Appendix to "Behavior of a New Median PCE Measure: A Tale of Tails," Daniel Carroll and Randal Verbrugge

A weighted median of a sample, in this case a "sample" consisting of 217 component price index changes, is the 50th weighted percentile of the sample. Our median PCE, which is constructed as a weighted median, makes use of the aggregation weights in the index and is as a result a measure of the central tendency of price change that is comparable to the headline PCE change. The core PCE index omits food and energy items irrespective of where those price changes lie in the distribution for that month, which means the aggregration weights of these items are effectively set to zero. Because these weights are set to zero, the weights used in the core PCE differ from the weights used in constructing headline PCE. For the same reason—omission of a category—the weights used in the median PCE excluding OER are also different from those used in constructing headline PCE. The logic behind our median PCE follows from the median CPI.[1] We obtain price and weight data from the Bureau of Economic Analysis. We closely follow the method and code detailed in Dolmas (2005) to identify the weighted median price index change each month.

We obtain price and quantity data for PCE components from Section 2 of the underlying tables from the "Personal Income and Outlays" release published by the Bureau of Economic Analysis. Specifically, table 2.4.4U contains monthly price indexes and table 2.4.5U contains the monthly expenditures for each component. We divide each component's expenditure by its price to obtain a time series of quantities.

Denote the price and quantity of component *i* at time *t* by P_{it} and Q_{it}, respectively. From these data the median PCE can be constructed in the following manner.

1. Calculate the price change for each component according to $\Delta P_{it} = \frac{P_{it} - P_{i,t-1}}{P_{i,t-1}}$.
2. Calculate the weight, ω_{it} assigned to the i-th component in the basket at time *t*, where $\omega_{it} = \frac{1}{2}\frac{Q_{i,t-1}P_{i,t-1}}{\sum_j (Q_{j,t-1}P_{j,t-1})} + \frac{1}{2}\frac{Q_{it}P_{i,t-1}}{\sum_j (Q_{jt}P_{j,t-1})}$.
3. Renormalize the weights so that they add up to 1, i.e., $w_{it} = \frac{\omega_{it}}{\sum_i \omega_{it}}$.

[1] For some recent work on the usefulness of the median CPI, see, e.g., Meyer, Venkatu and Zaman (2013) or Meyer and Zaman (2018).

4. Sort the ΔP_{it}'s from largest price decline to largest price increase and then compute the cumulative sum of the associated w_{it}'s.
5. Locate the price change associated with a cumulative weight of 0.5, i.e., the median price change. If no such value exists, because the cumulative weight does not land exactly on 0.5, then take the two components with cumulative weights on either side of 0.5 and linearly interpolate the change. That is, if $i = a$ is the nearest component below and $i = b$ is the nearest component above, then the median price change is $(1 - s)\Delta P_{at} + s\Delta P_{bt}$ where $s = \frac{0.5 - w_{at}}{w_{bt} - w_{at}}$.[2]

[2] Because we use monthly data, these steps produce the median monthly change. As noted in the *Commentary* that this appendix accompanies, we convert the monthly change to an annualized rate to provide the reader with a natural point of reference.

Table 1

	Inflation Measure	RMSE vs. 2SMA		
		1984-2016	**1984-2007:6**	**2007:7-2016**
Monthly	Core PCE	1.14	1.27	0.91
	Trimmed-mean PCE	**0.68**	**0.63**	**0.73**
	Median PCE	0.81	0.76	0.85
	Median PCE excluding OER	**0.68**	0.64	**0.73**
Year-over-year	Core PCE	0.50	0.42	0.58
	Trimmed-mean PCE	0.55	0.46	0.65
	Median PCE	0.64	0.54	0.75
	Median PCE excluding OER	**0.43**	**0.34**	**0.53**

In this table, we report the root mean squared error of each simple trend inflation indicator against a two-stage moving average of headline PCE inflation, which we are using to approximate the "true" trend in inflation. We report this for the full sample, and for two subsamples; and we report this at both the monthly frequency and at the year-over-year frequency.

Table 2: Root Mean Squared Forecast Errors

	1984-2007:6				2007:7-2016			
	6-month	**12-month**	**24-month**	**36-month**	**6-month**	**12-month**	**24-month**	**36-month**
PCE	1.01	0.97	0.88	0.69	2.02	1.42	0.90	0.78
Core PCE	1.01	0.95	0.86	0.68	1.95***	1.29***	0.85***	0.75***
Trimmed-mean PCE	*1.04*	*0.98*	0.85	0.64*	*2.06*	1.33***	*0.97*	*0.95*
Median PCE	*1.04*	0.96	0.76***	0.61***	2.02	1.28***	*1.01*	*1.04*
Median excluding OER	0.99*	0.94**	0.83***	0.62***	*2.06*	1.38	*0.98*	*0.92*

* significant at the 10 percent level
** significant at the 5 percent level
*** significant at the 1 percent level