Extending the Range of Robust PCE Inflation Measures

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Robust Measures of PCE Inflation

- Judging trend inflation is hard but important
- Reason: (Headline) Inflation averages all expenditure categories
  - Many categories experience large transitory shocks
- Response: Robust measures of inflation
  - Easy to communicate methods
  - Heightened attention: *"I want to see inflation, and median and trimmed mean, compellingly headed back to our target"* (Barkin, January 2023)

Robust Measures of PCE Inflation

- Robust Measures of Inflation:
  - Drop some expenditure categories from inflation
  - Remove transitory variation and provide information on trend movements
  - **Examples:**
    Trimmed mean inflation (Dallas Fed), median inflation (Cleveland Fed), core inflation

- Statistical alternatives based on factor models:
  - Underlying Inflation Gauge (UIG, NY Fed) – not this paper

What we do

1. Properties of Official Trimmed Mean and Median inflation
   - Substantial disagreement in many months
   - Trimmed mean slightly better than median inflation at capturing trend inflation
2. Are Alternative Trimmed Mean Measures Better?
   - Construct 2,500 trimmed mean measures
   - Choose trims targeting trend inflation and evaluate according to RMSE

Key Findings for Optimal Trimmed Mean Measures

1. A range of trims deliver similar prediction error over time
2. However, significant variation in level predictions in any month
   - Differences between 0.5pp–1pp.
3. Reason: Trimming reduces variance, but adds bias
4. Results robust to different targets, periods
5. Core (PCE excluding food and energy) always loses

$\longrightarrow$ No grounds to select a single series based on forecasting performance

PCE Inflation Data

- Personal Consumption Expenditure (PCE) data from NIPA
  - Produced and revised by the Bureau of Economic Analysis
  - Preferred inflation measure used by the Federal Reserve
- Extended sample: January 1959 $\longrightarrow$ October 2022
  - Official Trimmed Mean/Median series only from 1977 (our sample 40% longer)
  - Extended data available at ▸ https://ocamp020.github.io/Robust_Inflation_Series.xlsx
- Robust measures: Removes α% of expenditure with lowest inflation and β% with highest
- Yearly inflation by chaining monthly rates

Construction of Official Robust Inflation Series

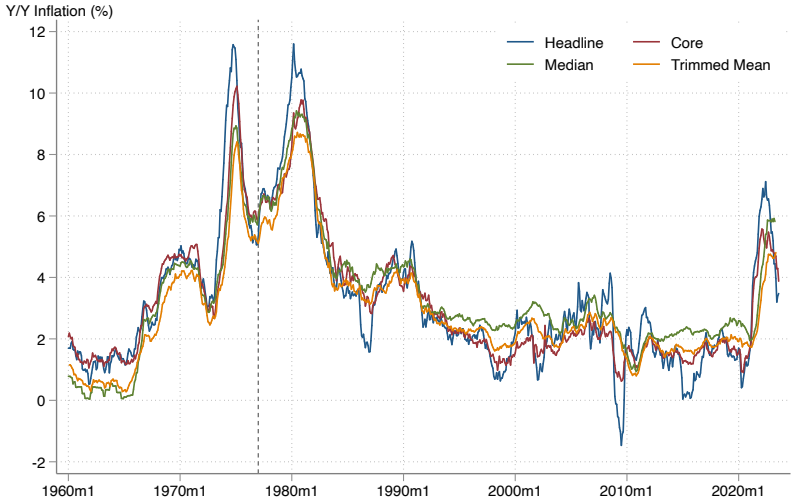
Dallas FED Trimmed Mean Inflation:

- Trim out the $\alpha = 24\%$ lowest and $\beta = 31\%$ highest inflation categories
- Trims chosen based on prediction of trend inflation (1977-2005)
  - Centered moving average ($\pm 16 \textit{months}$)
  - 24-month forward-moving average of headline inflation

Cleveland FED Median Inflation:

- Equivalent to trimmed mean inflation with $\alpha = \beta = 50\%$

Long Series of Robust Measures of Inflation



(Re-)Evaluating Robust Measure of Inflation

Objective: Match measures of current trend inflation ($\bar{\pi}$) for 1970-2022

- Current trend inflation: Centered moving average ($\pm$16 months)

$$rmse^i = \sqrt{\frac{1}{T}\sum_t (\pi_t^i - \bar{\pi}_t^j)^2}$$

Paper:

- Other current trend: Band-pass filter, Christiano and Fitzgerald (2003)
- Forward moving average: 13-24 months ahead or 0-24 months ahead
- Time Periods: 1970-1989 and 2000-2022

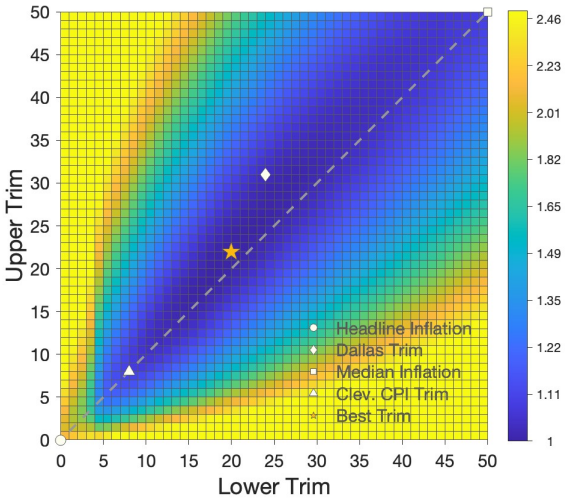
Performance of *Official* Measures details

PCE Inflation Measure				DM Test
Headline	Core	Trim. Mean	Median	$\Pr(z > \lvert DM \rvert)$
2.20	1.47	1.10	1.16	0.066

- Trimmed Mean and Median inflation are much better than no trimming
- Trimmed Mean is slightly better than Median inflation (DM test)
  - Mainly due to recent period and current trend inflation target

Performance *Across* Trims: Current Trend 1970-2022

What is the RMSE relative to the optimal trim RMSE?



- Wide range with similar RMSE (blue area)
- Optimal Trim:

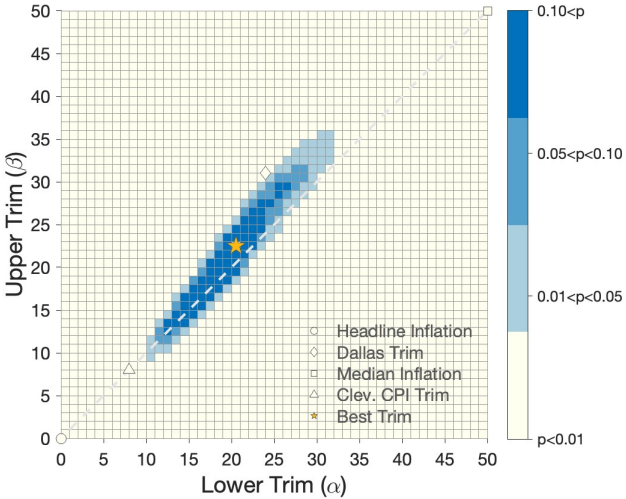
$$(\alpha^\star, \beta^\star) = (20\%, 22\%)$$

Slightly asymmetrical (higher upper trim)

- Statistically significant improvement over current robust measures

Range of "Best" Trims: Current Trend 1970-2022

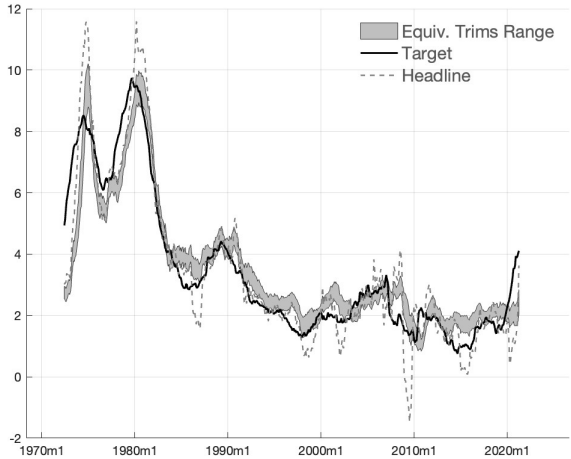
Is a given trim's RMSE statistically different from the optimal trim's RMSE?



- Diebold-Mariano test for difference of RMSE
- Set of equivalent trims is wide $\alpha, \beta \in [10, 30]$
- Trim more high-inflation categories

Time Series of Robust Inflation Range

Range Targets Current Trend 1970-2022

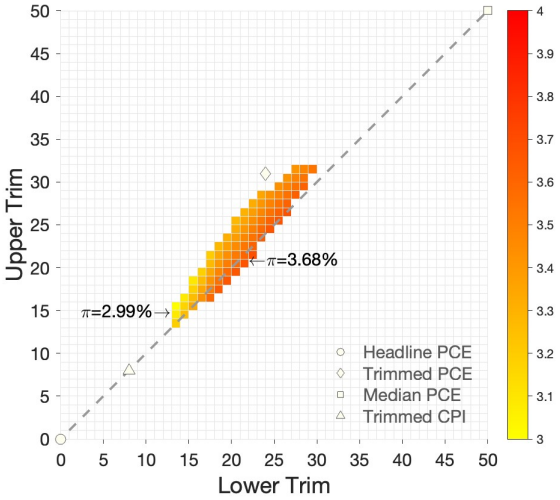


- Average range across best trims $\approx$ 0.60pp
- Range lags changes in targeted trend inflation
  (more so for future trend)
- Range goes up to 1.16pp for future trend

Future trend series

Implied Levels of Current Trend Differ

Trimmed Mean inflation May 2023 for best trims



- Implied range ≈ 0.70pp across best trim combinations

One-month inflation (annualized):

- Headline: 1.6%
- Median: 3.6%
- Trimmed Mean: 3.2%

Conclusion: Key Findings

1. A range of trims deliver similar prediction error over time
2. However, significant variation in level predictions in any month
   - Differences between 0.5pp–1pp.
3. Reason: Trimming reduces variance, but adds bias
4. Results robust to different targets, periods
5. Core (PCE excluding food and energy) always loses

$\longrightarrow$ No grounds to select a single series based on forecasting performance

Appendix

Summary Statistics back

	Inflation Measures			
	Headline	Core	Median	Trimmed Mean
	Full Sample (748 months)			
Mean	3.27	3.21	3.33	2.96
Std. Dev.	2.42	2.13	2.01	1.86
Coeff. Var.	0.74	0.66	0.60	0.63
	$\pi < 2.5\%$ (373 months)			
Mean	1.55	1.73	2.01	1.72
Std. Dev.	0.67	0.53	0.95	0.70
Coeff. Var.	0.43	0.31	0.47	0.41
	$\pi \geq 5\%$ (123 months)			
Mean	7.76	7.09	6.85	6.31
Std. Dev.	2.00	1.59	1.60	1.57
Coeff. Var.	0.26	0.22	0.23	0.25

Performance of Official Measures - Details back

Trend	Sample	PCE Inflation Measure			DM Test
		Headline	Trim. Mean	Median	$\Pr(z > \lvert DM \rvert)$
Current	1970-2022	2.20	1.10	1.16	0.066
	1970-1989	2.28	1.62	1.51	0.047
	2000-2022	2.47	0.75	0.95	0.000
Band Pass	1970-2022	2.11	1.25	1.30	0.066
	1970-1989	1.98	1.65	1.55	0.035
	2000-2022	2.42	1.01	1.18	0.000
Future	1970-2022	2.93	2.12	2.14	0.476
	1970-1989	3.48	3.02	3.00	0.841
	2000-2022	2.93	1.59	1.61	0.561
Forward	1970-2022	2.43	1.62	1.66	0.181
	1970-1989	2.74	2.38	2.34	0.393
	2000-2022	2.56	1.09	1.21	0.000

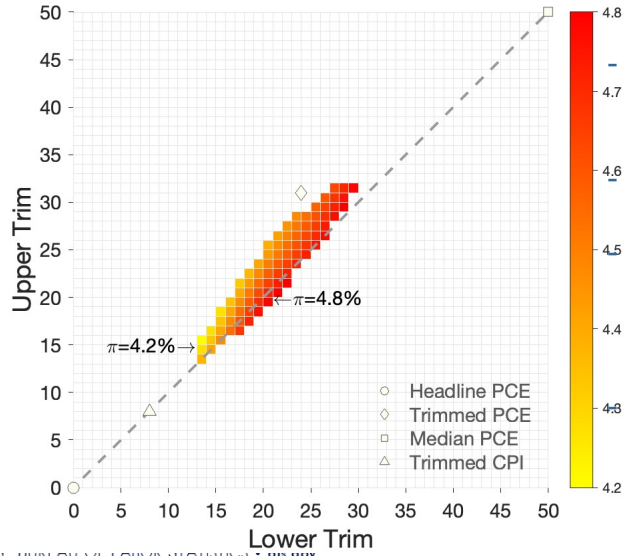
Best trims details

details

Trend	Sample	Best Trims			DM Test
		Lower	Upper	RMSE	$\Pr(z > \lvert DM \rvert)$
Current	1970-2022	20	22	1.06	0.014
	1970-1989	18	16	1.44	0.238
	2000-2022	22	29	0.74	0.474
Band Pass	1970-2022	11	11	1.12	0.000
	1970-1989	12	10	1.36	0.003
	2000-2022	15	18	0.97	0.050
Future	1970-2022	27	32	2.09	0.192
	1970-1989	49	50	2.90	0.560
	2000-2022	28	32	1.55	0.302
Forward	1970-2022	15	17	1.59	0.150
	1970-1989	13	13	2.26	0.158
	2000-2022	24	31	1.09	0.815

What About Implied *Levels* of Current Trend?

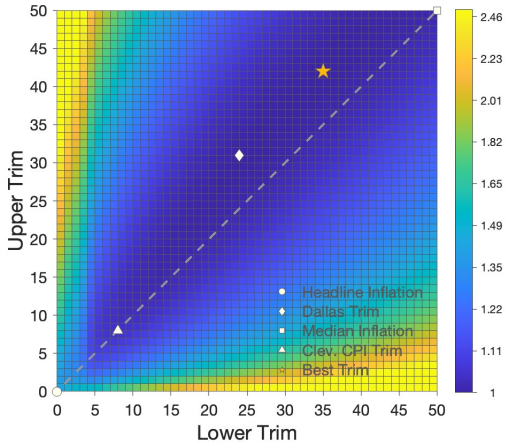
Trimmed Mean inflation May 2023 for top 50 trims



- Asymmetrical trims: Trim more high-inflation
- Trim between 12-30%
- Range≈60bp for trimmed mean across these best trim combinations
- Headline inflation was 4%

Optimal Trims for Implied Future Trend 1970-2022

RMSE relative to optimal trim

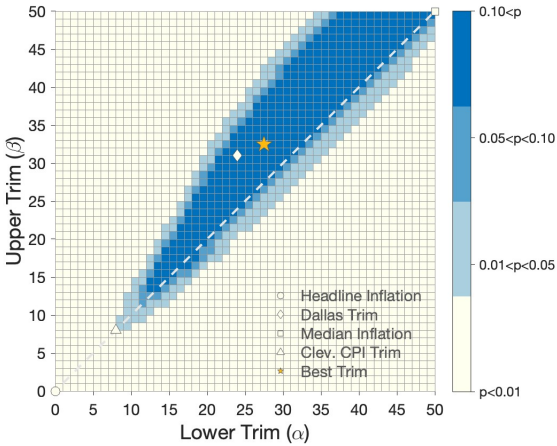


- Optimal Trim:
  $(\alpha, \beta) = (27\%, 32\%)$
- Forecasting is an equalizer for the error

Back to Current Trend

Range of Equivalent Trims: Future trend 1970-2022

Test of RMSE relative to optimal trim

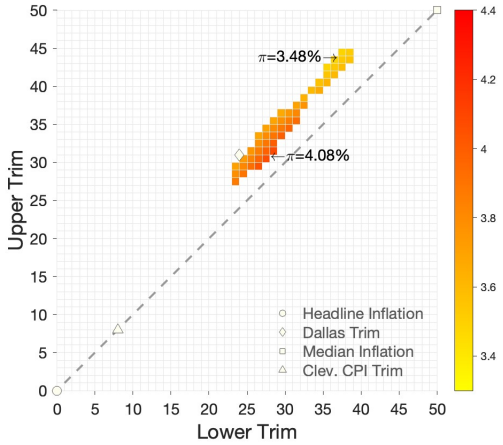


- Diebold-Mariano test for difference of RMSE
- Set of equivalent trims is wider! ($\alpha, \beta \in [10, 50]$)

Back to Current Trend

What About Implied Levels of Future Trend?

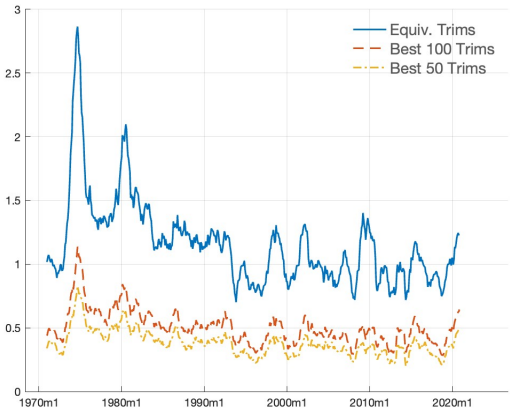
Trimmed Mean inflation October 2022 for top 50 trims



- **More** asymmetrical trims
- Trim between 22-45%
- Still ≈40bp range

Back to Future Trend

Range of Inflation Predictions

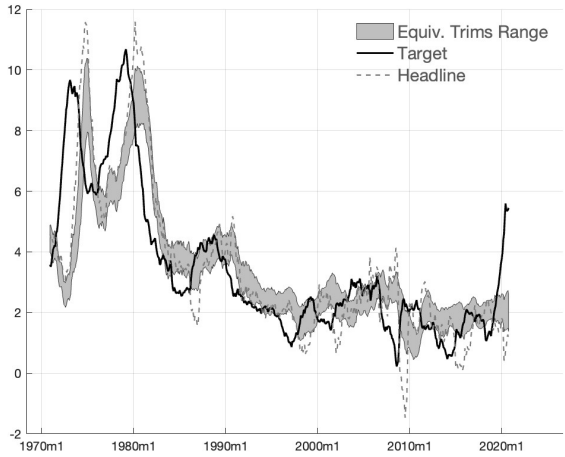


- Range≈50bp for trimmed mean across these 50 trim combinations
- Range>100bp for trimmed mean across trims statistically equivalent to best trim
- Large spikes over time for the range

Back to Current Trend

Time Series of Robust Inflation Range: Future Trend

Range Targets Future Trend 1970-2022

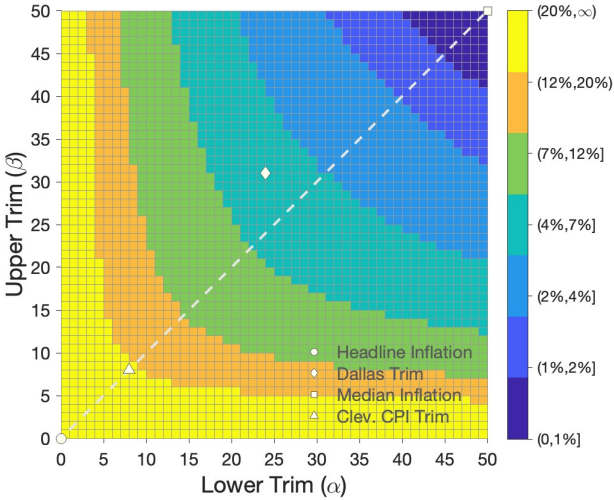


- Average range of equivalent trims ≈ 60bp
- Range lags changes in targeted trend inflation (more so for future trend)
- Range goes up to 1.16pp for future trend

Back to current trend series

Why Do So Many Trims Deliver Similar Outcomes?

Range of Inflation Category Levels by Trim: $\pi_{1-\beta} - \pi_{\alpha}$

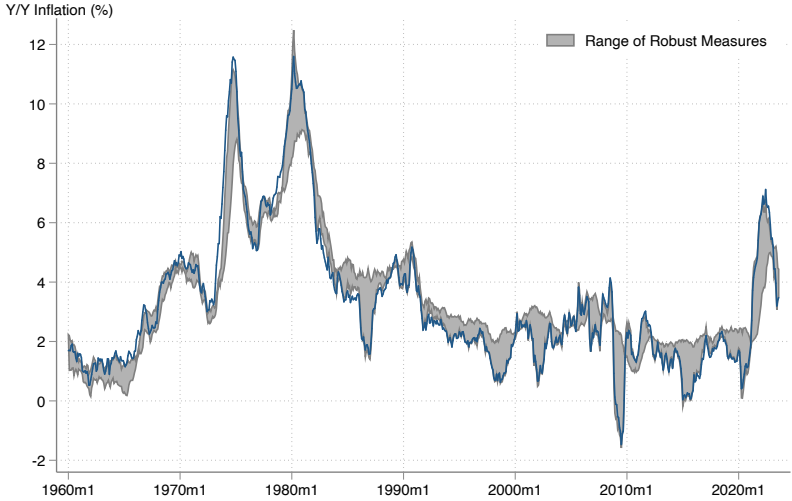


- Small differences in inflation range across categories $\longrightarrow$ Small differences in RMSE
- Robust inflation range $< 7pp$ for most trims

Excluded Categories

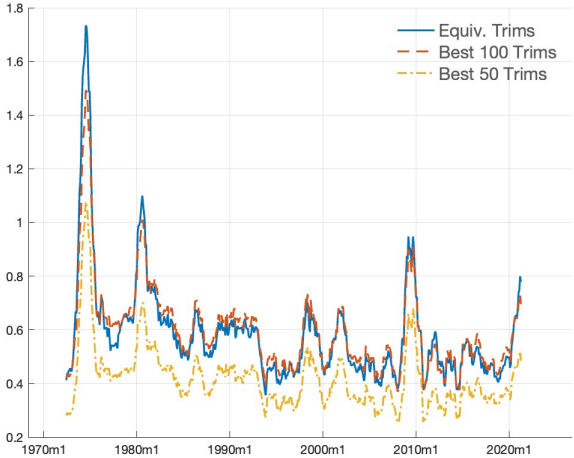
	Median	Trimmed Mean	Middle 80% ($\alpha, \beta = 10\%$)
		Most Commonly Excluded	
1		Eggs	Eggs
2	71 series	Food on farms	Vegetables
3	never median	Vegetables	Food on farms
4		Fruit	Used auto margin
5		Gasoline	Fuel oil
		Most Commonly Included	
1	Owner-occ homes	Owner-occ homes	Owner-occ homes
2	Other purch meals	Other purch meals	Other purch meals
3	Tenant-occ homes	Owner-occ mobile hms	Tenant-occ homes
4	Nonprofit hospitals	Casino gambling	Casino gambling
5	Physician services	Tenant-occ homes	Lotteries

Agreement Between Series



1. Robust series differ often from (more volatile) headline inflation
2. Range across series≈0.8pp

Zooming into the Range of Inflation Predictions

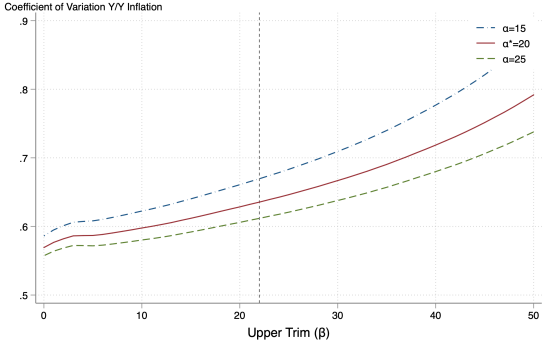


The range is substantial:

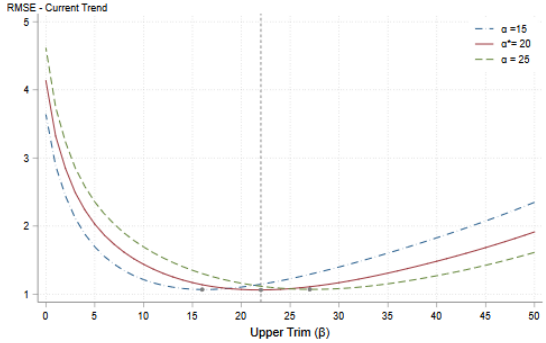
- Range≈0.60pp for trimmed mean across trims statistically equivalent to best trim
- Even across top 50 trim combinations, range ≈ 0.40pp for trimmed mean
- Large spikes over time on the range

Why Do So Many Trims Deliver Similar Outcomes?

Coefficient of Variation Across Trims



RMSE Across Trims



- Trimming, for example on upper tail (β), raises trimmed mean series' variance relative to series' mean (coefficient of variation, left panel)
- At the same time, average error remains similar across trims
  RMSE is relatively stable around the optimal trim (right panel)