Nutrition Coordinating Center • Expertise in food and nutrient databases, nutrition surveillance, public health nutrition, and dietary assessment
<p>Dr. Edward Jaenicke Ph.D., agricultural and natural resource economics</p>	<p>Department of Agricultural Economics, Sociology, and Education, Pennsylvania State University</p>	<ul style="list-style-type: none"> • Professor of agricultural economics • Expertise in economic modeling of food purchase behavior, retail food product offerings and prices, organic food and agriculture, and understanding the link between food behavior and health
<p>Dr. Lorrene Ritchie Ph.D., nutritional sciences, registered dietitian</p>	<p>Division of Agriculture and Natural Resources, University of California</p>	<ul style="list-style-type: none"> • Director of the Nutrition Policy Institute and cooperative extension nutrition specialist • Expertise in nutrition education and behavior, nutrition and hunger in the population, and nutrition policies and programs • Research focuses on the development of interdisciplinary, science-based, and culturally relevant solutions to poor diet and food security

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Appendix B.

Lower-Priority Options for Reevaluating the TFP

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This appendix describes options for reevaluating the TFP that were discussed during meetings with the expert panel but not included in the main report. The panelists ranked these alternatives to the current optimization model as less promising or feasible than those presented in the main report (Box B.1). Sections A through C briefly describe each approach and its potential advantages, followed by the rationale for considering the approach to be less promising than the three top options.

Box B.1. Lower-priority options

- Diet simulation-based option
- Agent-based microsimulation option
- Generative AI option▲

A. Diet simulation-based option

1. Description and advantages

Under this option, CNPP would develop thousands of simulated diets composed of foods and beverages widely available and consumed in the United States. The next step would be to analyze the costs of these hypothetical diets to establish a minimum (or otherwise appropriate) cost required to achieve varied diets that meet nutritional guidelines. The simulation could have features added to obtain diets that realistically reflect consumption patterns among households with low incomes in the United States. For example, commonly consumed foods or lower-cost foods could be given a higher probability of selection in each simulated diet. The simulation could also be structured so that healthier foods would be more likely to be selected. Existing data sources on purchasing or consumption, prices, and nutrition and dietary guidance would be needed, but the actual diets would be generated through the simulation.

This option demonstrates the feasibility of purchasing healthy diets for a certain level of resources. The simulation approach generates a large number of diets that meet nutritional criteria and then examines the cost distribution to find the cost for the TFP. Because the output would be structured as diets based on specific foods, it would be easier to understand and interpret compared with the current optimization model or other models that end up with a market basket by averaging items or food categories.

2. Rationale for considering lower-priority option

Many of the simulated diets would be noticeably different than actual consumption patterns. Without specifying additional constraints, the simulated diets may not be practical or palatable.

B. Agent-based microsimulation option

1. Description and advantages

This option involves developing an agent-based microsimulation model in which simulated agents (individuals or households with varying preferences and dietary needs) determine their food and beverage consumption patterns. After the model is calibrated to achieve results that align with actual food consumption, it would be altered to restrict food choices to lower-cost baskets that align with dietary guidelines.

This approach has the potential to answer existing and novel policy questions. It would account for heterogeneous tastes, different dietary needs, time, convenience, variety, food availability, and other aspects of individual decision making among individuals and households.

2. Rationale for considering lower-priority option

This option is likely to be complex and sensitive to the many modeling decisions and parameters that must be made and set. Although the economics literature includes many examples of agent-based modeling, it is used less frequently now because it is so dependent on the modeling decisions. In addition, it would require a large amount of time and effort.

C. Generative AI option

1. Description and advantages

This option would use generative artificial intelligence (AI) as a tool for creating diets and menus meeting certain constraints of the TFP. AI models would likely draw on various sources of information available online, such as model menus and shopping lists. They could also incorporate information on costs, preferences, and nutrition constraints. Retail grocers have explored this approach to produce shopping lists that fit within specified budgets.

This approach has the potential to fulfill the goal of TFP by weighing costs, preferences, and other factors by synthesizing large amounts of data. It could be done relatively quickly and with less effort than other approaches.

2. Rationale for considering lower-priority option

The current state of AI modeling in general is likely too limited for this to be a feasible approach today. For example, substantial effort would need to be made to train a generative AI model to produce realistic and palatable menus that adhered to the TFP reevaluation requirements. This effort would be necessary because publicly available models are unable to differentiate between the quality of the information they use as input sources, which could bias the types of menus developed. AI methods also lack documentation and replicability. However, the field is changing rapidly, so this option could become more feasible in the future.

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