Innovations in Measuring the Economy – A New Approach to Price Statistics

Susan E. Fleck, PhD

Bureau of Labor Statistics

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What I will talk about

- Which price statistics: Import and Export Price Index measures

- The new approach – synopsis

- The Details
  - Why
  - What

- Thoughts on innovation in official statistics

- Disclaimer: This presentation includes research results that have been previously presented. The contents relate to a forthcoming change in the Import and Export Price Indexes that has been previously announced. More detailed information will be provided with the release of the December 13, 2024 MXPI news release. The information is being shared for statistical purposes, to inform interested parties, and to encourage discussion of work in progress.

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Price Statistics @ BLS

LABEL MARKET   PRICES   PAY AND BENEFITS   WORKPLACE SAFETY   WORKPLACE EFFICIENCY

# Import and Export Price Indexes

- Acronym: MXPIs

- Track monthly transaction price trends of products traded across U.S. borders
  - ▶ Top-level official measure is for all-goods (excludes services)

- Target population of MXPIs
  - ▶ Merchandise goods trade (100% goods coverage)
  - ▶ Air freight and passenger trade (~7% services coverage)

- Majority of trade is sampled
  - – Some spot prices and unit values used for world-priced commodities

Goods MXPI

- Principal Federal Economic Indicator

- Monthly publication

- Most recent prices are from previous month to publication

- Inputs to inflation-adjust U.S. Gross Domestic Product and Trade measures

U.S. Goods Trade by BEA End Use Category, September 2024
Millions of U.S. dollars
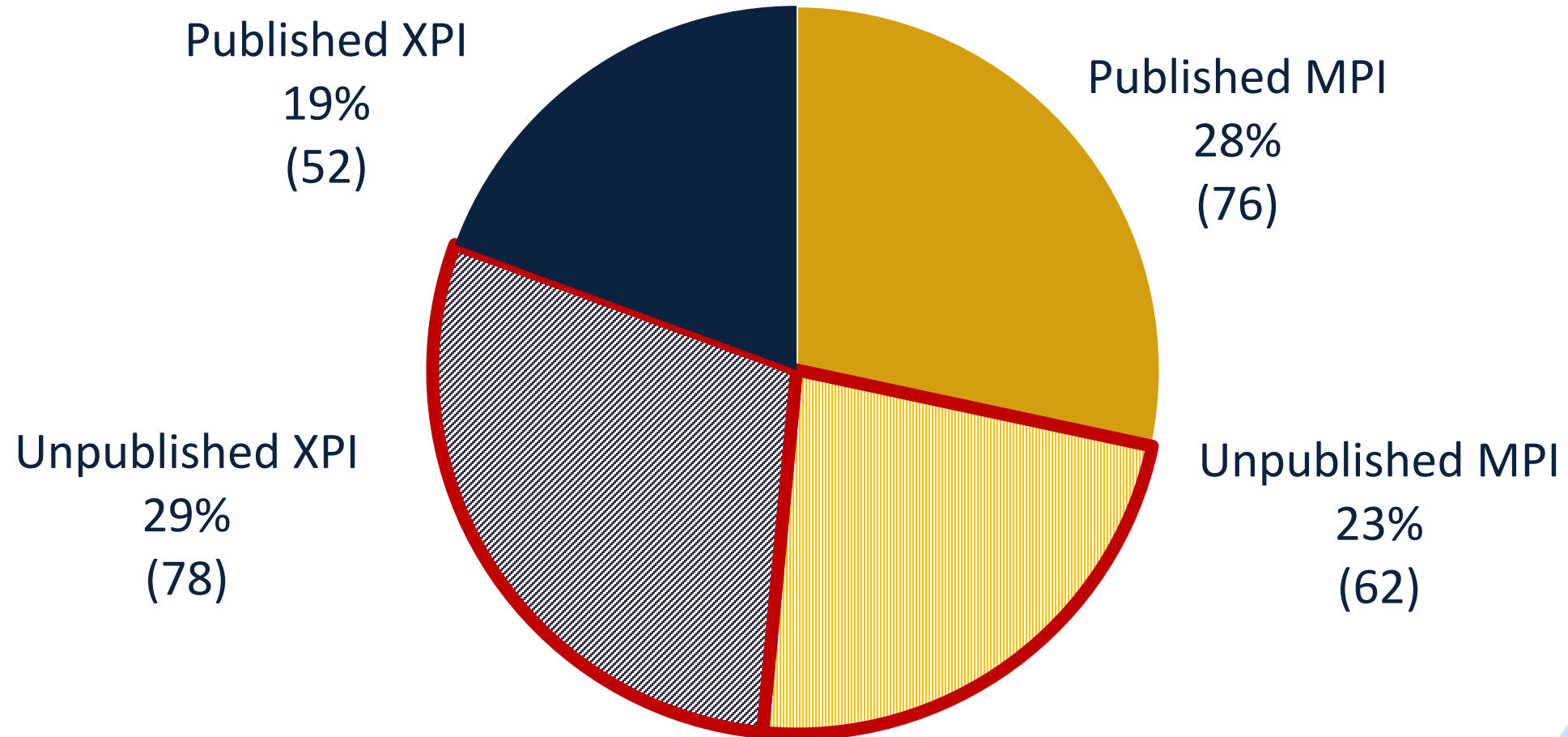

Imports ■ Exports ■
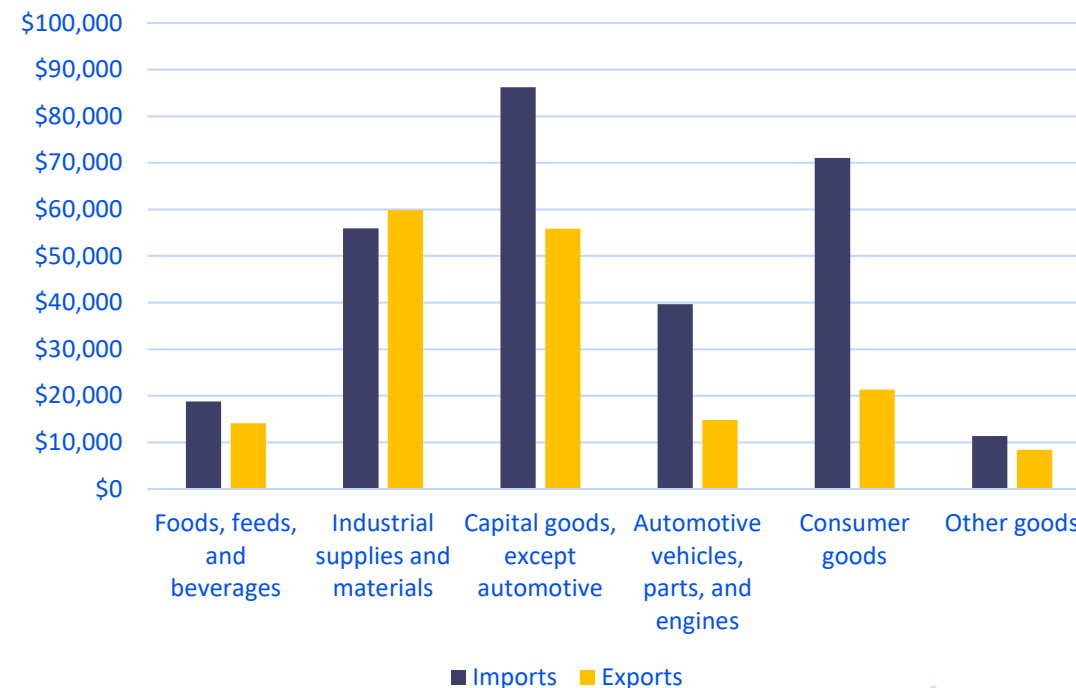
Source: U.S. Census Bureau, U.S. International Trade in Goods and Services (FT900)

Synopsis of the New Approach

Problem – Publish Very Few Detailed MXPIs

5-digit Detailed BEA End Use MXPI, N = 268

Published XPI
19%
(52)

Published MPI
28%
(76)

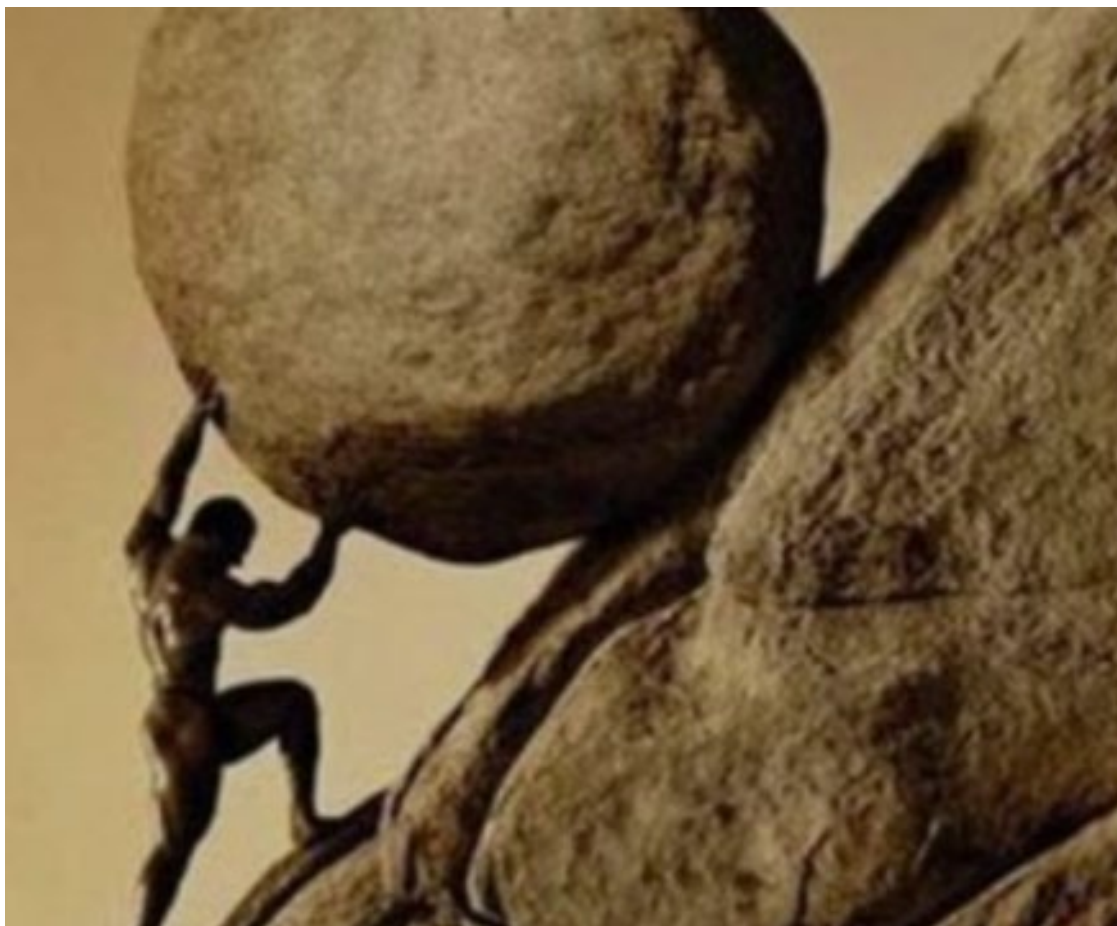Unpublished XPI
29%
(78)

Unpublished MPI
23%
(62)

Solution – Find More Prices

- Use sample frame for MXPI Survey

- As a data source for import and export prices

- Source: Administrative Trade Records from US Census and US Customs

U.S. Customs and Border Protection

Major Challenges

- Calculating unit values with trade records of large shipments creates biased measures
  - Price varies as result of shipping contents not market trends
- Finding a method to calculate MXPIs with unit values that does not cause a break in series

Main Improvements

- Reduce unit value bias
  - MARS
  - Coefficient of Variation
- Address bias:
  - Superlative index methodology using previous year's trade
  - Eliminates substitution and new goods bias
  - Captures just-in-time trade patterns
- Incorporate into current approach
  - Blend unit values with directly-collected prices
- Greatly expand # of MXPIs for data users
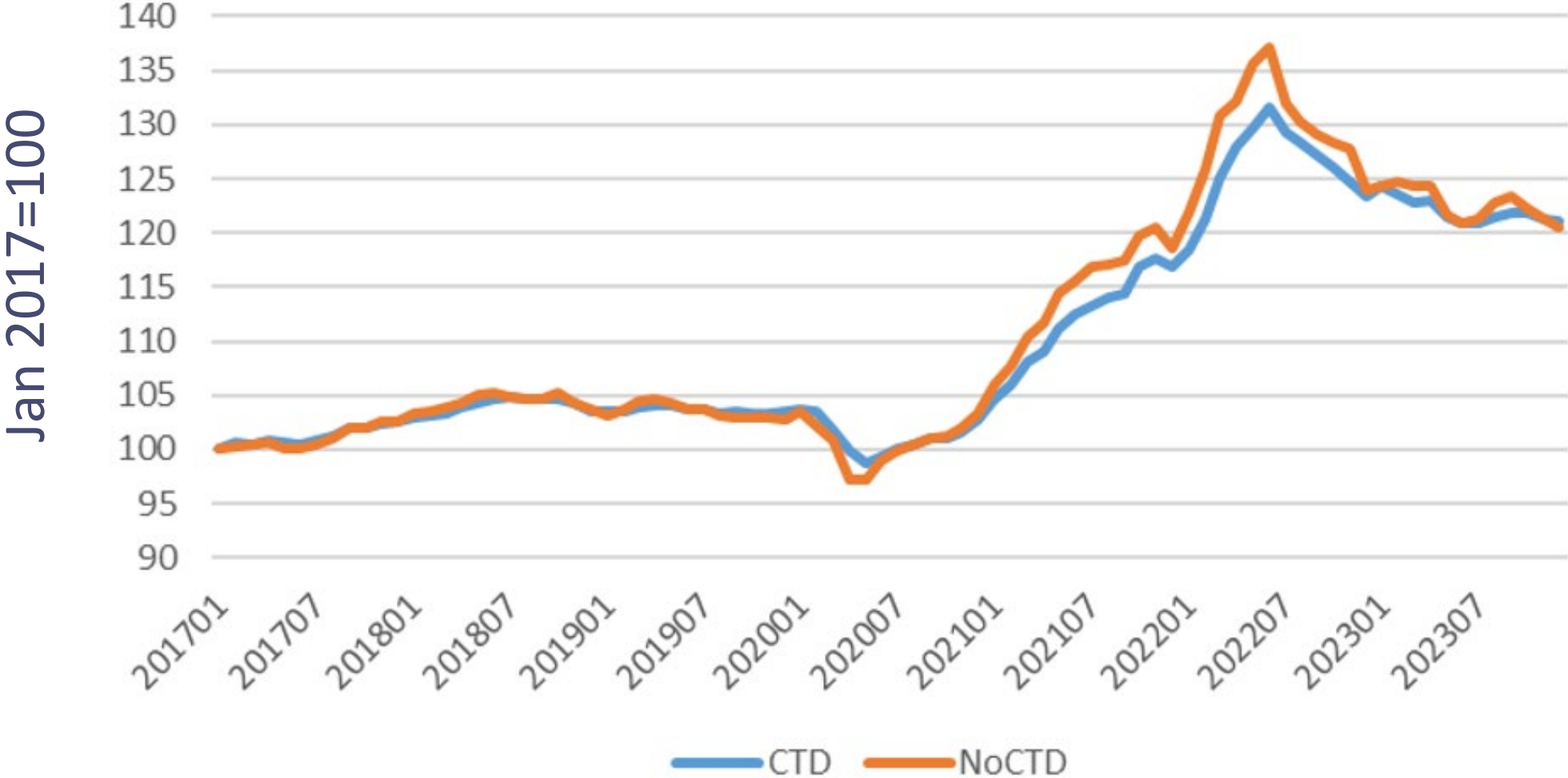
Comparison of Official and Blended MPI, All Goods
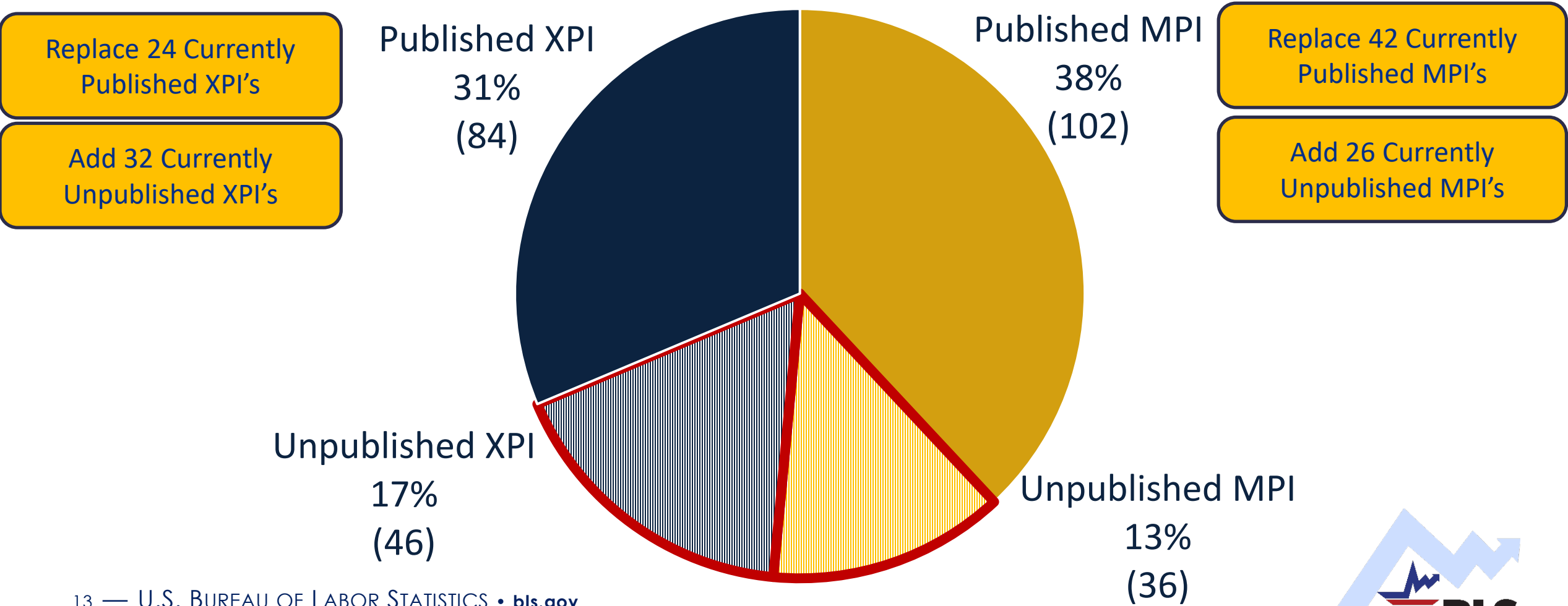## Jan 2017-Dec 2023
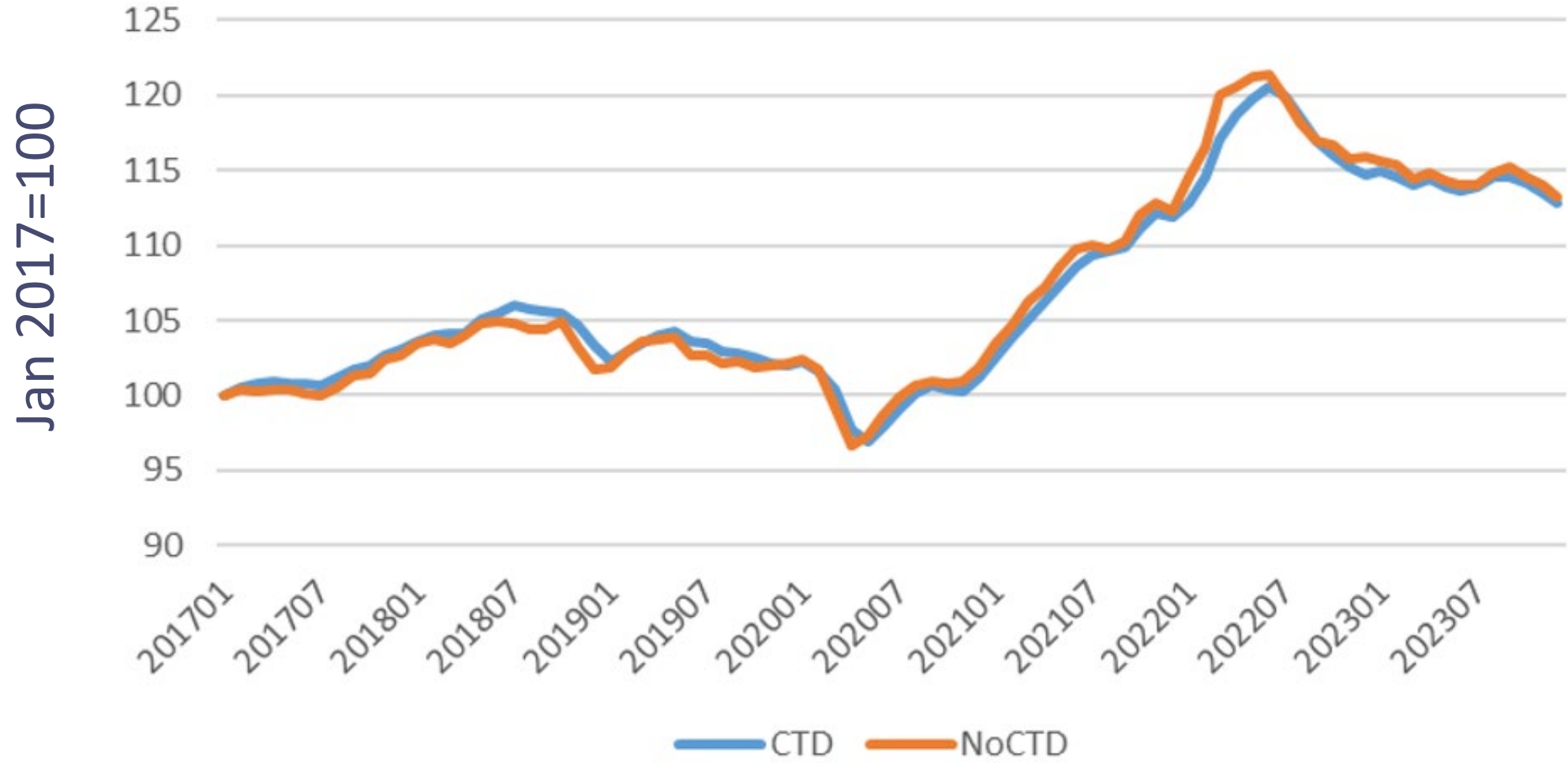
Comparison of Official and Blended XPI, All Goods
Jan 2017-Dec 2023

Expansion of Homogeneous MXPIs With Use of Census Trade Data

5-digit Detailed BEA End Use MXPI, N = 268

Replace 24 Currently Published XPI's

Add 32 Currently Unpublished XPI's

Published XPI
31%
(84)

Published MPI
38%
(102)

Replace 42 Currently Published MPI's

Add 26 Currently Unpublished MPI's

Unpublished XPI
17%
(46)

Unpublished MPI
13%
(36)

The Details – Why and What

The Problem

Survey collection
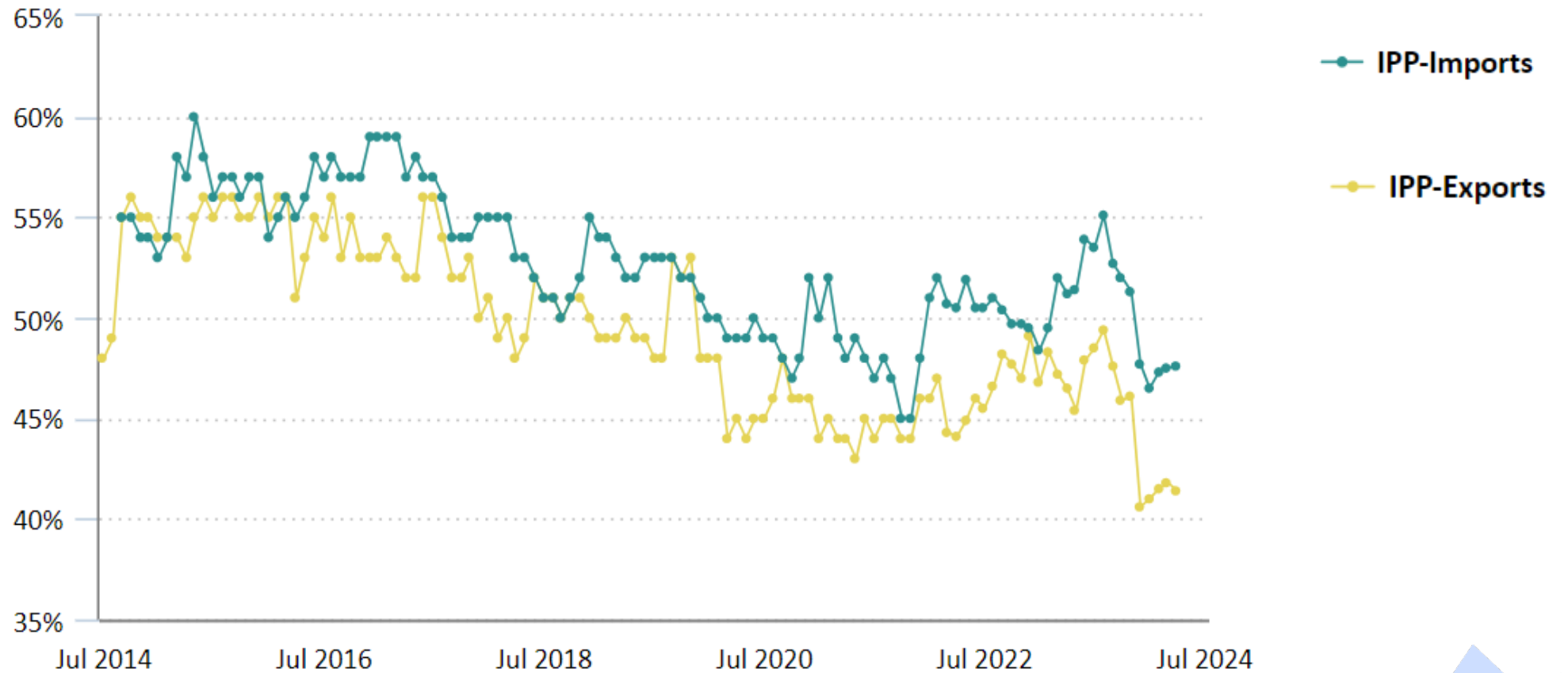## Difficulties with Data Collection

Impact on quality
Declining Response Rates

Impact on output
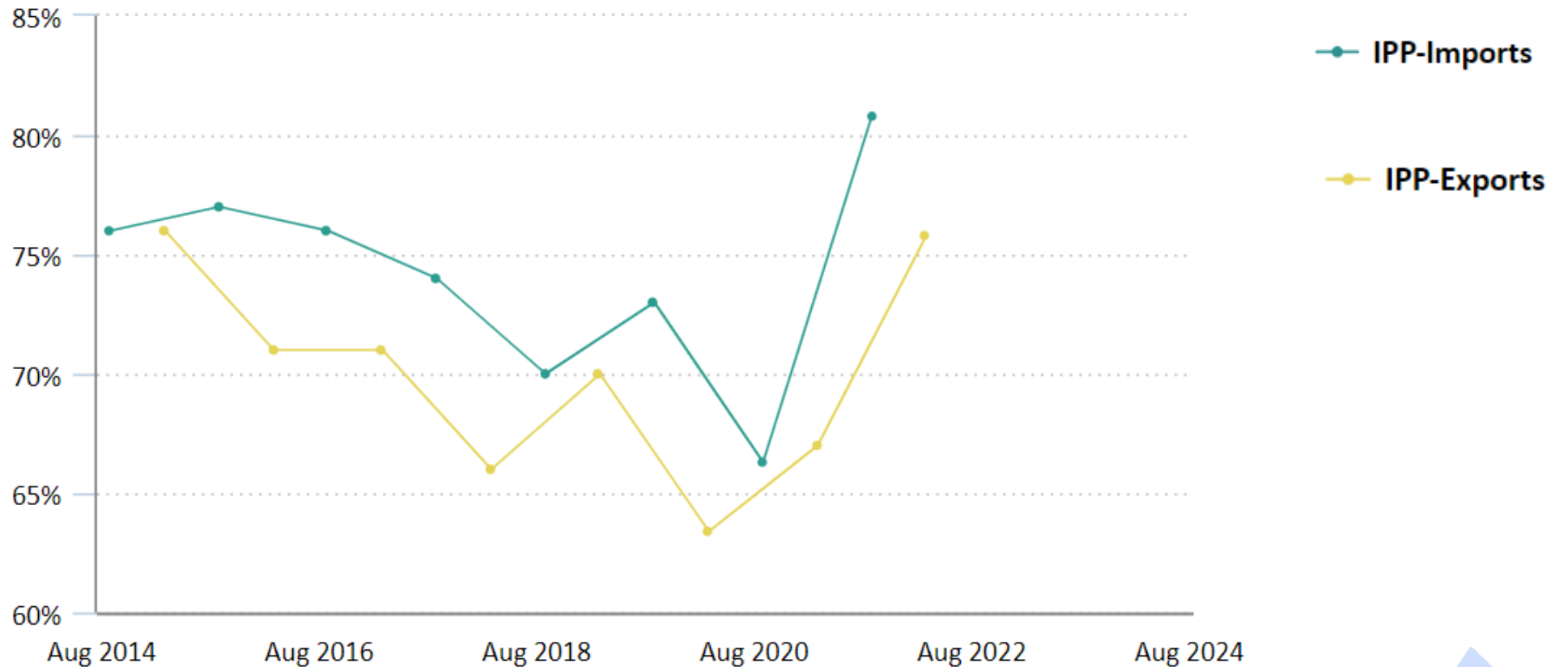## Fewer official measures of Import and Export Price Indexes

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Establishment Survey Unit Response Rates, MXPI

Jul 2014-Jul 2024

Source: BLS, Household and establishment survey response rates : U.S. Bureau of Labor Statistics

Establishment Survey Initiation Unit Response Rates by Sample, MXPI
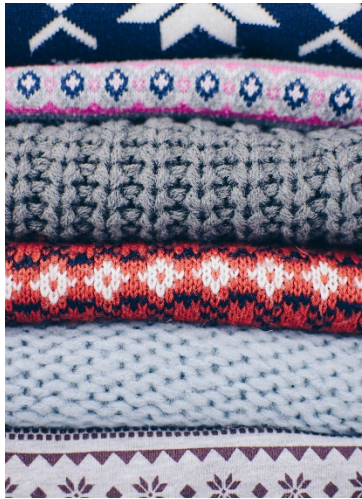## Jul 2014-Jul 2024

Source: BLS, Household and establishment survey response rates : U.S. Bureau of Labor Statistics

2022 values affected by COVID write off policy.

Survey Sample Process

The Solution: Census Administrative Trade Records

What is the Innovation?

■ Change from Survey Production to Data Production

■ New Data Source for Alt Data Prices replacing Survey Prices

■ Revised Concepts and Methods

■ New Outputs (not different, just a lot more)

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From Survey Production to Data Production

Current Approach

- Sampling
- Field Collection/Initiation of new respondents
- Continued monthly pricing of items from survey respondents
- Calculation and review of index estimates and variances
- Publication
- Maintaining current index structures and weights

New Approach w Census admin records

✓ Continue current approach for heterogeneous products

Change approach for homogeneous products

Replace first three steps

Process Census data for lower-level unit value indexes

Combine unit value indexes with directly-collected prices for MXPI calculation

From Sample Frame to Prices

Administrative Trade Records from US Census and US Customs

Dollar Value of Trade Covered by Census Trade Data, 2022
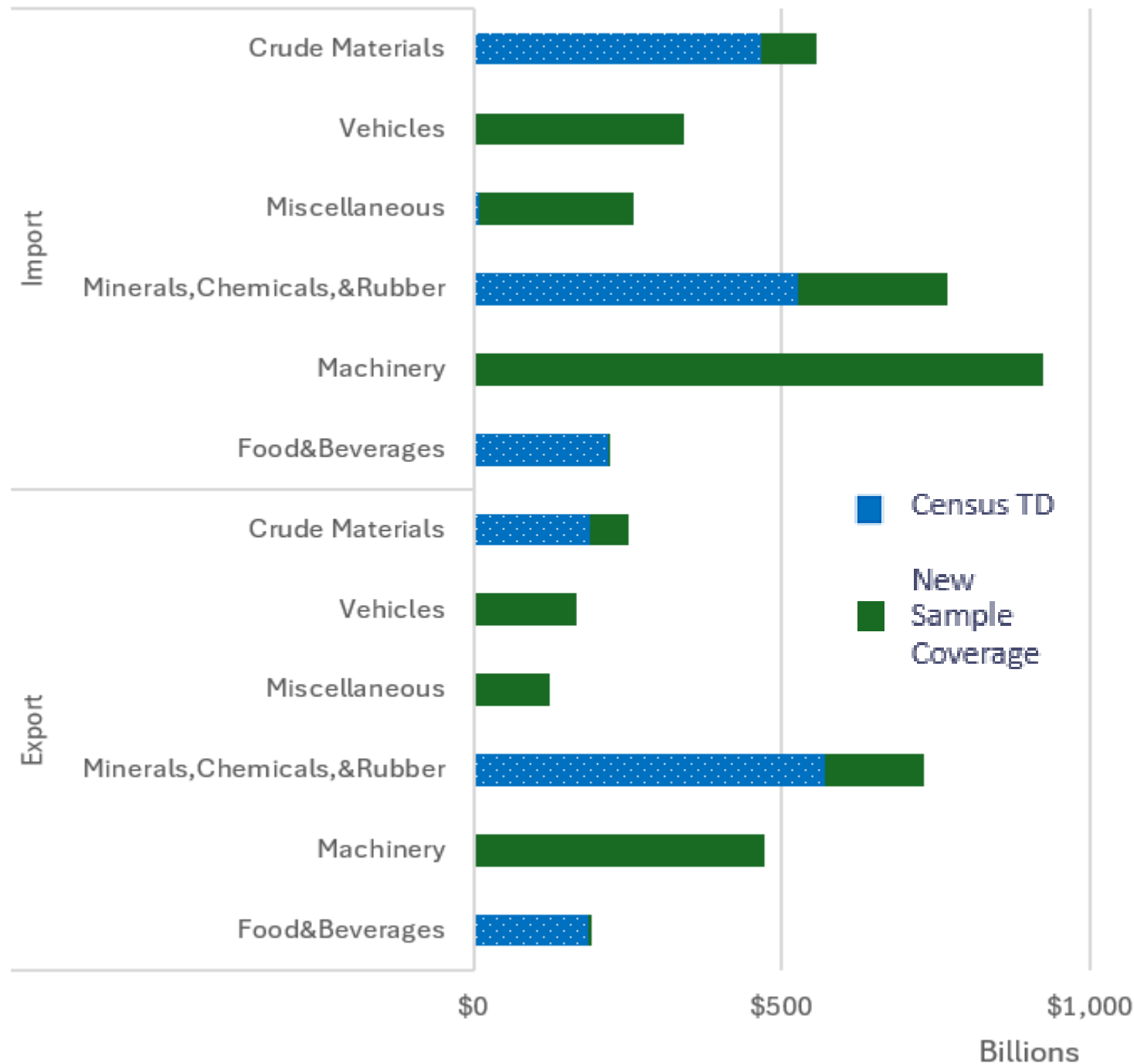
■ Exports - $1.96 trillion

 ▶ o/w $.945 trillion Census TD

 ▶ 48%

■ Imports - $3.1 trillion

 ▶ o/w $1.221 trillion Census TD

 ▶ 39%

Revised Concepts and Methods

- Price of shipment instead of one item

- Price covers full month instead of one transaction in the month

- Complete coverage instead of sample coverage

- Assign attributes for unique product varieties

- Use MARS method from Dutch CPI

- Use Coefficient of Variation for outlier removal

- Lower level superlative methodology

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Unit Values and Product Varieties

- Matched Model –
Actual Price of Unique
Item

- Unit Value – Average Price
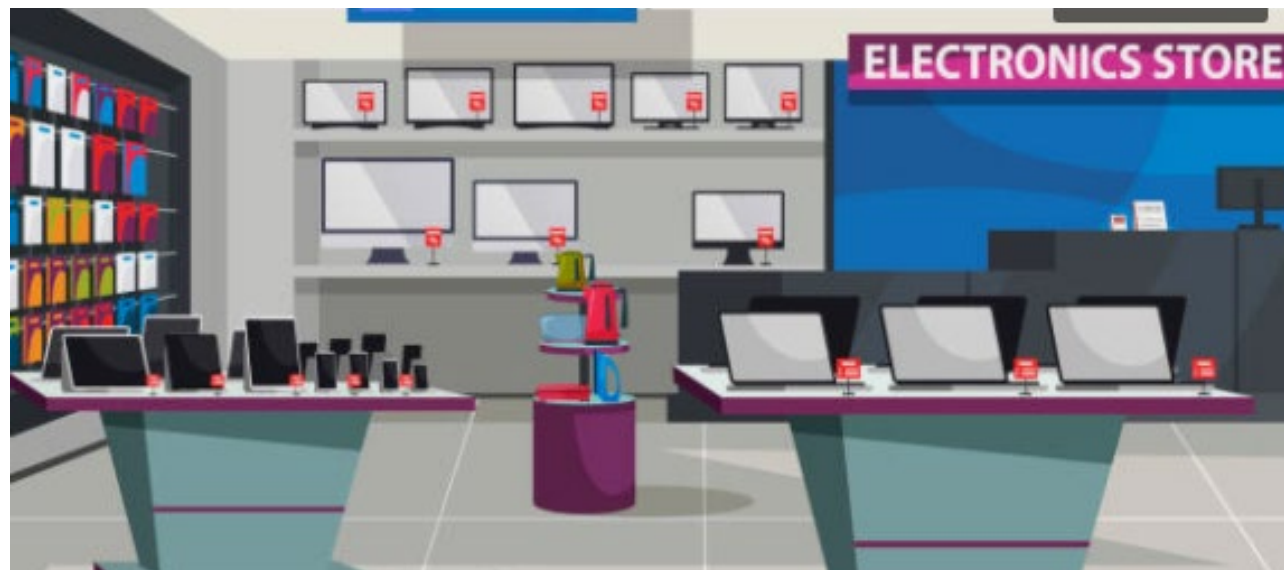of Similar Groups of Items

Unit Values and Product Varieties
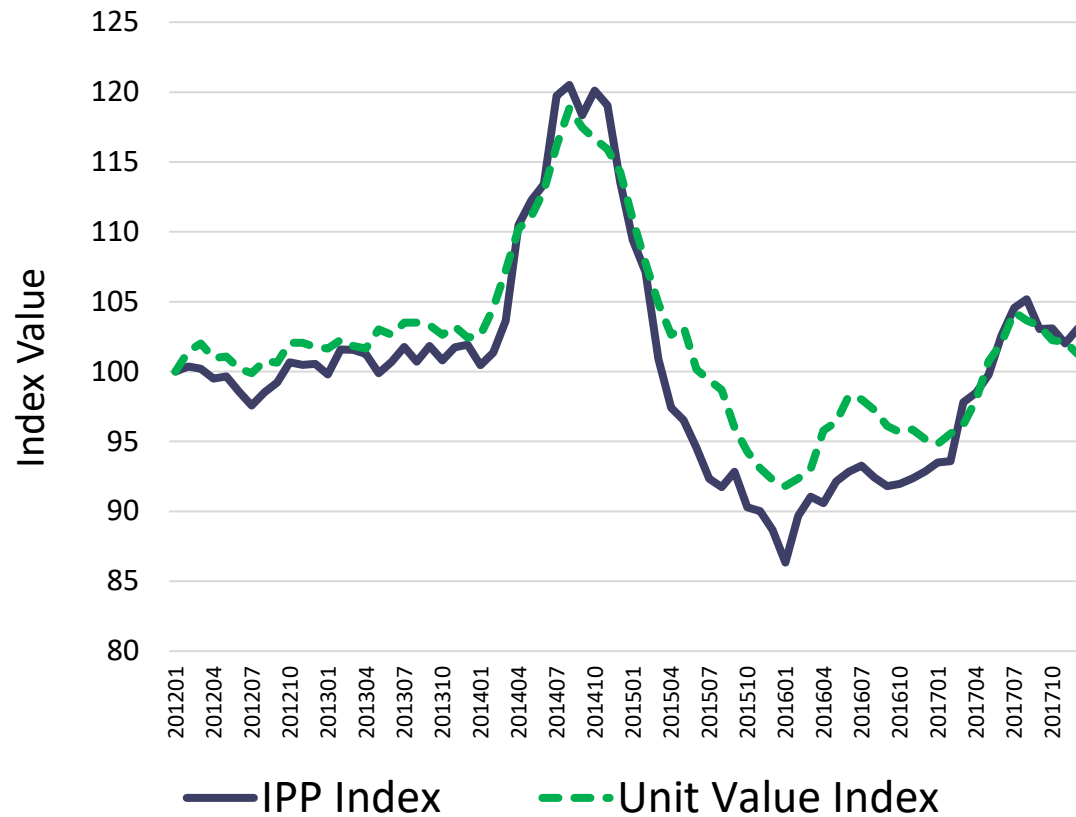
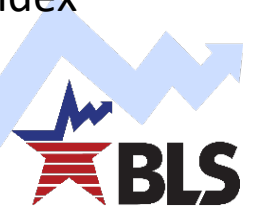- Unit Value – Homogeneous Products

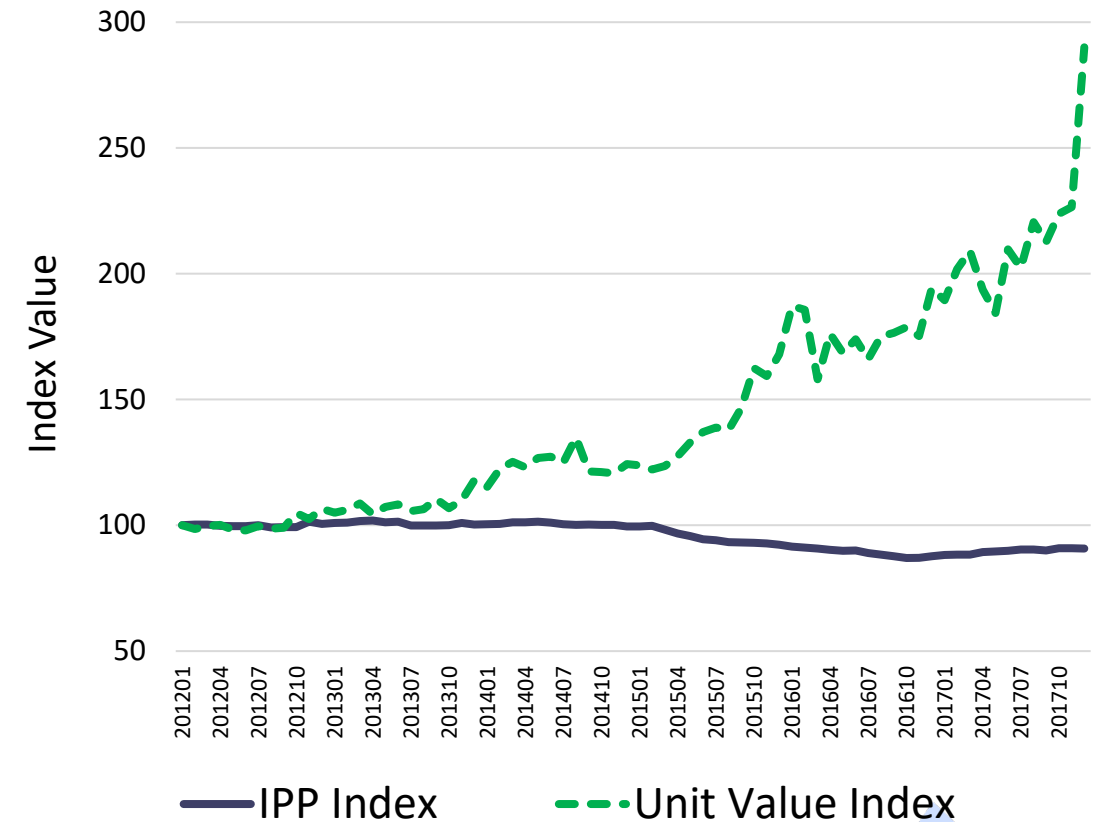- Unit Value – Heterogeneous Products

Unit Values for Homogeneous Products Match Official Price Indexes

Export Price Index: Meat&Poultry

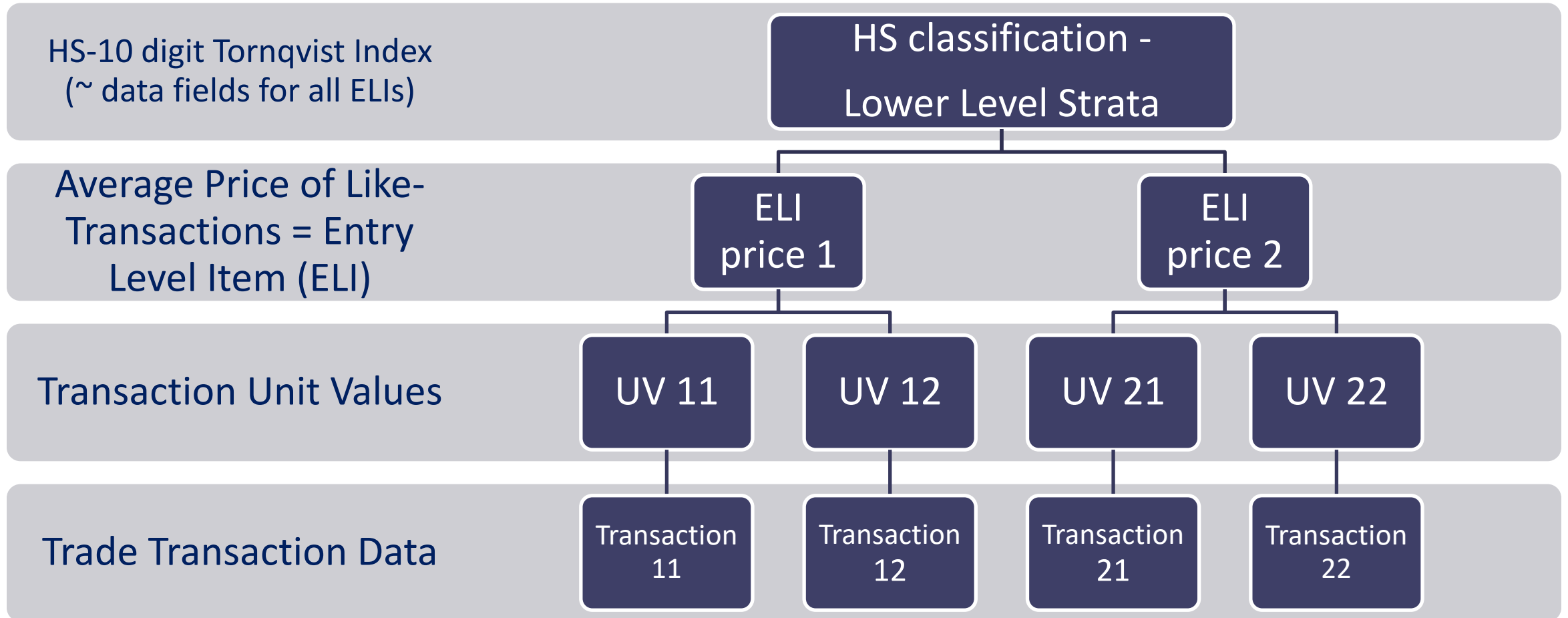## Export Price Index: Computer Parts

Unit Values

- Calculate unit value of each transaction record

$$p_{s,t} = \frac{v_{s,t}}{q_{s,t}}$$

- Aggregate all unit values for each unique product variety

$$p_{k,t} = \frac{\sum_{s \in S_k} q_{s,t} p_{s,t}}{\sum_{s \in S_k} q_{s,t}}$$

- Calculate unit value index of all product varieties for each 10-digit HS product category

$$r_{c,t} = \prod_{k \in K_c} \left[\frac{p_{k,t}}{p_{k,y(t)-1}} \right]^{\frac{v_{k,y(t)-1}/V_{y(t)-1}^t + v_{k,t}/V_t^{y(t)-1}}{2}}$$

Calculating Unit Value Indexes

HS-10 digit Tornqvist Index
(~ data fields for all ELIs)

Average Price of Like-Transactions = Entry Level Item (ELI)

Transaction Unit Values

Trade Transaction Data

HS classification - Lower Level Strata

ELI price 1

ELI price 2

UV 11

UV 12

UV 21

UV 22

Transaction 11

Transaction 12

Transaction 21

Transaction 22

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Product Varieties - Match-Adjusted R Squared

- Degree of Product Match
- Ratio of all items traded in a month relative to the base period
- 1 – less churn, 0 - more churn
- Less churn is better
  - ▶ Fewer attributes positively correlated w less churn

$$\frac{\sum_{i \in G_{0,t}} q_{i,t}}{\sum_{i \in G_t} q_{i,t}}$$

- Degree of Product/Price Homogeneity
- Proportion of the variation in transaction unit values explained by variation in the product variety unit value
- 1 – more homogeneous, 0 - less homogeneous
- More homogeneous is better
  - ▶ Higher R^2 more similar

$$R_t^K = \frac{\sum_{k \in K} q_t^k (p_t^k - p_t)^2}{\sum_{i \in G_t} q_{i,t} (p_{i,t} - \bar{p}_t)^2}.$$

Goods Categories with most Variable Price Movements covered by Census Trade Data
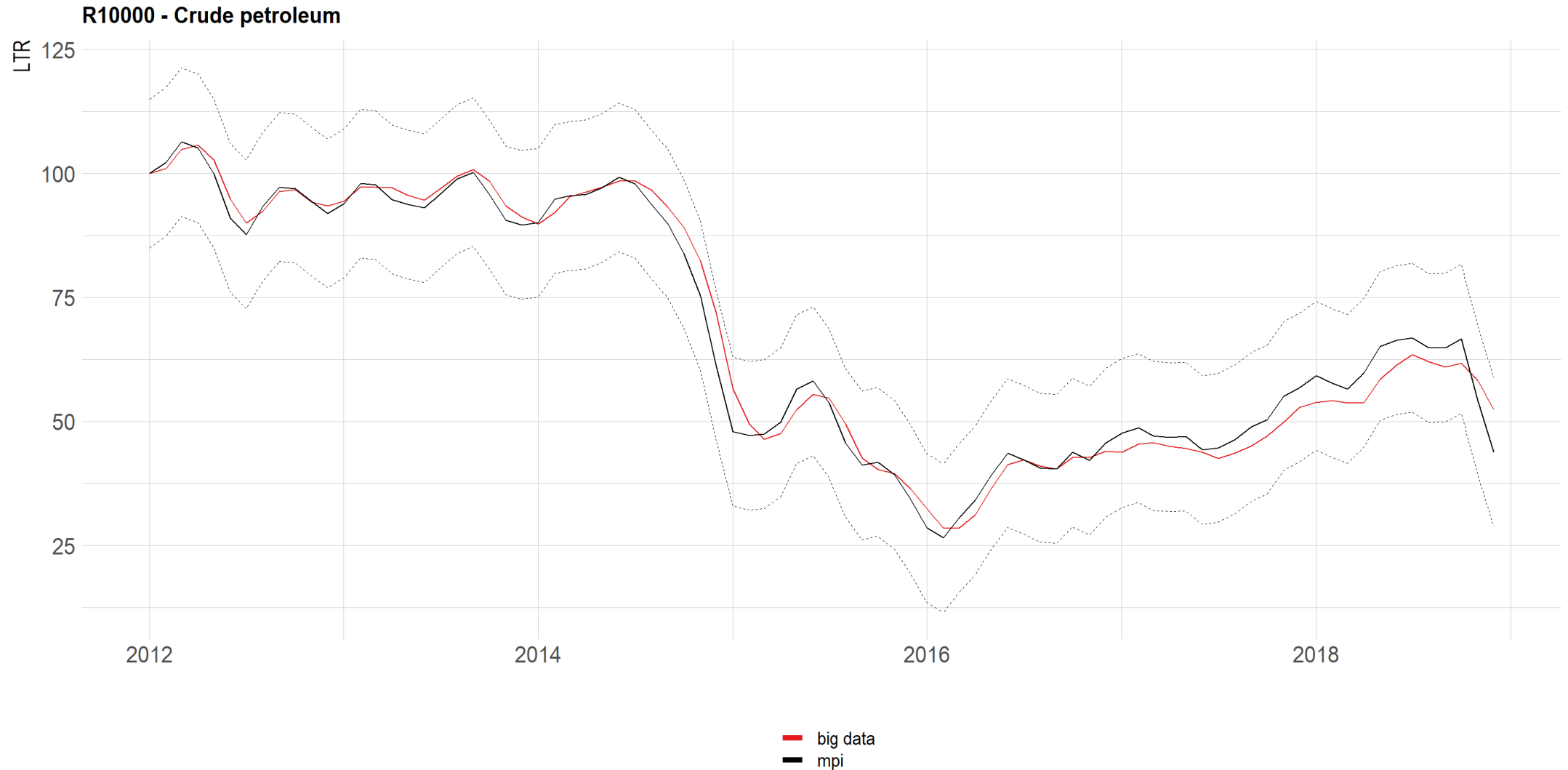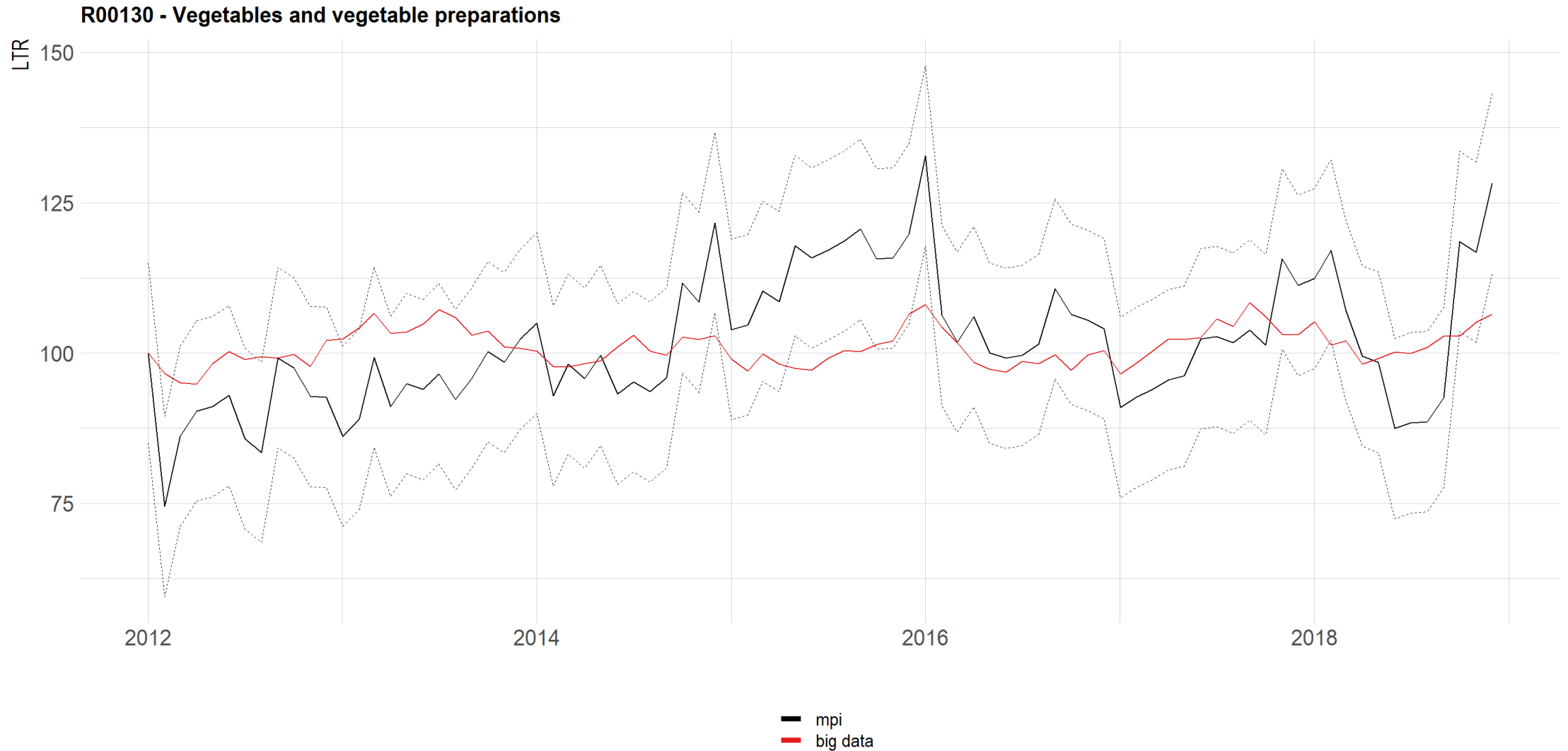
Monthly Percent Change of MPI by Goods Type, Jan-Oct 2024
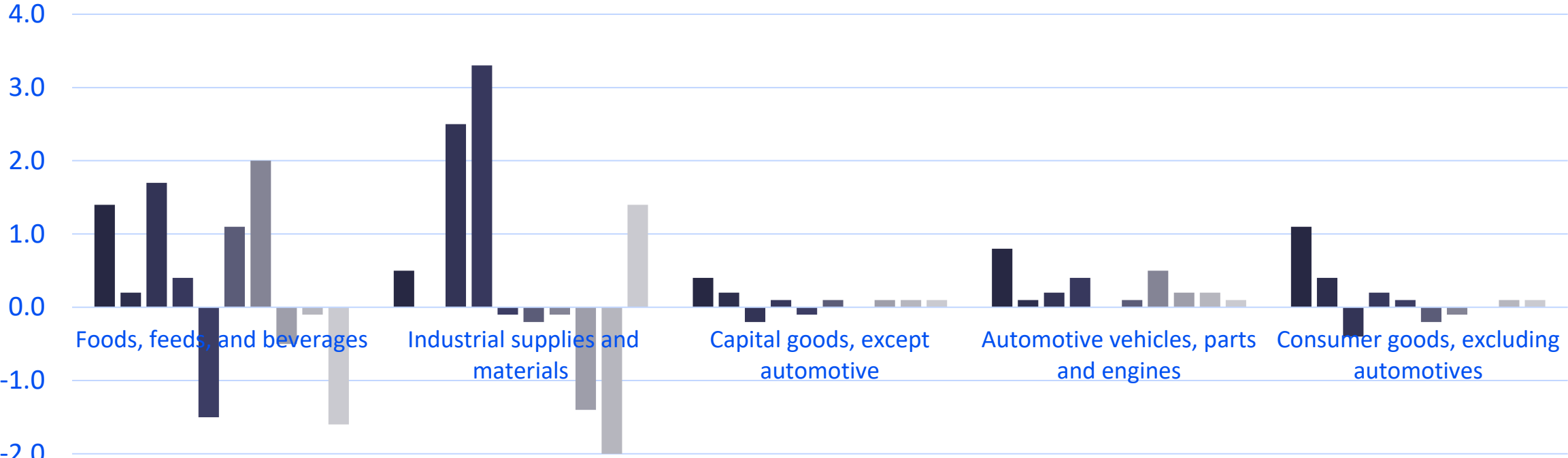
Source: U.S. Bureau of Labor Statistics, U.S. Import and Export Price Indexes
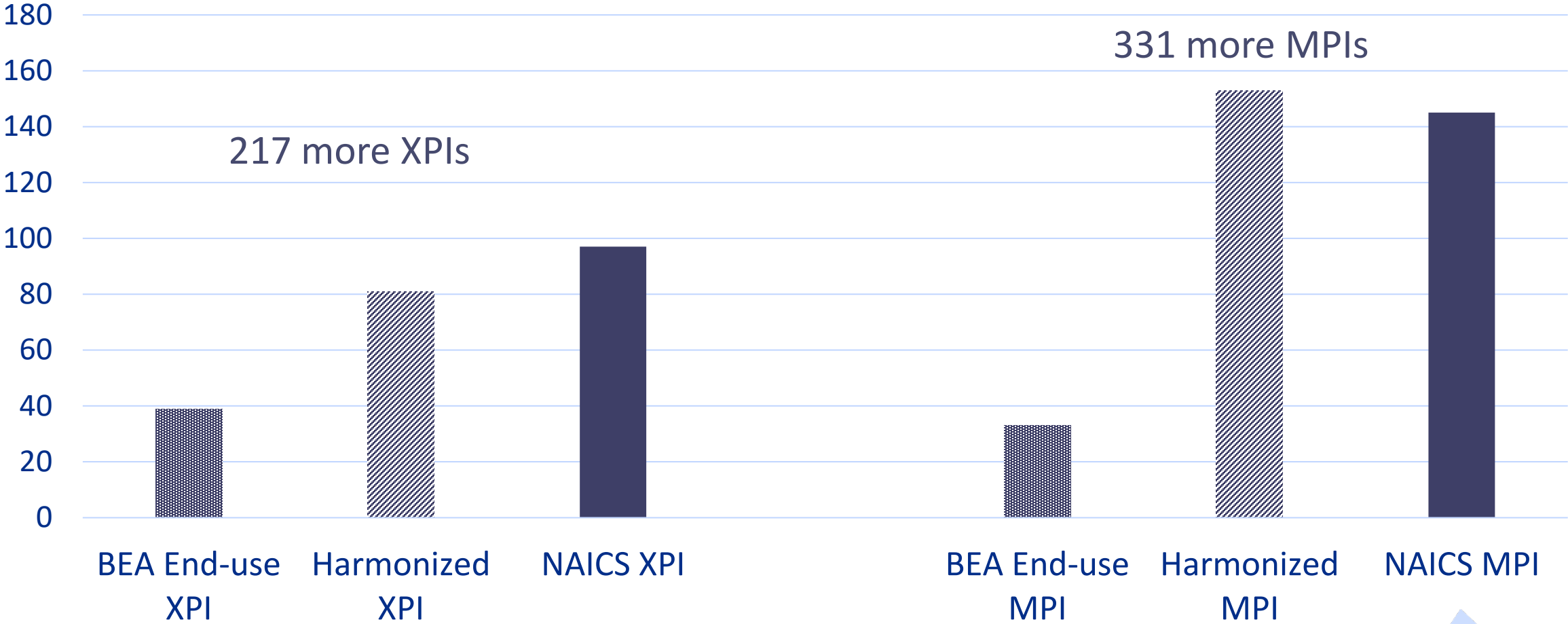
Import Comparisons – Crude Petroleum

R10000 - Crude petroleum

Legend: big data (red), mpi (black)

Import Comparison – Vegetables

R00130 - Vegetables and vegetable preparations

More Outputs

March 2025 Publication Expands Number of MXPIs by 50%

217 more XPIs

331 more MPIs

Thank you