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# FAPRI-MU Model Documentation for Estimating Supplemental Nutrition Assistance Program Expenditures and Benefits

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The authors of this report are Hoa Hoang (HoangH@missouri.edu), Pat Westhoff (WesthoffP@missouri.edu) and Wyatt Thompson (ThompsonW@missouri.edu).

## Introduction

This report documents a model that estimates benefits and budgetary costs of the Supplemental Nutrition Assistance Program (SNAP). SNAP, formerly the Food Stamp program, is the nation's largest nutrition program and the largest program of any type operated by the U.S. Department of Agriculture (USDA). According to Congressional Budget Office's estimate, federal expenditures on SNAP account for about 80% of the projected Farm Bill program spending over the course of the next 10 years (CBO, 2021).[1]

To better understand policy impacts on households as well as federal expenditures on the program, we develop a system of equations to project SNAP participation and expenditures. Model equations estimate the number of people eligible for SNAP benefits, the proportion of people who participate in the program, monthly benefit levels and total budgetary costs of the program. These variables are projected ten years into the future to support forward-looking program assessment and decision making. This SNAP outlook starts from the agricultural and related market projects published routinely by the Food and Agricultural Policy Research Institute at the University of Missouri (FAPRI-MU). More specifically, we utilize macroeconomic projections published by IHS Markit and food price projections from the Agricultural Markets and Policy (AMAP) team at the University of Missouri based on the FAPRI-MU outlook.[2] Historical and current data are drawn from data series and reports published by government agencies such as USDA's Food and Nutrition Service, the Bureau of Labor Statistics and the Census Bureau. We use econometric regressions to estimate equation parameters but seek to maintain a balance between statistical and economic significance. We do not attempt to replicate statistical procedures that previous studies utilized for analyzing specific economic relationships historically, however we ensure that behavioral equations are consistent with program operations and key findings in the literature.

## How SNAP works

The main purpose of SNAP is to provide additional resources for low-income households to purchase food. As a counter-cyclical program, SNAP participation has been inversely correlated with the health of the economy. Federal- and state-level policies toward program eligibility and benefits also affect participation to a great extent. To be eligible for the program, a household first must meet the threshold for gross income. After deducting for eligible expenses such as shelter and child care costs, household net income must be below the federal poverty guidelines for the respective household size. The Thrifty Food Plan (TFP), which is intended to reflect the minimum cost to acquire a healthy diet, is used to establish maximum SNAP benefit levels. As a supplemental nutrition program, it is expected that a household should spend 30% of their net income on food, with SNAP making up the difference between that amount and the cost of the TFP. Therefore, the actual benefit receipt for most households with non-zero net income would be calculated as the difference between the maximum benefit level and the intended out-of-pocket spending.

By law, the maximum benefit levels are strictly tied to changes in USDA's estimate of the cost of the Thrifty Food Plan. In normal years, maximum benefit levels for each household size are adjusted for annual inflation in the cost of the TFP. To be precise, benefits for a fiscal year beginning on October 1 are based on benefits in the previous year and TFP inflation between June of the previous year and June of the current calendar year. Benefit levels are also sometimes subject to temporary increases as part of a policy response to mitigate the impact of economic recessions. For example, the maximum benefit level for one-person household was raised by 16% between 2008 and 2009 and fixed at $200 from 2010 to 2013 owing to the American Reinvestment and Recovery Act. During the COVID-19 pandemic, the maximum benefit levels were going through two major updates: a temporary 15% increase starting in

[1] Congressional Budget Office (CBO). (2021). Baseline Projections for Selected Programs. Available at https://www.cbo.gov/data/baseline-projections-selected-programs.

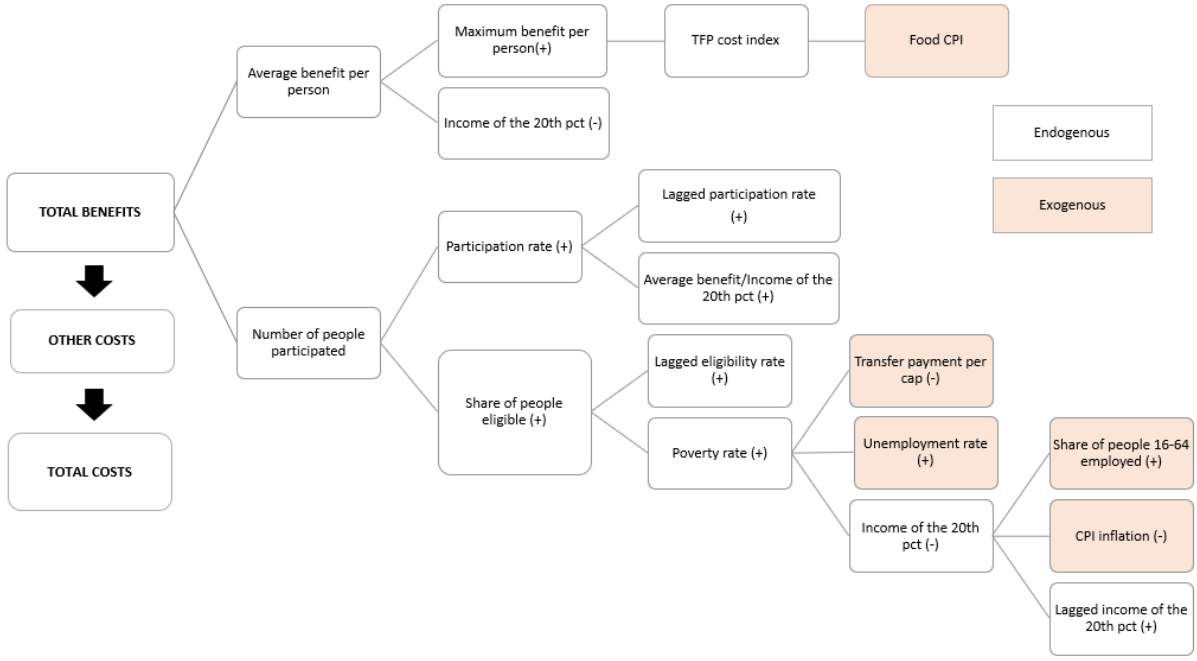
[2] The Food and Agricultural Policy Research Institute at the University of Missouri (FAPRI-MU). FAPRI-MU Baseline Outlook. Available at https://www.fapri.missouri.edu/publications/outlook/

January 2021 and as soon as it expired, a 21% increase compared to the level before USDA reevaluated the TFP in 2021 (USDA, 2021).[3]

To better reflect the real increase in the cost of TFP and therefore the purchasing power of SNAP benefits in the projected years, we develop a proxy for the TFP by constructing a TFP index, which is the weighted index of the CPIs for key food-at-home (FAH) items including meats, cereals and breads, dairy, fruits and vegetables and other FAH products. The weight for each major food group is based on the respective expenditure share estimated in the 2021 Thrifty Food Plan (USDA, 2021).

Our model is a system of equations driven by endogenous and exogenous variables (Figure 1). The endogenous variables, which are estimated, include poverty rates, the income of households in the lowest quintile, program eligibility, participation rates, average benefits, TFP index, and maximum benefit levels. Exogenous macroeconomic variables that drive the system include labor market indicators, transfer payment, and general inflation.

Figure 1: Model flowchart.




Notes: The flow chart runs from right (exogenous factors) to left (key program indicators). Signs in each box (- or +) denote the expected relationship with the respective dependent variable on the left-hand side. Pct denotes percentile.

[3] U.S. Department of Agriculture. Thrifty Food Plan, 2021. August 2021. FNS-916. Available at https://FNS.usda.gov/TFP.

## Model Variables

| Variable | SOURCE | UNITS | Averages | |
|---|---|---|---|---|
| | | | 2002-2011 | 2012-2021 |
| **Unemployment rate** | IHS Markit | Percent | 6.5 | 5.7 |
| **Employment** | IHS Markit | Millions | 141.0 | 150.0 |
| **Population** | IHS Markit | Millions | 300.5 | 324.8 |
| **Population over 16** | IHS Markit | Millions | 235.4 | 259.6 |
| **Population 16-64** | IHS Markit | Millions | 197.3 | 209.3 |
| **Labor force under 65** | IHS Markit | Millions | 145.1 | 149.7 |
| **Real disposable income per capita** | IHS Markit | Thousand 2012 dollars | 37.2 | 42.9 |
| **Nominal disposable income** | IHS Markit | Billion dollars | 10068.9 | 14865.7 |
| **Nominal disposable income per capita** | Calculated | Dollars | 33421.5 | 45683.8 |
| **Transfer payment** | IHS Markit | Billion dollars | 1769.8 | 3059.7 |
| **Government transfer per capita** | Calculated | Dollars/person | 4492.8 | 5949.1 |
| **Consumer price index (CPI) - All urban** | IHS Markit | 1982-84 = 1 | 2.0 | 2.5 |
| **Annual CPI Inflation** | Calculated | Percent | 2.4 | 1.9 |
| **Consumer food CPI** | AMAP | 1982-84 = 100 | 201.1 | 251.6 |
| **Food CPI annual change** | Calculated | Percent | 2.8 | 2.9 |
| **Food at home (FAH) CPI** | AMAP | 1982-84=100 | 199.7 | 241.6 |
| **FAH CPI annual change** | AMAP | Percent | 2.7 | 2.8 |
| **Cereal and Bakery** | AMAP | 1982-84=100 | 225.9 | 274.9 |
| **Meat** | AMAP | 1982-84=100 | 191.9 | 252.1 |
| **Dairy** | AMAP | 1982-84=100 | 189.4 | 221.2 |
| **Fruit and Vegetables** | AMAP | 1982-84=100 | 254.6 | 297.1 |
| **Other Food At Home** | AMAP | 1982-84=100 | 176.2 | 210.6 |
| **TFP index** | Calculated | 1982-84=100 | 307.9 | 315.1 |
| **TFP index annual change** | Calculated | Percent | 2.5 | 2.4 |

| Variable | SOURCE | UNITS | Averages | |
|---|---|---|---|---|
| | | | 2002-2011 | 2012-2021 |
| *Other calculated variables* | | | | |
| **Mean household income at the 20th percentile, real** | Census | 1990 Dollars | 7043.3 | 7018.4 |
| **Mean household income at the 20th percentile, nominal** | Census | Dollars | 10922.9 | 13234.9 |
| **Percent of population below the poverty line** | Census | Percent | 13.2 | 12.8 |
| **Percent of population eligible** | Calculated | Percent | 14.2 | 15.9 |
| **Number of people eligible** | Calculated | Millions | 42.8 | 51.5 |
| **Participation rate** | USDA | Percent | 66.7 | 83.8 |
| **Average participation** | USDA | Millions | 28.9 | 43.1 |
| **Average monthly benefit per person** | USDA | Dollars per person | 102.9 | 139.4 |
| **Total benefits** | USDA | Billion dollars | 37.5 | 71.9 |
| **All other costs** | Calculated | Billion dollars | 2.9 | 4.4 |
| **Total program costs** | USDA | Billion dollars | 40.4 | 76.3 |
| **Maximum monthly benefit for one-person household** | USDA | Dollars | 164.7 | 197.8 |
| **Share of population over 16 employed** | Calculated | Percent | 59.9 | 57.8 |
| **Share of population 16-64 employed** | Calculated | Percent | 68.8 | 67.4 |
| **Real average benefits** | Calculated | 1982-84=100 | 50.8 | 55.2 |
| **Average benefits/20th percentile of income** | Calculated | Percent | 11.3 | 12.6 |
| **Average benefit/Maximum benefit** | Calculated | Percent | 63.9 | 70.1 |
| **Share of population receiving SNAP benefits** | Calculated | Percent | 9.6 | 13.3 |

## Equations

| **Real household income at the 20th percentile** | | **2013-19 elasticity** |
|---|---|---|
| **-3021.09** | Intercept | |
| **119.33** | Share of people 16-64 employed | 1.16 |
| **-70.10** | CPI inflation | -0.02 |
| **0.29** | Lag of real household income at the 20$^{th}$ percentile/1000 | |
| | | |
| **Percent of population below the poverty line** | | |
| **28.39** | Intercept | |
| **-2.43** | Real household income at the 20$^{th}$ percentile/1000 | -1.32 |
| **0.29** | Unemployment rate | 0.11 |
| **-0.01** | Real transfer payment/1000 | -0.004 |
| | | |
| **Maximum monthly benefit for a one-person household** | | |
| **1** | Maximum Benefit (t-1)*TFP index inflation of the preceding FY | |
| | | |
| **Average monthly benefit per person** | | |
| **-23.19** | Intercept | |
| **0.80** | Maximum monthly benefit per person | 1.22 |
| **-0.40** | Nominal household income at the 20$^{th}$ percentile/1000 | -0.04 |
| | | |
| **Percentage of people eligible** | | |
| **-0.98** | Intercept | |
| **0.97** | Percent of the population below the poverty line | 0.78 |
| **0.11** | Lag(Percentage of population eligible) | |
| | | |
| **Participation rate** | | |
| **8.05** | Intercept | |
| **0.61** | Ratio of average benefits to nominal household income at the 20$^{th}$ percentile | 0.09 |
| **0.81** | Lag(Participation rate) | |
| | | |
| **Total participants** | | |
| **1** | Participation rate*Number of people eligible | |
| | | |
| **Total benefits** | | |
| **1** | Total participants * Average monthly benefits * 12/1000 | |
| | | |
| **All other costs** | | |
| **0.03** | Total benefits | |
| **0.95** | CPI-All Urban | |
| | | |
| **Total costs** | | |
| **1** | **Benefits + All other costs** | |