The Effect of Component Disaggregation on Measures of the Median and Trimmed-Mean CPI

Christian Garciga[1]; Randal Verbrugge[1]; Saeed Zaman[1]
[1]Federal Reserve Bank of Cleveland

Abstract

Limited influence measures – Median and Trimmed-Mean Consumer Price Index – of inflation produced by the Federal Reserve Bank of Cleveland (FRBC) for decades.

- These measures have proven useful for: tracking the medium-term trend (MTT) in inflation; forecasting inflation; and understanding inflation dynamics.
- Widely used and cited in financial press.

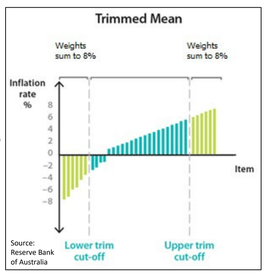
Previous improvements to the FRBC methodology have involved increasing the level of CPI components disaggregation in the CPI components.
We **systematically investigate the impact of further disaggregation** on Median CPI and Trimmed-Mean CPI inflation.

We find that further disaggregation does **not** necessarily improve the measures: Substantially more disaggregation of shelter components helps, whereas only slightly more disaggregation for non-shelter category helps.

Introduction

Median and Trimmed-Mean CPI inflation rates are constructed from the cross-sectional distribution of price changes:

- Item price changes of goods and services are ranked from the lowest value (usually negative) to the highest value.
- A specified percentage of price changes from the tails of the distribution is removed and the average inflation from the resulting interior region of the distribution is calculated.



The current FRBC measures are based on 45 components of the CPI

- Shelter is split into
  - Rent of primary residence (Rent)
  - Lodging away from home
  - Owner's Equivalent Rent of primary residence (OER)
    - Split into four regions, Northeast, Midwest, South, West
  - Tenants' and household insurance

A common understanding is that greater disaggregation is preferable, as it leads to more precise signal about the MTT. **We prove theoretically that this is false** and demonstrate that **the optimal level of disaggregation is an empirical question**.

What we do? (empirical part)

After proving that greater disaggregation need not help, starting with the current FRBC Median CPI basket, we disaggregate the basket along two dimensions:

Disaggregating Shelter

(1) Split each of the four OER components ("OER4") into two subcomponents based on city-size classes - resulting in total of eight OER indexes ("OER8").

(2) Apply the same disaggregation to the four Rent components - resulting in a total of eight Rent indexes ("RENT8").

Disaggregating Non-shelter

(3) For non-shelter components, we use the current FRBC non-shelter component basket as our baseline and then construct four additional non-shelter component baskets (C2, C3, C4, and C5) using the disaggregation structure of the CPI.

In total, we **evaluate the performance of 15** median and trimmed-mean measures constructed from respective 15 candidate baskets of CPI components, ranging in size from the current FRBC basket (denoted FRBC-OER4) of 45 components to a basket of 148 components (Table 1).

Table 1. Number of Components in the Candidate Component Baskets

	FRBC	C2	C3	C4	C5
OER4	45	59	93	105	137
OER8	49	63	97	109	141
OER8-RENT8	56	70	104	116	148

Evaluation Criteria

1. *Tracking the ex-post MTT in CPI inflation*
   - Ex-post MTT: 36-month centered moving average of 12-month CPI inflation
   - Examine the Root Mean Squared Error (RMSE) of deviations between each median or trimmed-mean measure and the ex-post MTT estimate

$$\mathrm{RMSE}(\hat{\pi}^{MTT} - \hat{\pi}_j) = \sqrt{\frac{1}{T}\sum_{t=1}^{T}(\hat{\pi}_t^{MTT} - \hat{\pi}_{j,t})^2}$$

where $\hat{\pi}^{\mathrm{MTT}}$ denotes the MTT proxy, $\hat{\pi}_j$ is a candidate median or trimmed-mean CPI inflation, and $(\hat{\pi}_t^{\mathrm{MTT}} - \hat{\pi}_{j,t})$ measures the deviation between the two at time t

2. *Maximizing in-sample predictability over future movements in CPI*
   - Estimate regressions of the form

$$\pi_{t+h} - \pi_t = \alpha_{j,k} + \beta_{j,h}(\pi_t - \hat{\pi}_{j,t}) + \epsilon_{j,t+h}$$

where π_{t+h} is the year-over-year rate of CPI inflation *h* months ahead

Results

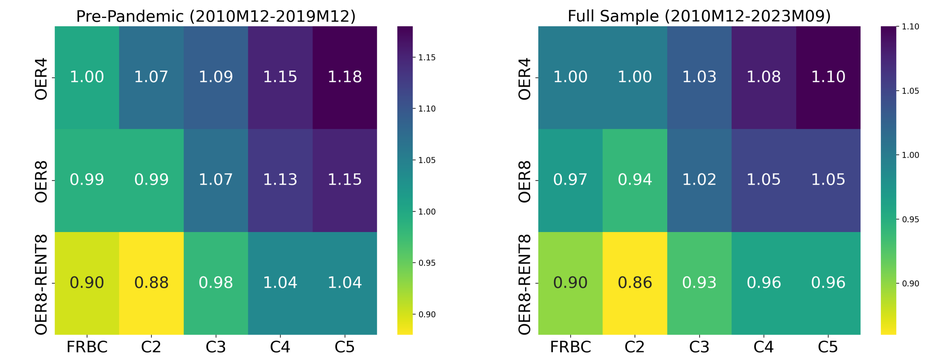


Chart 1. $\mathrm{RMSE}(\hat{\pi}^{MTT} - \hat{\pi}_j)$ of Median Inflation Measures, Relative to FRBC-OER4

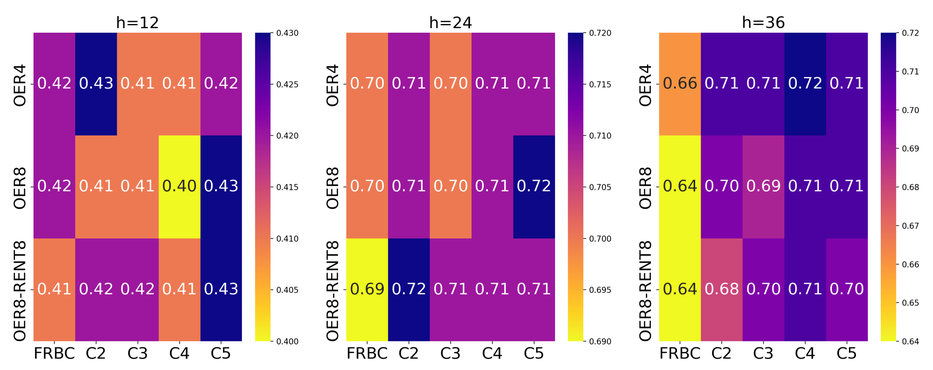
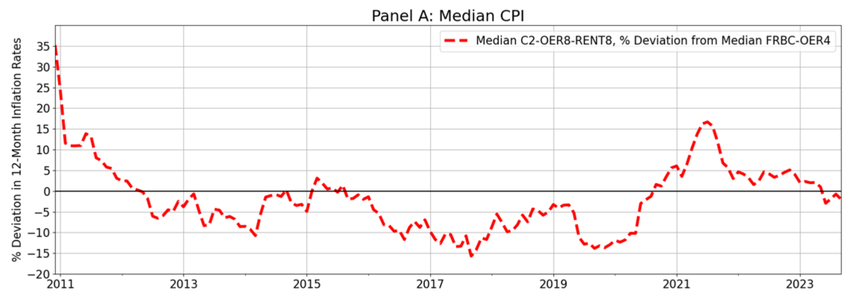


Chart 2. In-Sample Adjusted R^2, Pre-Pandemic Sample (2010M12-2019M12), Median Measures



Note: deviations are in percent, not percentage points.

Chart 3. Deviation between FRBC-OER4 and C2-OER8-RENT8 Measures of Median CPI Inflation

Main Takeaway

The optimal mix of disaggregation in terms of:

- *Tracking the ex-post MTT in CPI inflation*: Disaggregating both OER and Rent into eight components, in combination with only slightly more non-shelter disaggregation (i.e., C2-OER8-RENT8).
- *Maximizing in-sample predictability over future movements in CPI*: The official FRBC measure (FRBC-OER4) is about as good as the alternatives.

Our study has established that **the optimal level of disaggregation need not be the highest level of disaggregation**.

Contact

Saeed Zaman
Federal Reserve Bank of Cleveland
Email: saeed.zaman@clev.frb.org
Website: www.clevelandfed.org

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