United States Department of Agriculture

Statistical properties of the Purchase to Plate Crosswalk: A comparison of Healthy Eating Index scores across Federal surveys

Federal Committee on Statistical Methodology

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The findings and conclusions in this presentation are those of the authors and should not be construed to represent any official USDA or U.S. Government determination or policy. This research was supported by the U.S. Department of Agriculture's Economic Research Service and Center for Nutrition, Policy and Promotion. Findings should not be attributed to IRI.

Purchase to Plate Team

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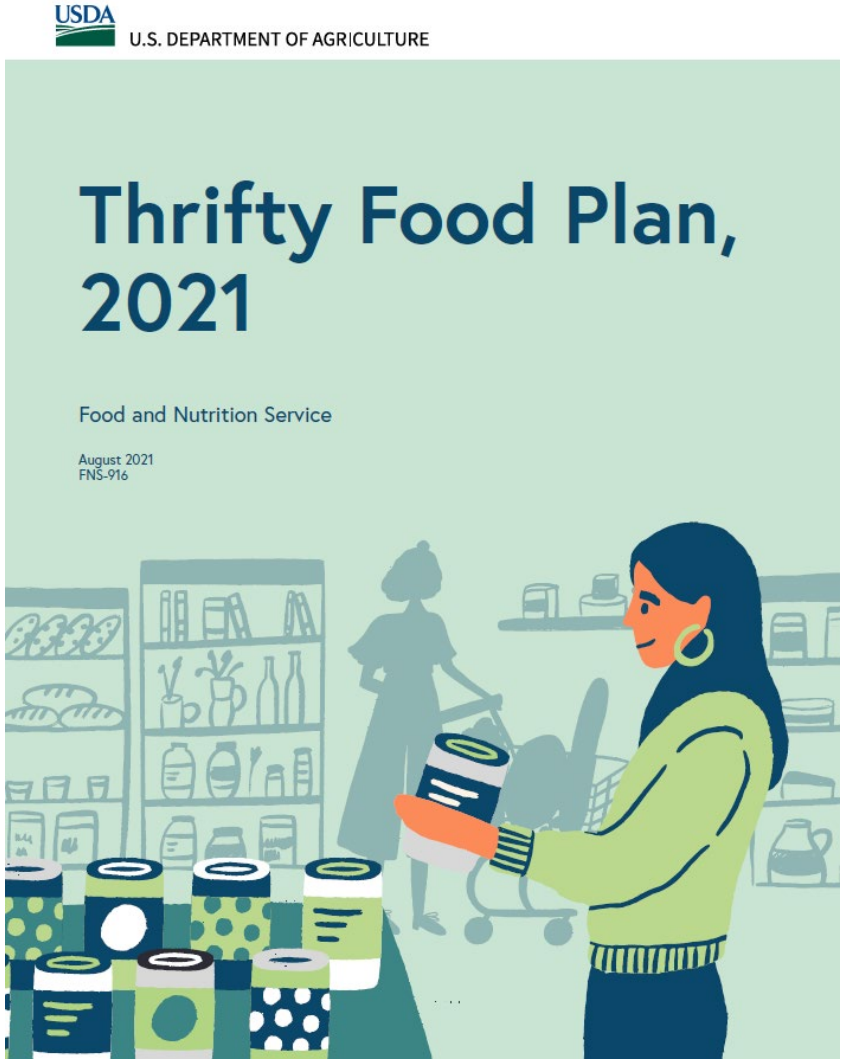
TFP Market basket update



- Current:
  - Food composition
  - Consumption patterns
  - Dietary guidance
  - Food prices
- Approved scientific methods

Current Research – Retail Food Purchases

- Interactions between
  - Food environment and HEI
  - Local media coverage and HEI
  - Self reported chronic diseases, food environment, and HEI
  - HEI over time/seasonality
  - Income and HEI over full distribution
  - Dollar stores and HEI
- Who purchases healthy food?
- Added sugar purchases – overview

Purchase to Plate Suite

- Purchase to Plate Crosswalk (PPC):
  - Allows scanner data users to measure the healthfulness of store purchases
- Purchase to Plate Price Tool (PPPT):
  - Allows users to estimate custom prices for NHANES foods
- Purchase to Plate Ingredient Tool (PPIT):
  - Breaks NHANES foods back into ingredients, based on U.S. retail food purchases

Development of the Purchase to Plate Crosswalk

An evolving process

Data Sets for the Purchase to Plate Suite

- Food Scanner data 

- USDA Food and Nutrient Database for Dietary Studies

Food (at home) Scanner Data

- Retail point-of-sale (POS) data
  - Purchase transaction records collected from store POS systems
- Household scanner data
  - Household-scanned purchases
  - Linked with household demographics
- Product information
- Store information

Photo credit: USDA

Food and Nutrient Database for Dietary Studies (FNDDS)

- Nutrient values for foods reported consumed by What We Eat in America (WWEIA) participants
- A set of "recipes" for nutrient calculation
- "ingredients" in recipes are not necessarily purchasable in stores
- Updates every two years:
  - New foods reported/developed
  - Changes in methodology

Scanner Data (n=350,000)



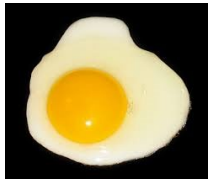




FNDDS (n=10,000)



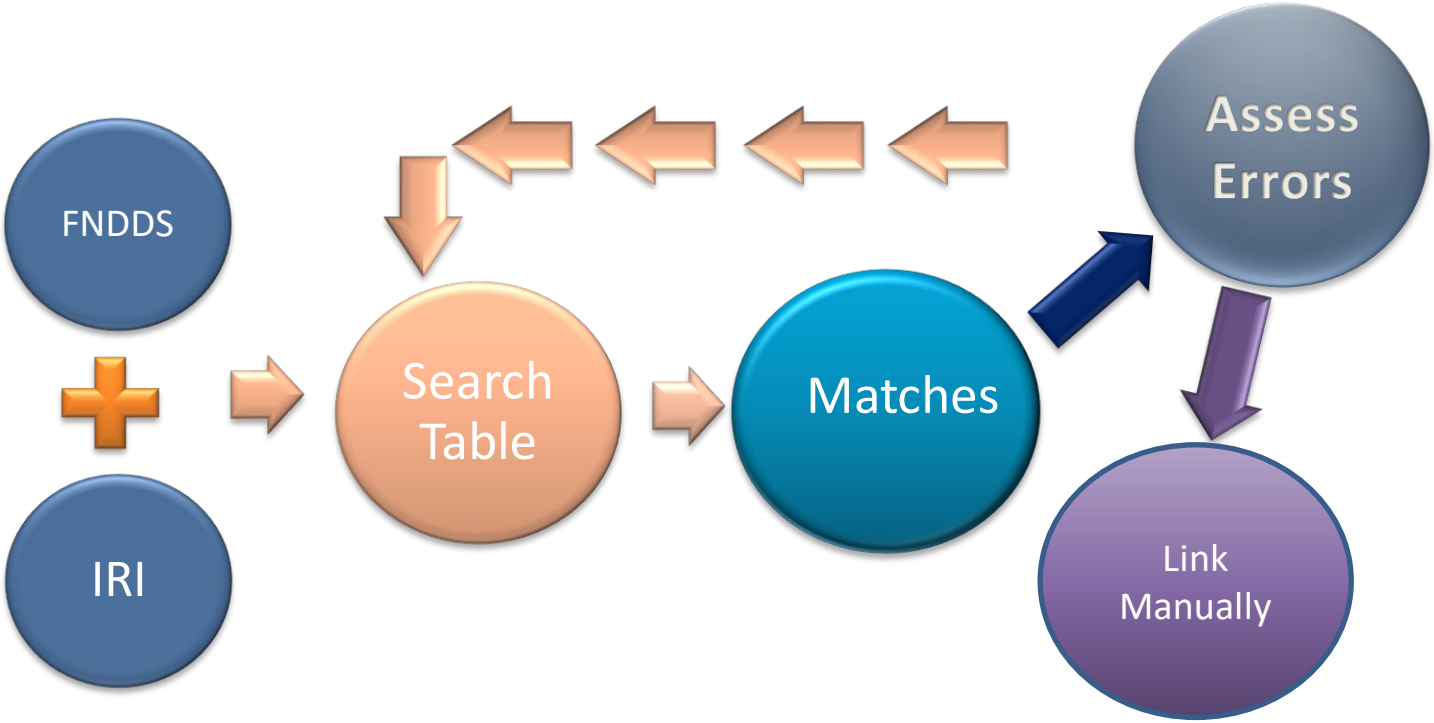




Scanner and USDA data are different

Difference	IRI Scanner Data 2015-16	FNDDS 2015-16
Primary use	Market research	Support WWEIA nutrition monitoring and research in NHANES.
Number of items	500,000	12,000
Database structure	Wide- many blank columns	Long – not consistent information
Form of item (product weight)	Purchase form (weight can include both edible and non-edible parts)	Raw or cooked (weight does not include inedible parts)

Methods


FNDDS
IRI
Search Table
Matches
Assess Errors
Link Manually

Linking methods

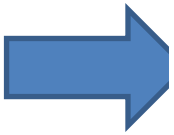
- Round 1: FNDDS 2011-12
  - Completely semantic and probabilistic matches all at once
  - Arranged both IRI and FNDDS items into more homogenous groups
  - USDA and contractors reviewed a sample of matches
- Round 2: FNDDS 2013-14
  - Started with semantic tables from previous round
  - Used the IRI product dictionary categories
  - Limited probabilistic matching to two rounds before going to hand-match
  - Contractor reviewed every match; USDA reviewed a sample
- Round 3: FNDDS 2015-16
  - Extreme time pressure
  - Fewer UPCs, but percent of sales match close
  - Used previous semantic table
  - Developed validation plan for prices derived from the match
- Round 4: FNDDS 2017-18
  - Assumed correct matches from previous round were correct in new round
  - Price validation method continued to identify mismatches
- Round 5: FNDDS 2019-20
  - Big changes to data
  - More homogenous matching groups

Yield Factors are UPC-based

350,000 yield factors from:

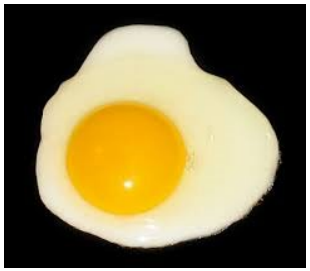
- FNDDS
- Other government sources
- Agriculture Handbook 102
- Market Checks

Purchase to Plate Price Tool



NHANES and WWEIA

- NHANES – National Health and Nutrition Examination Survey
  - 5,000 individuals each year
  - Released in 2-year cycles
  - Detailed medical exam
- What We Eat in America (WWEIA)
  - Two 24-hour dietary recalls
  - Nutrition data for foods as ingested



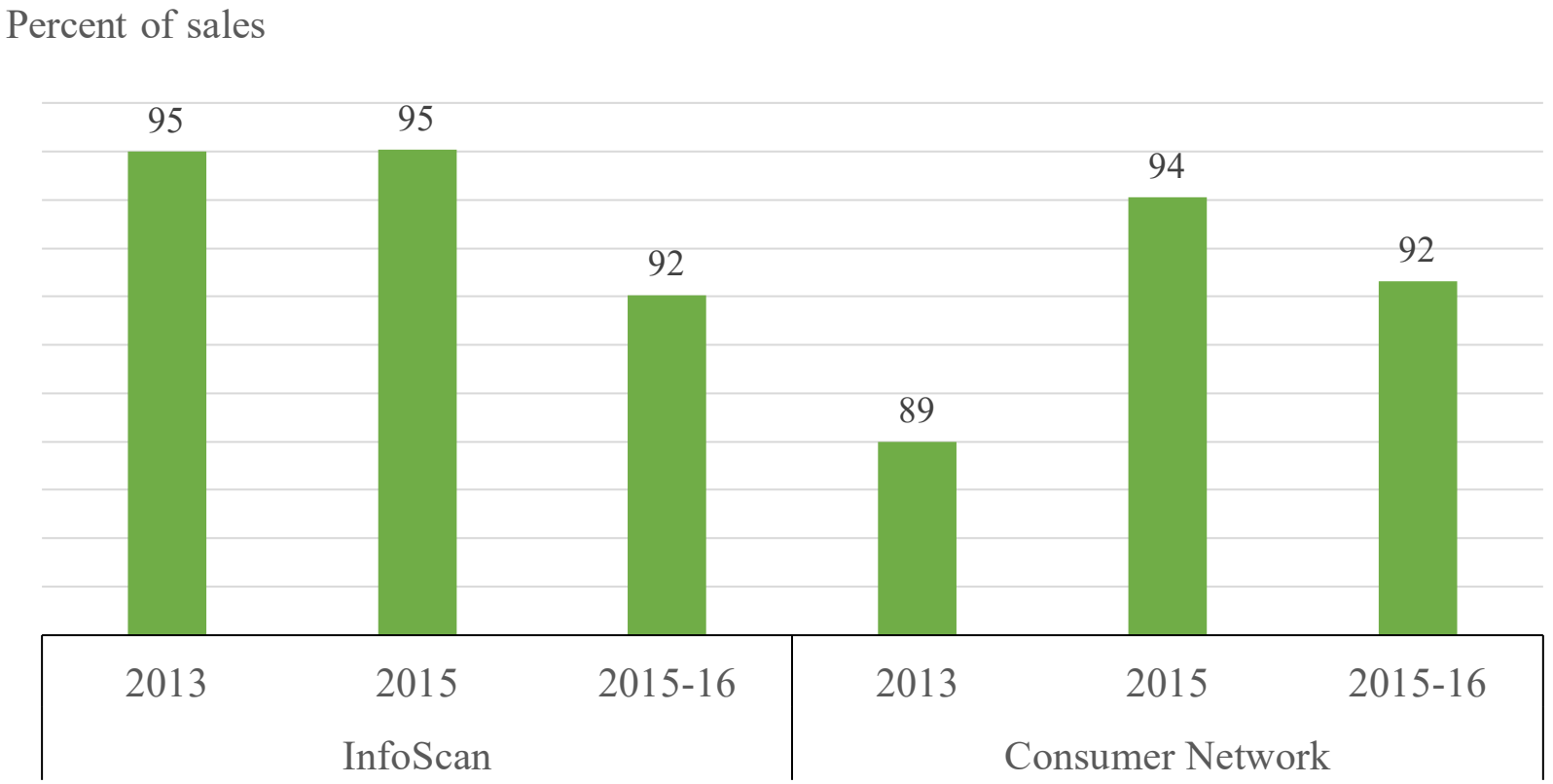
Recipes to price “as eaten” food

- Ingredients used are purchased from stores
- Convenience foods used
- Almost all foods prepared in 30 minutes or less

Validation of the Purchase to Plate Crosswalk

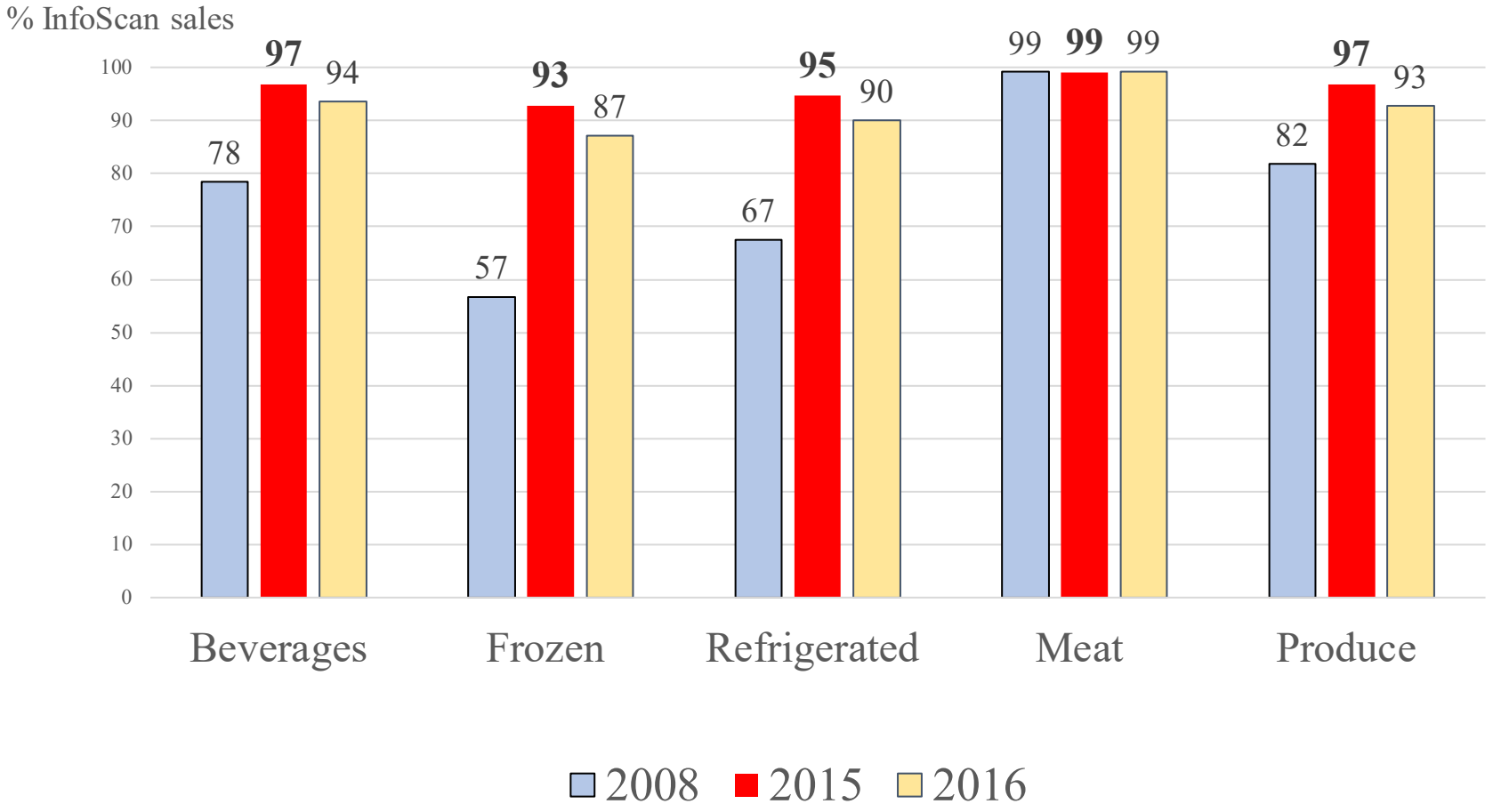
Allows scanner data users to import the nutrition data from the USDA Nutrition Data

Coverage of the PPC



Source: ERS using IRI Infoscan and The Consumer Network 2013, 2015, 2016

Coverage of 2013-14 PPC in Selected Years



Healthy Eating Index

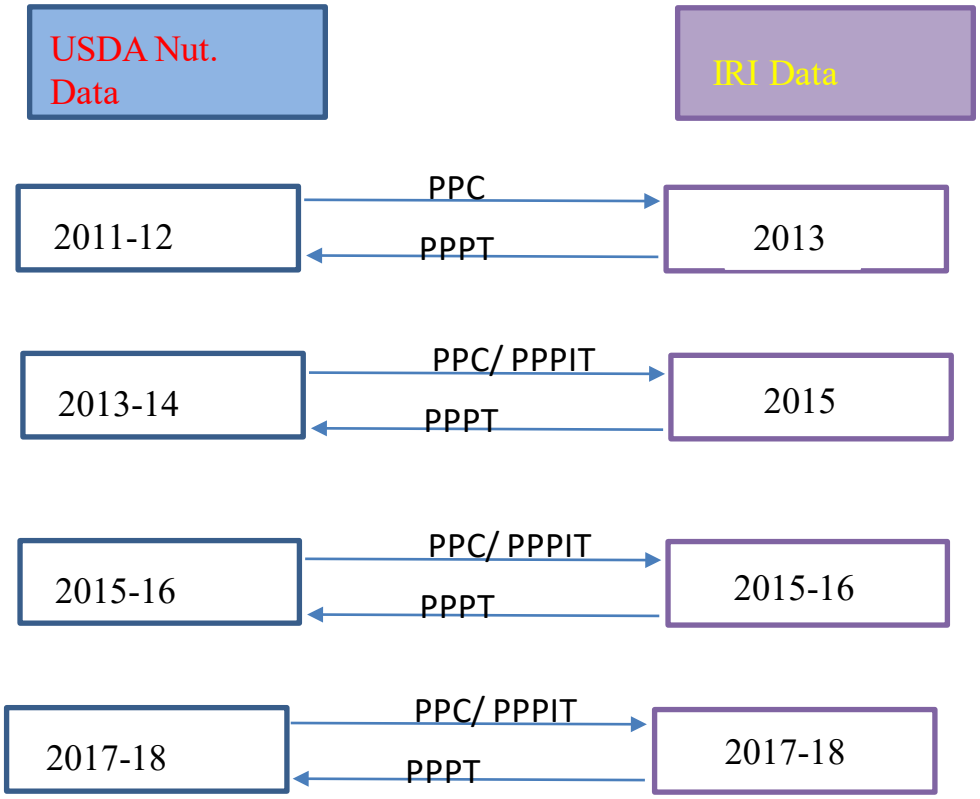
- Measure of compliance with the *U.S. Dietary Guidelines for Americans*
- Used by economists, nutritionists, and epidemiologists
- Updated when the DG'S updated
- HEI – 2015 is the most current
- 100 total points
  - 13 components
  - Higher score = better compliance

https://epi.grants.cancer.gov/hei/

HEI–2015 COMPONENT	MAXIMUM	STANDARD FOR MAXIMUM SCORE	STANDARD FOR MINIMUM SCORE OF ZERO
ADEQUACY (higher score indicates higher consumption)			
Total Fruits	5	≥ 0.8 cup equiv. / 1,000kcal	No fruit
Whole Fruits	5	≥ 0.4 cup equiv. / 1,000kcal	No whole fruit
Total Vegetables	5	≥ 1.1 cup equiv. / 1,000kcal	No vegetables
Greens and Beans	5	≥ 0.2 cup equiv. / 1,000kcal	No dark-green vegetables, beans, or peas
Whole Grains	10	≥ 1.5 ounce equiv. / 1,000kcal	No whole grains
Dairy	10	≥ 1.3 cup equiv. / 1,000kcal	No dairy
Total Protein Foods	5	≥ 2.5 ounce equiv. / 1,000kcal	No protein foods
Seafood and Plant Proteins	5	≥ 0.8 ounce equiv. / 1,000kcal	No seafood or plant proteins
Fatty Acids	10	(PUFAs + MUFAs) / SFAs ≥ 2.5	(PUFAs + MUFAs) / SFAs ≤ 1.2
MODERATION (higher score indicates lower consumption)			
Refined Grains	10	≤ 1.8 ounce equiv. / 1,000kcal	≥ 4.3 ounce equiv. / 1,000kcal
Sodium	10	≤ 1.1 gram / 1,000kcal	≥ 2.0 grams / 1,000kcal
Added Sugars	10	≤ 6.5% of energy	≥ 26% of energy
Saturated Fats	10	≤ 8% of energy	≥ 16% of energy

https://epi.grants.cancer.gov/hei/

Purchase to Plate Suite

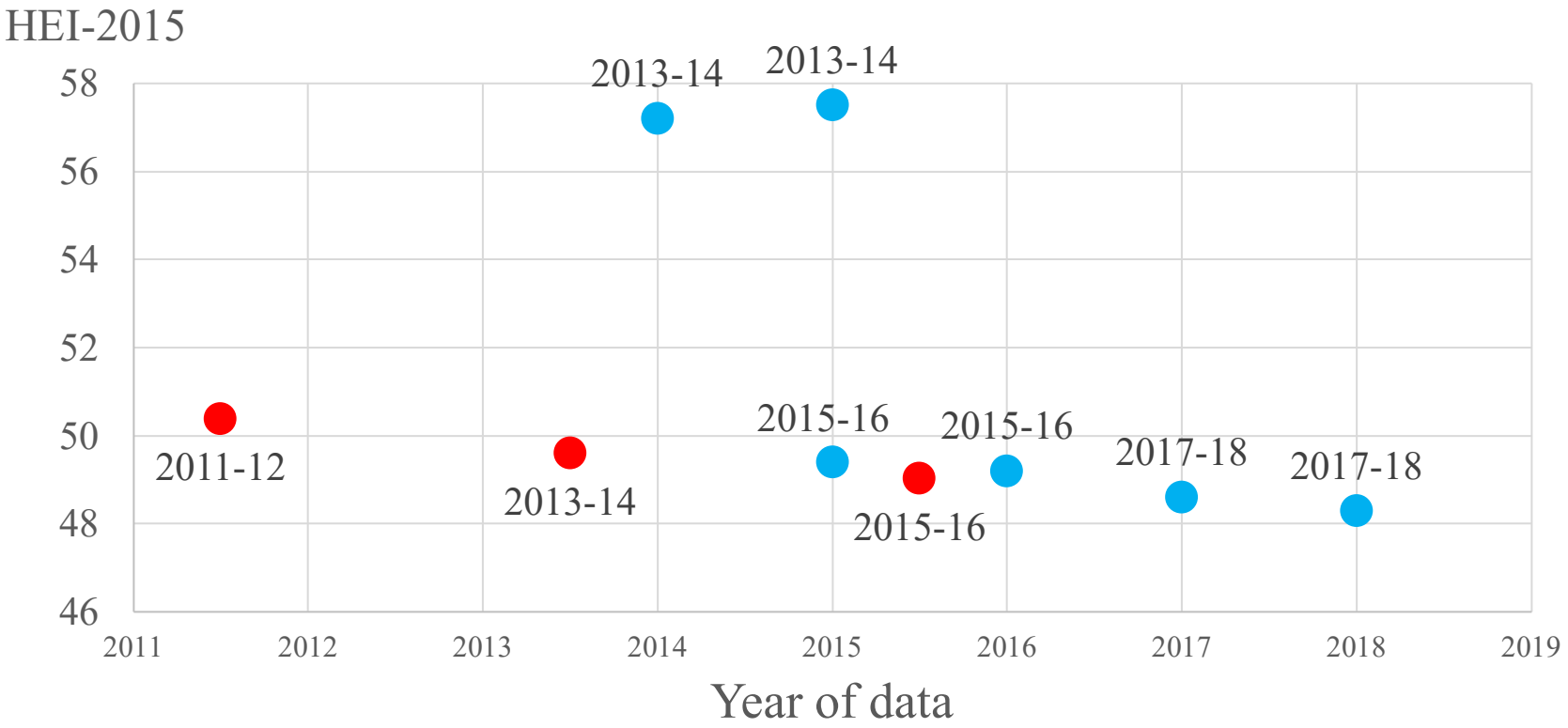


PPC – Purchase to Plate Crosswalk imports FNDDS/FPED data into scanner data

PPPT – Purchase to Plate Price Tool estimates prices for NHANES/WWEIA foods

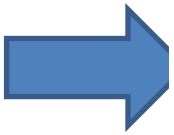
PPPIT – Purchase to Plate Ingredient Tool estimates the purchase weight for ingredients in NHANES/WWEIA foods

Comparison of HEI-2015 Scores



NOTE: Data labels indicate the version of the FNDDS used for the calculation

Verification of Purchase to Plate Price Tool



Purchase to Plate National Average Prices for NHANES (PP-NAP)

- Compare average food category price changes to CPI
  - Chicken/Eggs 2015/16
  - Ice Cream 2017/18

- Compare estimated expenditure using WWEIA dietary recall
  - BLS Consumer Expenditure Survey
  - ERS Food Expenditure Series
    - Must assume food loss and sales tax
    - Annual expenditure higher in Food Expenditure Series
  - NHANES Flexible Consumer Behavior Survey
    - Must assume food loss and sales tax
    - Monthly expenditures within 95 percent confidence interval

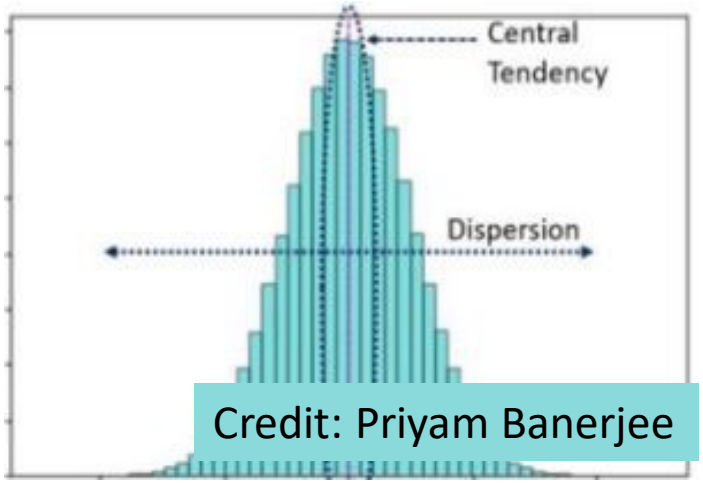
Next Steps: Statistical Properties across Time

Group foods to align with CPI categories:

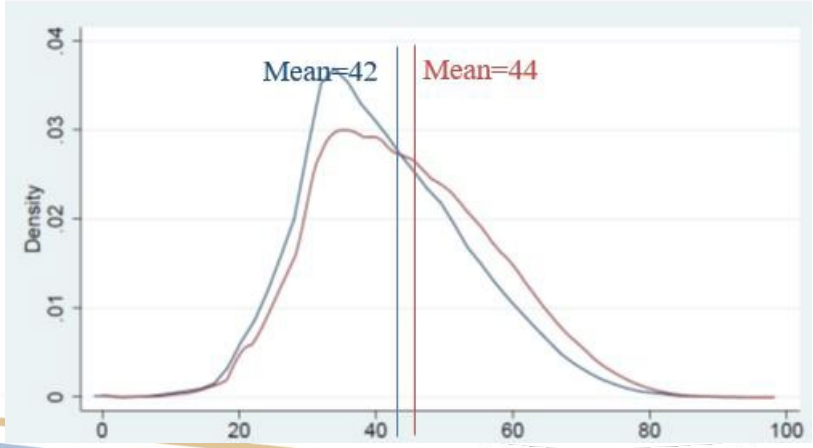
- May include only a subset of prices if food not in CPI
  - Foods prepared at home
- Establish which parts of PP-NAP track with inflation, and which do not.

Statistical Properties Between Data Sets

- More detailed comparisons to
  - BLS Consumer Expenditure Series
  - ERS Food Expenditure Series
- Measures of central tendencies
- Measures of dispersion
- Measures of position



Credit: Priyam Banerjee



Limitations of the Purchase to Plate Suite

- PPC
  - Match rate varies by supermarket category.
  - Not tested with years other than creation year—check coverage rate of PPC and compare to other national estimates of HEI
- PPPT/PPIT
  - Price differences might be based on price calculation method.
  - Not fully tested with subdivisions of IRI data
  - Generates average prices which are not appropriate for most demand models
- Retail data:
  - 15% of stores; half of all retail food sales recorded in the Economic Census.
  - Purchases represent most large chains so breakdowns may not represent what is available at smaller and independent stores
  - Not all stores provide data to IRI or allow USDA access to it
- Household data:
  - Under reporting by participants
  - Does not use random weight data

Conclusions

1. HEI scores for the last two cycles (FNDDS 15-16 and 17-18) are consistent with findings from NHANES, suggesting we have a reasonable method.
2. Price changes across cycles combine inflation and methods.
3. Mean estimated daily food cost aligns with ERS data products

Next Steps

PPC

1. Complete the analysis for FNDDS 11-12, going back to 2008.
2. Include the Consumer Network (household) panel
3. Examine within consistency for household data: Do relative differences along key demographics align with NHANES?

PP-NAP

1. Group foods for CPI comparison
2. Include Consumer Expenditure Survey
3. Robustness checks on ERS Food Expenditure Survey and Flexible Consumer Behavior Module
    1. Food loss assumptions
    2. Food tax assumptions

Thank you

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IRI topic page:
https://www.ers.usda.gov/topics/food-markets-prices/food-prices-expenditures-and-establishments/using-proprietary-data/#iri

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