

Comparing Two Measures of Core Inflation: PCE Excluding Food & Energy vs. the Trimmed Mean PCE Index¹

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1. Introduction

The inflation objective of the FOMC is set in terms of the rate of change of the price index for total personal consumption expenditures (PCE). However, total PCE price inflation is highly volatile, even on a year-to-year basis. Consequently, economists and policymakers have suggested alternative procedures for reweighting the index's components so as to reduce the variance of the measured inflation, to better distinguish transitory from persistent movements, and, ultimately to better anticipate future developments in inflation. The literature has used the generic term “core” inflation to refer to these alternative measures; conceptually, they can be grouped into several categories: exclusion indexes, central-tendency statistical measures, variance-weighted indexes, regression-weighted indexes, model-based trend inflation measures, and component-smoothing indexes.²

The goal of this memo is to provide an assessment of two of the most commonly used indicators of core inflation: the PCE price index excluding food and energy (an exclusion index), and the Dallas Fed trimmed mean PCE price index (a central-tendency statistical measure). In particular, we consider their relative performance in terms of three arguably desirable properties of a core measure: its ability to be less volatile than total inflation while having the same average rate over longer periods of time, its power to predict future inflation, and its ability to avoid undergoing large revisions across data vintages.³

Using these criteria, we do not identify one measure as being clearly preferable to the other. The index excluding food and energy offers the advantage of having the same mean as total PCE price inflation over a sufficiently long sample, but it is more affected by data revisions. In contrast, the trimmed mean index is less subject to subsequent revisions, but it has tended to run slightly higher

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² A non-exhaustive list of contributions in this literature includes Brischetto and Richards (2007), Bryan and Cecchetti (1994), Bryan and Pike (1991), Catte and Sløk (2005), Cecchetti (1997), Clark (2001), Cogley (2002), Crone, *et al.* (2011), Detmeister (2011), Dolmas (2005), Freeman (1998), Rich and Steindel (2007), and Robalo Marques, *et al.* (2003). For a review of this literature, see Wynne (2008).

³ We concentrate on these three criteria because they are among the most relevant dimensions typically used to assess core inflation measures in real time. One could in principle use other criteria to compare these measures. For example: their ability to track an ex-post estimate of trend inflation; their ability to predict future inflation in a Phillips curve type of model (i.e., by adding variables such as the unemployment rate gap and import prices, to implicitly account for factors that may cause underlying inflation to change in time); and, their ability to help drawing inferences about slack in the economy. While being relevant, these dimensions are beyond the scope of this memo.

than total PCE price inflation over the past 20 years or so. From a forecasting perspective, the two indexes anticipate future movements of total inflation better than total inflation itself; however, neither measure consistently outperforms the other.

The remainder of this memo is organized as follows. In Sections 2 and 3, we review the definition of the two core inflation measures that we consider, and present some summary statistics for the two measures. Section 4 compares the relative performance of the two measures in a real time forecasting exercise, and Section 5 analyzes the revisions across data vintages. Section 6 concludes.

2. Definitions and historical perspective

The concept of core inflation has long been present in academic and policy discussions. Although the meaning of the concept has evolved over time, today the notion of core is generally understood as referring to a measure of inflation that serves a variety of purposes, including providing a real time measure of inflation net of transitory factors; a predictor of future movements in total inflation; and, in some countries, an intermediate target for monetary policy (Detmeister, 2011). The most commonly used indicators of core inflation are exclusion indexes and central-tendency statistical measures, where the former are computed by removing a pre-specified list of components from the overall index and the latter are constructed by deleting a fixed proportion of extreme price changes. In this memo we focus on a particular exclusion index (the PCE price index excluding food and energy) and a particular central-tendency measure (the Dallas Fed trimmed mean PCE price index). Our choice is informed by the fact that these two indexes routinely enter policymakers' discussions of inflation developments.

A consumer price index excluding food and energy was first reported by the Bureau of Labor Statistics (BLS) in the *CPI Detailed Report* for December 1975.⁴ Starting in 1978, this exclusion index was routinely included in the *CPI Detailed Report*; subsequently, a similar exclusion measure was computed for the price index for personal consumption expenditures in the national accounts.⁵ The rationale behind an exclusion index is quite simple, and involves excluding a fixed list of items that are judged to be relatively more volatile and more subject to idiosyncratic shocks on average.⁶ When it was first introduced, this index was not motivated in terms of the estimated statistical properties of food and energy prices; rather, its use reflected the 1970s' experience of

⁴ A CPI index excluding food (only) was first reported by the BLS in the January 1957 *CPI Detailed Report* and subsequently appeared in the 1958 *Economic Report of the President*. Along these lines it might be worth mentioning that the definition of the "food" portion of the PCE price index has changed over time. For example, the "food away from home" price index is part of the "food" CPI index but not part of the "PCE food and beverages" price index, while the "alcoholic beverages" price index is part of "PCE food and beverages" price index but not part of the "food" CPI index.

⁵ The first academic contribution focusing on exclusion-based core inflation measures was Blinder (1982).

⁶ Blinder (1997) has also argued that "The real reason [why food and energy prices were excluded from the overall index] was that the prices of food (really, food at home) and energy are, for the most part, beyond the control of the central bank" (p. 160).

high commodity price volatility and represented an attempt to reduce the variance of measured consumer price inflation while maintaining its average over longer periods.

Like an exclusion index, a trimmed-mean index is based on the idea that large movements in prices for a subset of items can induce high volatility in total inflation. However, a trimmed-mean index differs from an exclusion index in that the price changes that are omitted can differ in each period the index is computed (that is, they are not confined to a fixed list of items that is specified in advance). The statistical motivation for the trimmed-mean measure is that a suitably chosen trimmed mean will provide a robust estimator of the location of a fat-tailed distribution, while a weighted mean typically will not. Hence, to the extent that the empirical distribution of individual consumer price changes tends to exhibit fat tails, a trimmed-mean inflation measure might be viewed as preferable to an exclusion measure on purely statistical grounds.

The particular application of the trimmed-mean approach to PCE price inflation was suggested by Dolmas (2005).⁷ An index of this sort has been published regularly by the Dallas Fed, and in what follows we will use the Dallas Fed's trimmed-mean measure for our analysis. As currently computed, the portion of personal consumption expenditure that is excluded from the trimmed mean represents 55 percent of overall PCE (24 percent from the lower tail of the distribution of monthly price changes and 31 percent from the upper tail).⁸ These thresholds are calibrated using data on monthly price changes from February 1977 to June 2009, and are chosen so as to minimize the difference between trimmed-mean inflation and a measure of trend inflation.⁹

3. Metric I: mean and volatility of the series

Figure 1 provides a visual representation of the issue that exclusion indexes and central-tendency statistical measures try to address. For each month in the sample, the gray areas show the distribution of the monthly percent changes of 178 PCE price index components.¹⁰ The blue, red, and yellow lines show the one-month percent changes of the total PCE price index, the PCE excluding food and energy index, and the trimmed mean index, respectively.

⁷ Bryan and Cecchetti (1994) applied this concept first to the consumer price index, and then Dolmas (2005) adopted the idea for PCE prices.

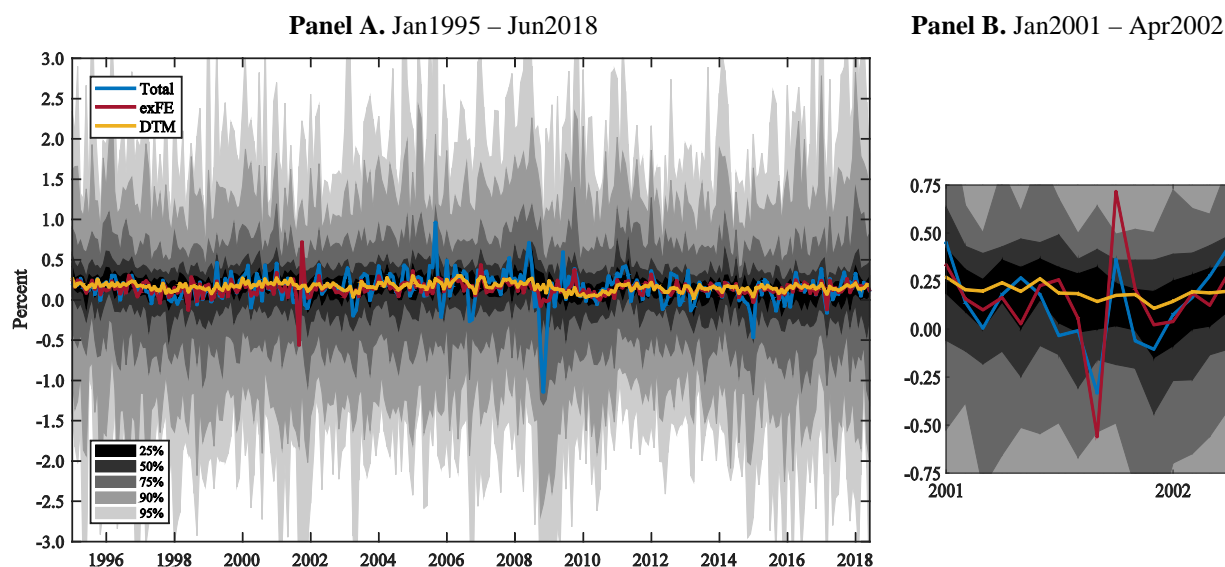
⁸ In terms of the *number* of PCE items excluded on average each month (as opposed to their share in overall PCE), since 1995 the trimmed mean has excluded 121 out of 178 components (or 68 percent)—with 59 items coming on average from the lower tail of the distribution of price changes and 62 items coming from the upper tail.

⁹ In detail, the method used for setting the trimming proportions uses three different notions of trend, and the trimming proportions minimize the average root mean squared error between the trimmed mean and each of the three. The three trends are a centered 36-month moving average, a forward 24-month moving average, and a band-pass filtered trend (with the pass-band chosen to correspond to the frequency range policy-makers seemed to respond to, see Dolmas 2005 for details).

¹⁰ The 178 subcomponents represent the same level of disaggregation used by the Dallas Fed to construct the trimmed mean PCE price index.

There are three main takeaways from Figure 1. First, in each month there is a wide distribution of price changes (Panel A of Figure 1); it is precisely this dispersion that makes it difficult for policymakers and others to interpret high-frequency inflation readings. Second, the index excluding food and energy and the trimmed-mean measure are both considerably less volatile than the total PCE price index. Finally, although the trimmed mean is able to smooth across idiosyncratic episodes more effectively than the index excluding food and energy (for example, during the 2001 episode shown in Panel B of Figure 1), both indexes tend to lie within the inner 25 percent range of the distribution of individual price changes.¹¹ In other words, both indexes do a reasonable job capturing the location of the price data distribution by successfully filtering out various item-specific shocks.

Figure 1. Distribution of monthly price changes.



Note: The gray areas show the inner range of monthly price changes for the percentiles specified in the figure’s lower-left legend generated by 178 subcomponents of the overall PCE price index. The blue line plots monthly changes in the total PCE price index; the red line plots the monthly change in the PCE price index excluding food and energy, and the yellow line shows the monthly percent change of the trimmed-mean PCE price index. **Source:** authors’ calculations using data from the Bureau of Economic Analysis and Federal Reserve Bank of Dallas.

Table 1 provides summary statistics (mean, standard deviation, skewness, and kurtosis) for the annualized monthly percent change in the total PCE price index and the two core measures over various subsamples.¹² In addition, Figure 2 plots the 12-month change in the various indexes from 1977 to the present.

¹¹ The 2001 swing in the PCE price index excluding food and energy was driven by the price index for life insurance, which plunged 55 percent in September 2001 and jumped 121 percent in October 2001 as a result of the 9/11 terrorist attacks.

¹² The skewness and the kurtosis are two statistical measures (the third and fourth moment) used to describe a distribution of data. The skewness describes the symmetry of the distribution around its mean (a skewness of zero

For a policymaking body such as the FOMC, which specifies its longer-term price objective in terms of total PCE inflation, it is useful if a core price index has an average rate of change that matches the mean rate of total inflation over a sufficiently long period of time. As is evident from line 1 of the table, from 1977 to 2009 the average change in the trimmed-mean measure is identical to the average change in the total PCE price index. However, this property of the index does not hold across shorter sample periods: For example, over the first two decades of the sample (line 2), trimmed-mean inflation ran about ¼ percentage point below total PCE price inflation; since the mid-1990s (line 3), the rate of increase in the trimmed-mean measure has run about ¼ percentage point above total inflation. By contrast, the average change in the index excluding food and energy has been almost identical to the overall inflation rate in all three periods.¹³

Table 1. Descriptive statistics of inflation measures

	Total PCE				excluding Food and Energy				Dallas Fed Trimmed Mean			
	<i>Mean</i>	<i>Std</i>	<i>Skew</i>	<i>Kurt</i>	<i>Mean</i>	<i>Std</i>	<i>Skew</i>	<i>Kurt</i>	<i>Mean</i>	<i>Std</i>	<i>Skew</i>	<i>Kurt</i>
(1) 1977-2009	3.5	3.2	0.3	5.7	3.5	2.5	1.1	3.9	3.5	2.0	1.4	4.5
(2) 1977-1995	4.8	3.2	0.8	3.5	4.8	2.5	0.7	3.0	4.5	2.1	0.9	2.9
(3) 1995-2018	1.8	2.3	-1.0	10.4	1.7	1.0	0.0	3.9	2.0	0.6	0.0	3.2

Note: the table shows descriptive statistics for monthly percent changes at an annual rate for three measures of PCE price inflation. “Std” stands for “Standard deviation”. “Skew” stands for Skewness. “Kurt” stands for Kurtosis. The descriptive statistics for the index excluding food and energy are computed by replacing the observations for September and October 2001 with the median of the series. This exclusion has a material effect only on the kurtosis and skewness in the 1995-1998 sample, which value would otherwise be 16.4 and -0.4, respectively. **Source:** authors’ calculations on Bureau of Economic Analysis (BEA) and Federal Reserve Bank of Dallas data.

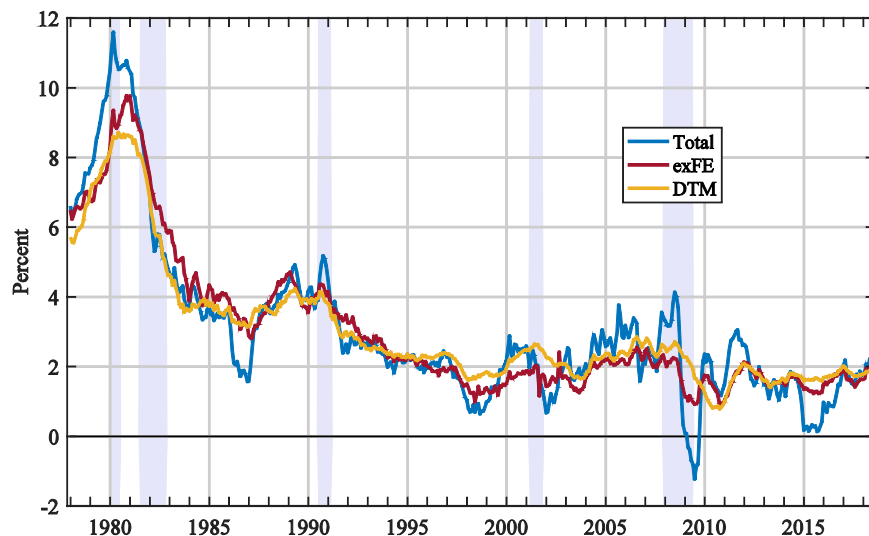
To summarize, despite their methodological differences, both indexes appear capable of reducing the variance of total inflation while capturing the location of the overall distribution of price changes. In addition, the changes in both core indexes are relatively more symmetric around their mean (their skewness is closer to zero), especially since the mid-1990s. The trimmed mean PCE index is able to smooth across large idiosyncratic episodes slightly better than the index excluding food and energy; however the fact that the trimmed-mean inflation measure has run consistently higher than total PCE price inflation since the mid-1990s suggests that its current level should be interpreted carefully. Also, it is worth noting that the gap between the average pace of total inflation and the trimmed mean varies over time to a greater extent than the gap between total

indicates symmetry). The kurtosis measures the fatness of the tails (a higher kurtosis indicates fatter tails). Both measures of core inflation appear to be symmetric around their means (skewness equals to 0 in the 1995-2018 sample) with thinner tails than total PCE prices inflation (lower kurtosis).

¹³ The focus of this paragraph is on the average rate of change, specifically meant as simple average and not as estimator of the central tendency. If one is more interested in the central tendency, then an alternative estimator could be the median. As a reference, the median for total PCE price inflation in the 1995-2008 sample is 2.0 percent, the median for the index excluding food and energy is 1.7 percent, while the median for the trimmed mean is 2.0 percent.

inflation and the index excluding food and energy.¹⁴ Therefore, it is more challenging to interpret the level of the trimmed mean, especially in relation to the FOMC’s longer-run inflation goal.

Figure 2. PCE price inflation.
12-month percentage change



Note: The figure shows the 12-month changes of total PCE price index (blue line), PCE excluding food and energy price index (red line), and the trimmed mean PCE price index (yellow line). The shaded areas indicate recessions as defined by the National Bureau of Economic Research (NBER). “Total” refers to “Total PCE price inflation”. “exFE” refers to “PCE price inflation excluding food and energy”. “DTM” refers to “Dallas FED Trimmed Mean PCE price inflation”. **Source:** authors’ calculations on Bureau of Economic Analysis (BEA) and Federal Reserve Bank of Dallas data.

4. Metric II: relative forecasting performance

A key purpose of a measure of core inflation is to provide an indication of the future direction of total inflation. Hence, we would like core inflation to be a better predictor of future total inflation than total inflation itself.

In this section, we investigate the relative forecasting performance of the index excluding food and energy and the trimmed mean index. Our goal is to predict total inflation twenty-four months ahead, and our benchmark is a forecast that only uses total inflation to predict itself.

Specifically, we follow Detmeister (2011) and use the following forecasting equation for total PCE price inflation:

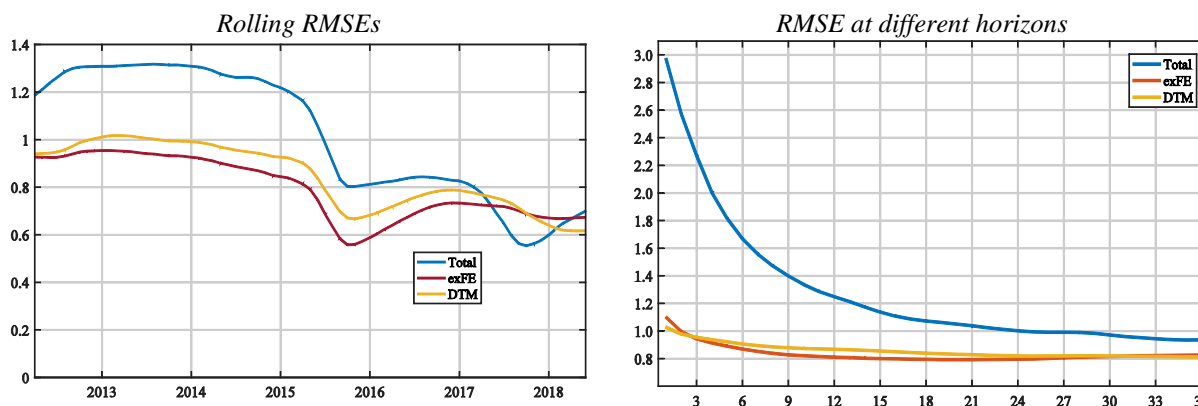
$$\pi_{t+h,t} = \alpha + \pi_{t,t-s}^c + \varepsilon_{t+h,t}, \tag{1}$$

¹⁴ The evidence about the time-varying gap between total PCE price inflation and the trimmed mean holds true even when alternative moving averages are applied. On the other hand, the gap between total PCE price inflation and PCE excluding food and energy price inflation appears more stable over time, especially when considering longer moving averages (see Figure A1 in the Appendix).

where $\pi_{t+h,t} = 100 \left[\left(\frac{p_{t+h}}{p_t} \right)^{\frac{12}{h}} - 1 \right]$ is total PCE price inflation between month t and month $t+h$ (expressed at an annual rate), $\pi^c_{t,t-s}$ is a specified measure of core inflation between month $t-s$ and month t (again at an annual rate), α is the average difference between total and core inflation over the past ten years, and $\varepsilon_{t+h,t}$ is a prediction error. Note that the inclusion of α means that the trimmed mean is not penalized in this exercise for averaging a little higher than overall PCE inflation over the past 20 years.

The forecasting exercise is run in real time, meaning that we construct our forecasts using the actual vintages of data that were available at each point in time.¹⁵ Our goal is to predict the annualized 24-month-ahead percent change in the total PCE price index computed using the latest available data (meaning the data published by the BEA on July 31, 2018). The first forecast we produce is for inflation over the 24 months from June 2005 to June 2007, using data available as of June 2005. Next, we produce a forecast for July 2007 using the data available as of July 2005. We then repeat the same procedure until June 2018, thereby yielding a total of 157 forecasts.

Figure 4. Forecast evaluation.
24-month percentage change



Note: The left panel shows the 5-years rolling window root mean squared error of the 24-month change of total (blue line), exFE (red line), and TM (yellow line) in predicting the 24-month change of total PCE inflation. Each point in the left panel represents the RMSE for the 5-year window ending at that date. The right panel shows the root mean squared error when different number of months is used in constructing the core measure's inflation rate (i.e., s in formula 1). For example, the point corresponding to the number “6” on the x-axis represents the RMSE of the 24-month total inflation has been predicted using the 6-month changes. “Total” stands for “Total PCE price”. “exFE” stands for “PCE excluding food and energy”. “DTM” stands for “Dallas FED Trimmed Mean PCE index”. **Source:** authors' calculations on Bureau of Economic Analysis (BEA) and Federal Reserve Bank of Dallas data.

¹⁵ In detail, at each point in time in which the forecast is produced, say at time T , α , which is the only parameters that needs to be estimated in order to produce a forecast, is estimated using the real time vintage of data at forecast origin time T . An alternative approach suggested by Koenig *et al.* (2003) would be to estimate α by using only first release data, i.e., for each $t = 1, \dots, T$ the observation of $\pi^c_{t,t-s}$ is taken from the vintage ending at date t . Koenig *et al.* (2003) argue that this approach delivers better forecasts, and Clements and Galvao (2013) confirms this result, though they show that the gains are very small, even more so when forecasting the final vintage. For additional discussion of different set-ups for real-time forecasting see Clark and Mc Cracken (2013).

Figure 4 summarizes the results of this exercise.¹⁶ The left panel of Figure 4 shows the root-mean-squared forecast error (RMSE) that obtains over a rolling 5-year window when we use the 24-month change in the core price index as a predictor; the right panel shows the root-mean-squared forecast error that obtains for the full sample when we use annualized core inflation rates computed over periods that range from one to 36 months (that is, we allow s in equation 1 to vary between one and 36).

Starting with the RMSEs computed over rolling windows (left panel), the index excluding food and energy and the trimmed mean each yield better forecasts than total PCE price inflation itself, although the improvement is minimal in recent years. In addition, until very recently the index excluding food and energy performs slightly better than the trimmed-mean measure. For the forecasting models that use core inflation measures computed over alternative horizons (right panel), both core measures perform better than total inflation, but none of them clearly dominates the other.¹⁷

Our results are robust to two variations in procedure. First, our results are qualitatively similar if we consider a different target, such as the first release of total PCE price inflation h -months ahead (see Figure A4 in the Appendix). As for the horizon, we consider three alternatives: $h=12$, $h=24$, and $h=36$ months ahead. Second, because our sample is limited and might be distorted by the Great Recession, we run a *pseudo*-real-time exercise starting in 1984 (the exercise is *pseudo*-real-time inasmuch as the forecasts are constructed using the current vintage of data); the results we obtain are broadly similar to those reported here (see Figure A5 in the Appendix).

Summing up, the results of the forecasting exercise show that the two measures of core inflation predict future inflation significantly better than total PCE price inflation itself. The trimmed mean and the measure excluding food and energy perform similarly well in predicting future inflation, with a slightly better performance in recent years of the trimmed mean in predicting average inflation over the next two years. However, over the previous six years or so the measure excluding food and energy delivered a more accurate forecast of total inflation. In conclusion, from the point of view of forecasting future inflation, there is no clear advantage of one measure over the other.

¹⁶ Results when the target variable is the 12-month change ($h = 12$), or the annualized 36-month change ($h = 36$), are shown in the Appendix (Figure A2 and A3), and are similar to those summarized in Figure 4. Forecast horizons shorter than 12 months are not examined, as those horizons are less relevant for policy decisions.

¹⁷ We have also used a Diebold–Mariano–West-style test to assess whether these differences in predictive ability are statistically significant (results not shown). We find that the index excluding food and energy and the trimmed mean measure do significantly better than total PCE (at a 10 percent level) for values of s that range from 1 to 10; for all other values of s that we consider, the difference in predictive ability is not statistically significant. The difference between the RMSEs for forecasts that use the index excluding food and energy and forecasts that use the trimmed mean is also not statistically significant at conventional levels.

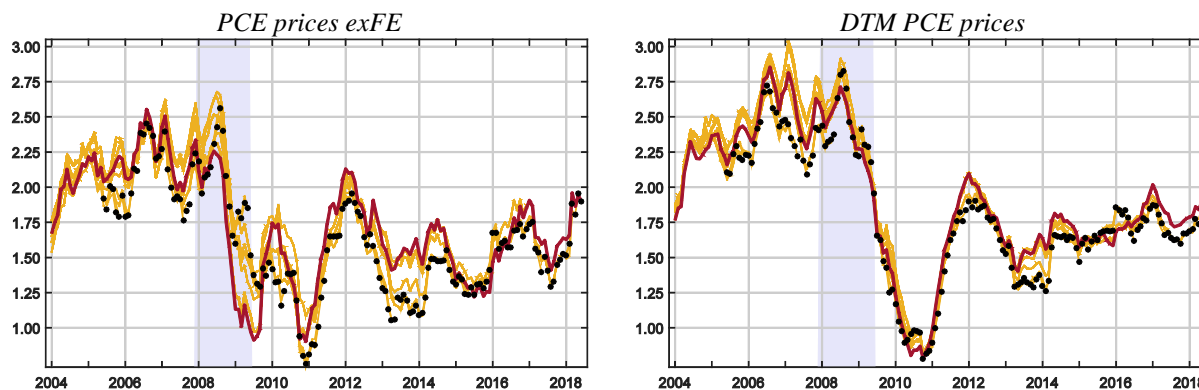
5. Metric III: revisions across data vintages

In the previous section, we demonstrated that the two core measures have roughly the same forecasting ability. Nevertheless, for a policymaker making and communicating decisions in real time, it is also desirable that a core inflation measure is not subject to large revisions. CPIs are the most important source data for PCE prices, and because the CPI is not revised (except for seasonal factors), the bulk of the revisions to PCE prices typically come from the non-market components, most of which are imputed and noisy.

To compare the relative performance of the two core inflation measures along this dimension, Figure 3 plots real time and current-vintage estimates of the 12-month change in the index excluding food and energy (left panel) and the trimmed-mean index (right panel).

In each chart, the red line shows the 12-month changes computed using the latest available data (meaning the data published by the BEA on July 31, 2018). The black dots show the value of the 12-month change in each month using the first release for that month. Finally, for each of the 157 black dots there is a corresponding yellow line, showing the 12-month changes computed using the associated vintages. Put differently, in the figure there is a yellow line for each black dot and each yellow line ends with a corresponding black dot.

Figure 3. PCE price inflation in real time
12-month percentage change



Note: In each panel the red line is the 12-month change obtained with the last available vintage of data (July 31, 2018), while the yellow lines are the 12-month changes obtained with all the remaining 156 vintages. The black dots represent the 12 month change of inflation for month M and year Y obtained with the vintage of data ending at month M and year Y. The ticks on the x-axis correspond to the month of January. “exFE” stands for “excluding food and energy”. “DTM” stands for “Dallas FED Trimmed Mean”. **Source:** authors’ calculations on Bureau of Economic Analysis (BEA) and Federal Reserve Bank of Dallas data.

As is apparent from the figure, the magnitude of the revisions to these inflation measures can be sizable at times. As an example, consider the 12-month change in January 2014 for the index excluding food and energy prices. According to the first vintage (indicated by the black dot), the 12-month change through January 2014 was estimated at 1.09 percent. It was then revised to 1.24 percent with the annual revision of that year; then to 1.44 and 1.47 percent with the two subsequent annual revisions. Finally, according to the current vintage (the red line), the 12-month change

through January 2014 is estimated to be 1.52 percent—about ½ percentage point higher than the first release.

Switching to the trimmed-mean index, this index is also subject to revisions, but such revisions tend to be smaller than those of the index excluding food and energy, as shown by the fact that the yellow lines are less dispersed around the red line.¹⁸

Table 2 gives some descriptive statistics for the revisions that we define as the difference between the current-vintage estimates (the red line in Figure 3) and the real time estimates (the corresponding black dots in Figure 3). In absolute terms, the mean revision is 19 basis points for the measure excluding food and energy and 12 basis points for the trimmed-mean measure. In addition to being smaller, the revisions to the trimmed mean are also less volatile: The standard deviation of the revision to the trimmed-mean inflation measure is 11 basis points, compared with 23 basis points for the change in the index excluding food and energy. Given its smaller bias and variability, the root-mean-square error for the trimmed-mean measure is also smaller than the one for the index excluding food and energy.¹⁹

Table 2. Statistics on PCE inflation revisions

	Total	exFE	DTM
Mean	0.03	0.09	0.09
Mean Absolute Value	0.17	0.19	0.12
Standard Deviation	0.24	0.23	0.11
Root Mean Squared Error	0.24	0.25	0.14

Note: Difference between current vintage and the first release of the 12-month percent change; “Total” refers to “Total PCE price inflation”. “exFE” refers to “PCE price inflation excluding food and energy”. “DTM” refers to “Dallas FED Trimmed Mean PCE price inflation”. **Source:** authors’ calculations on Bureau of Economic Analysis (BEA) and Federal Reserve Bank of Dallas data.

Summing up, both measures of core inflation are subject to revisions, though the revisions are larger for the index excluding food and energy than the trimmed mean. This evidence suggests that the first release of the index excluding food and energy should be interpreted with care. Also, this evidence suggests that from the point of view of the stability across data vintages, the trimmed mean is preferable over the index excluding food and energy.

¹⁸ *A priori*, neither of the two indexes is necessarily more stable than the other across vintages on purely theoretical grounds. That said, we can advance two possible explanations for this empirical fact. First, if an item is revised and the revision is sufficiently large to push it in the tail of the distribution, the item is removed by the trimmed mean while it is nevertheless included in the index excluding food and energy. Second, there might be a correlation between the size of the price change in the first release and the subsequent revision, and hence the items that revise the most would be those initially removed by the trimmed mean. Unfortunately, answering this question with precision would require analyzing all 157 vintages across all 178 PCE items, which is beyond the scope of this memo.

¹⁹ We have also computed the statistics across vintages (not shown). The main finding is that the first release of the data tends to be revised more than the subsequent releases (that is, the yellow lines in Figure 3 tend to lie in between the black dots and the red line). On top of this, the bulk of the revisions occur with the annual and comprehensive revisions, while the revisions that occur with the first few releases are less relevant. For a similar finding, see Price (2011).

6. A summing up

We have assessed the relative performance of two measures of core inflation according to three metrics: the measure's ability to match the mean rate of total PCE price inflation with a lower degree of variability; its susceptibility to revisions; and its ability to predict future inflation.

Our results do not identify one measure as clearly preferable to the other. The rate of change in PCE prices excluding food and energy price offers the advantage of having the same mean as total PCE price inflation over sufficiently long samples, but is more affected by data revisions than the trimmed mean. In contrast, the trimmed-mean is less subject to subsequent revision, but the index has tended to rise faster than the total PCE price index over the past 20 years or so. Finally, from a forecasting perspective, the two core measures anticipate future movement of total inflation better than total inflation itself; however, neither clearly outperforms the other.

We have not discussed communication-related issues, which we view as being outside the scope of this memo. That said, there is no clear winner in terms of understandability to the public, in our view. On the one hand, many non-economists caricature those who use the index excluding food and energy as implicitly assuming that “real people don't eat or drive cars.” On the other hand, non-economists might be hard pressed to rationalize the trimmed mean index because it throws out a potentially different set of prices each succeeding month, and it excludes a considerably larger fraction of overall PCE prices than does the index excluding food and energy.

In conclusion, our results suggest that the two indexes of core inflation should be viewed as complementary tools for gauging the underlying pace of inflation.

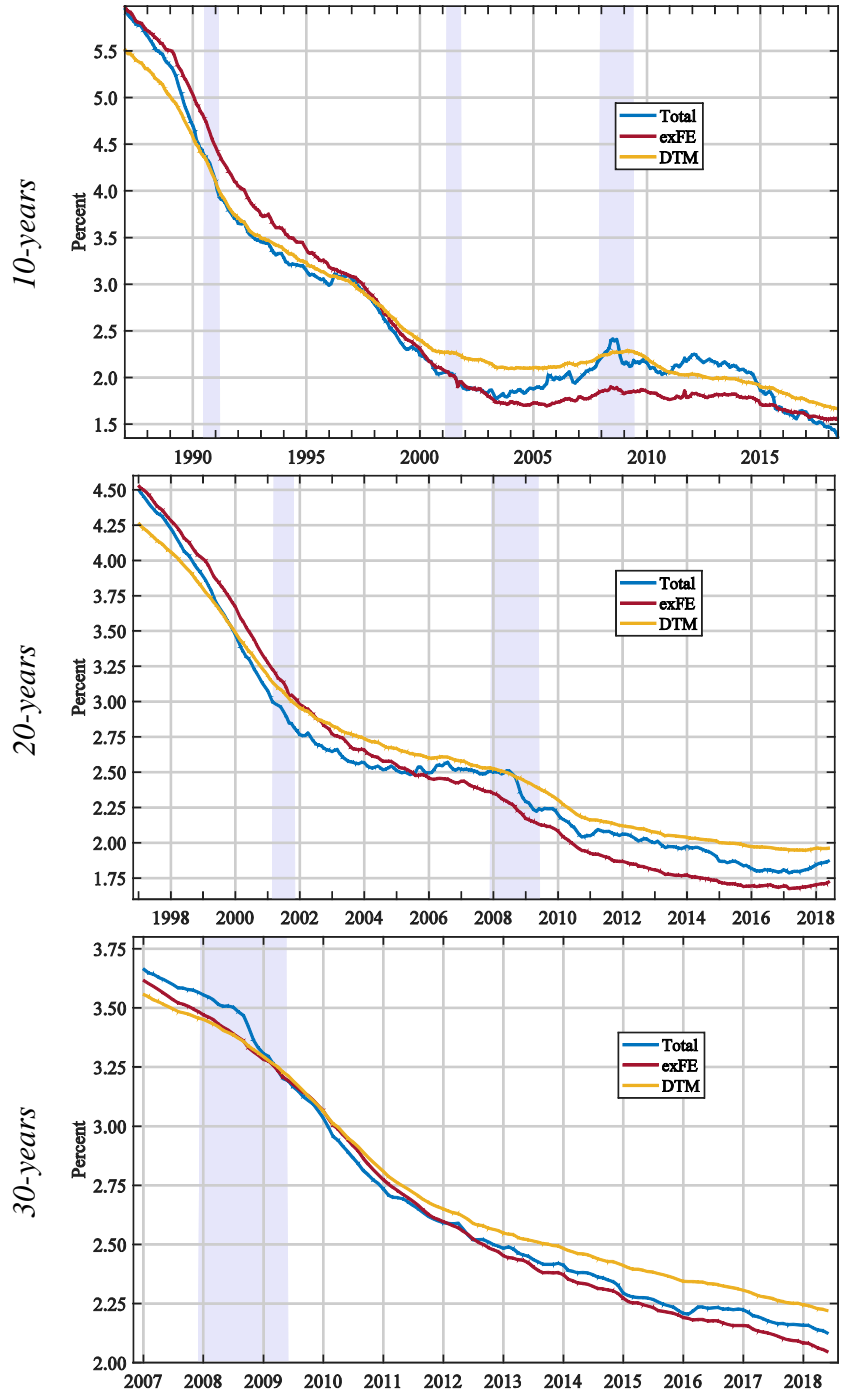
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Appendix – Additional Results

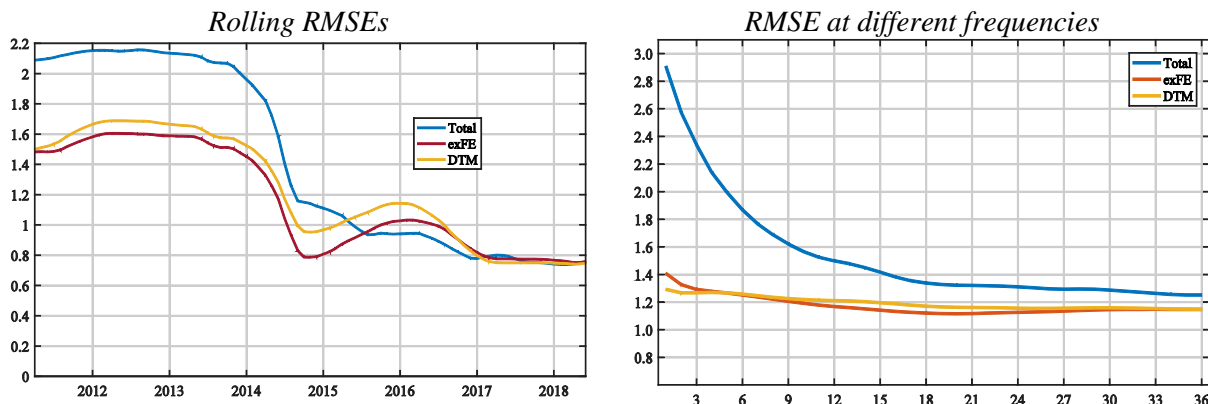
Figure A1. Moving average of PCE price inflation



Note: The Figure shows different moving averages of total PCE price index (blue line), PCE excluding food and energy price index (red line), and the trimmed mean PCE price index (yellow line).

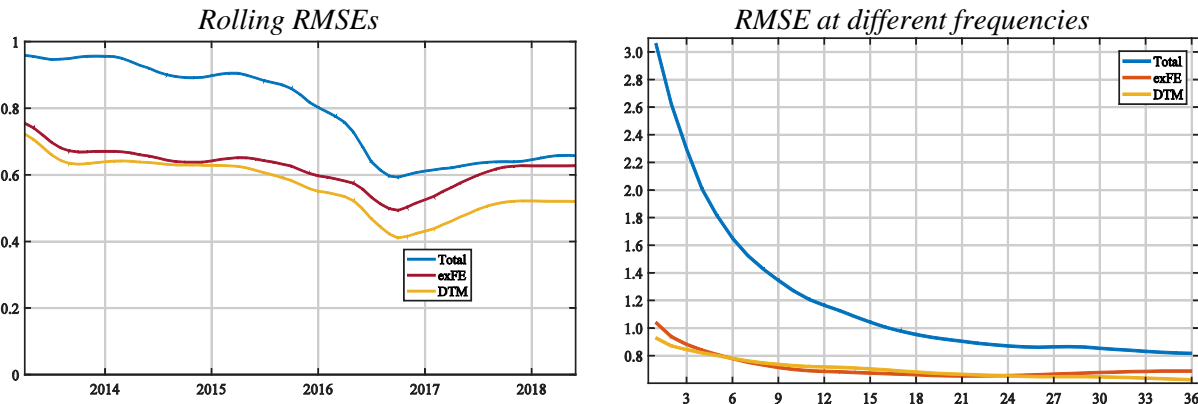
Figure A2 and Figure A3 show results of the real time forecasting exercise when the target variable is the 12-month change ($h = 12$), or the annualized 36-month change ($h = 36$).

Figure A2. Forecast evaluation.
12-month percentage change



Note: The left panel shows the 5-years rolling window root mean squared error of the 12-month change of total (blue line), exFE (red line), and TM (yellow line) in predicting the 24-month change of total PCE inflation. Each point in the left panel represents the RMSE for the 5-year window ending at that date. The right panel shows the root mean squared error when different number of months is used in constructing the core measure’s inflation rate (i.e., s in formula 1). For example, the point corresponding to the number “6” on the x-axis represents the RMSE of the 12-month total inflation has been predicted using the 6-month changes. “Total” stands for “Total PCE price”. “exFE” stands for “PCE excluding food and energy”. “DTM” stands for “Trimmed Mean PCE”. **Source:** authors’ calculations on Bureau of Economic Analysis (BEA) and Federal Reserve Bank of Dallas data.

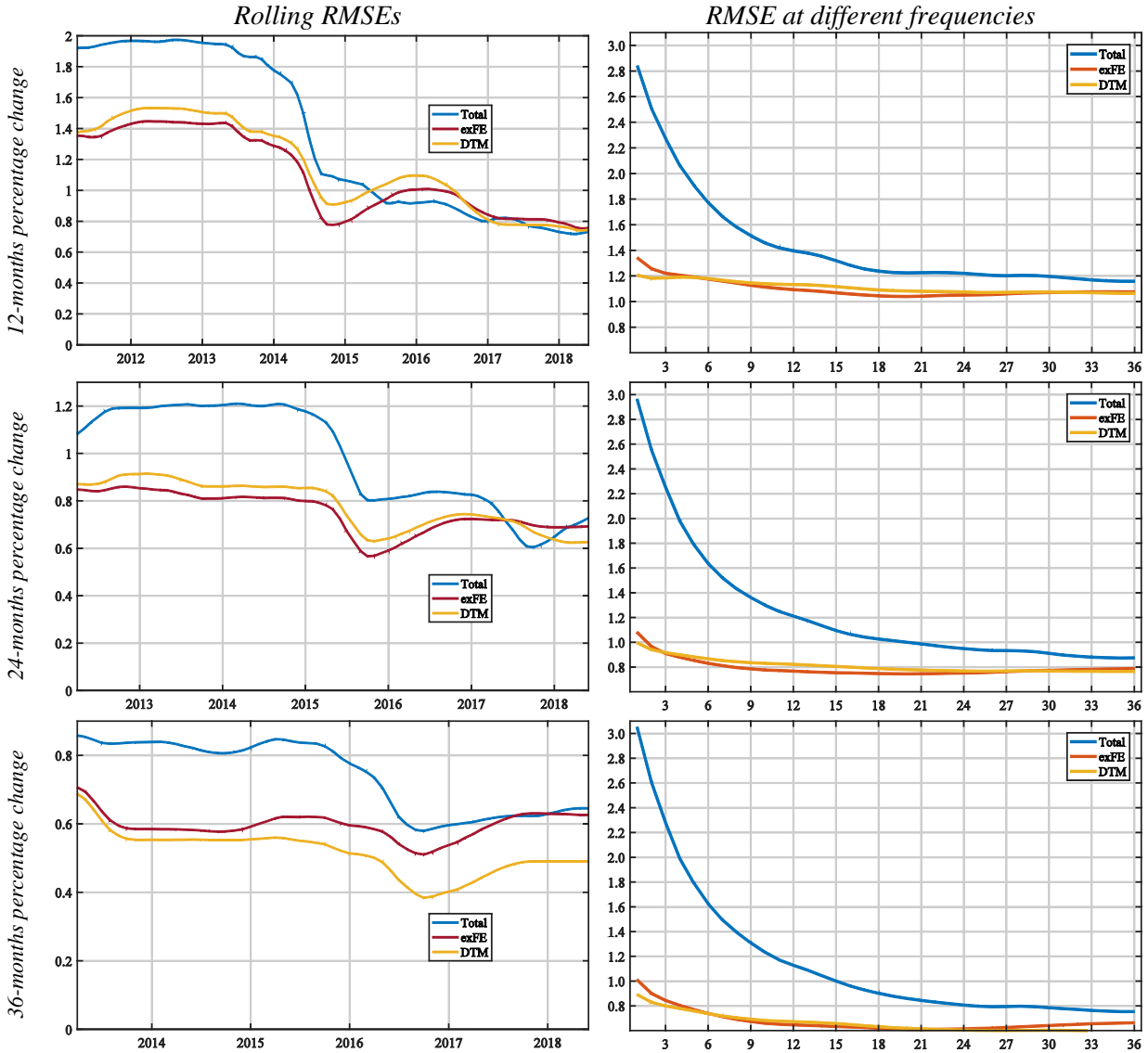
Figure A3. Forecast evaluation.
36-month percentage change



Note: The left panel shows the 5-years rolling window root mean squared error of the 36-month change of total (blue line), exFE (red line), and TM (yellow line) in predicting the 24-month change of total PCE inflation. Each point in the left panel represents the RMSE for the 5-year window ending at that date. The right panel shows the root mean squared error when different number of months is used in constructing the core measure’s inflation rate (i.e., s in formula 1). For example, the point corresponding to the number “6” on the x-axis represents the RMSE of the 36-month total inflation has been predicted using the 6-month changes. “Total” stands for “Total PCE price”. “exFE” stands for “PCE excluding food and energy”. “DTM” stands for “Trimmed Mean PCE”. **Source:** authors’ calculations on Bureau of Economic Analysis (BEA) and Federal Reserve Bank of Dallas data.

Figure A4 shows results of the forecasting exercise when a different target such as the value in the vintage h -months ahead (that is, the h -step ahead black dot in Figure 2) is considered.

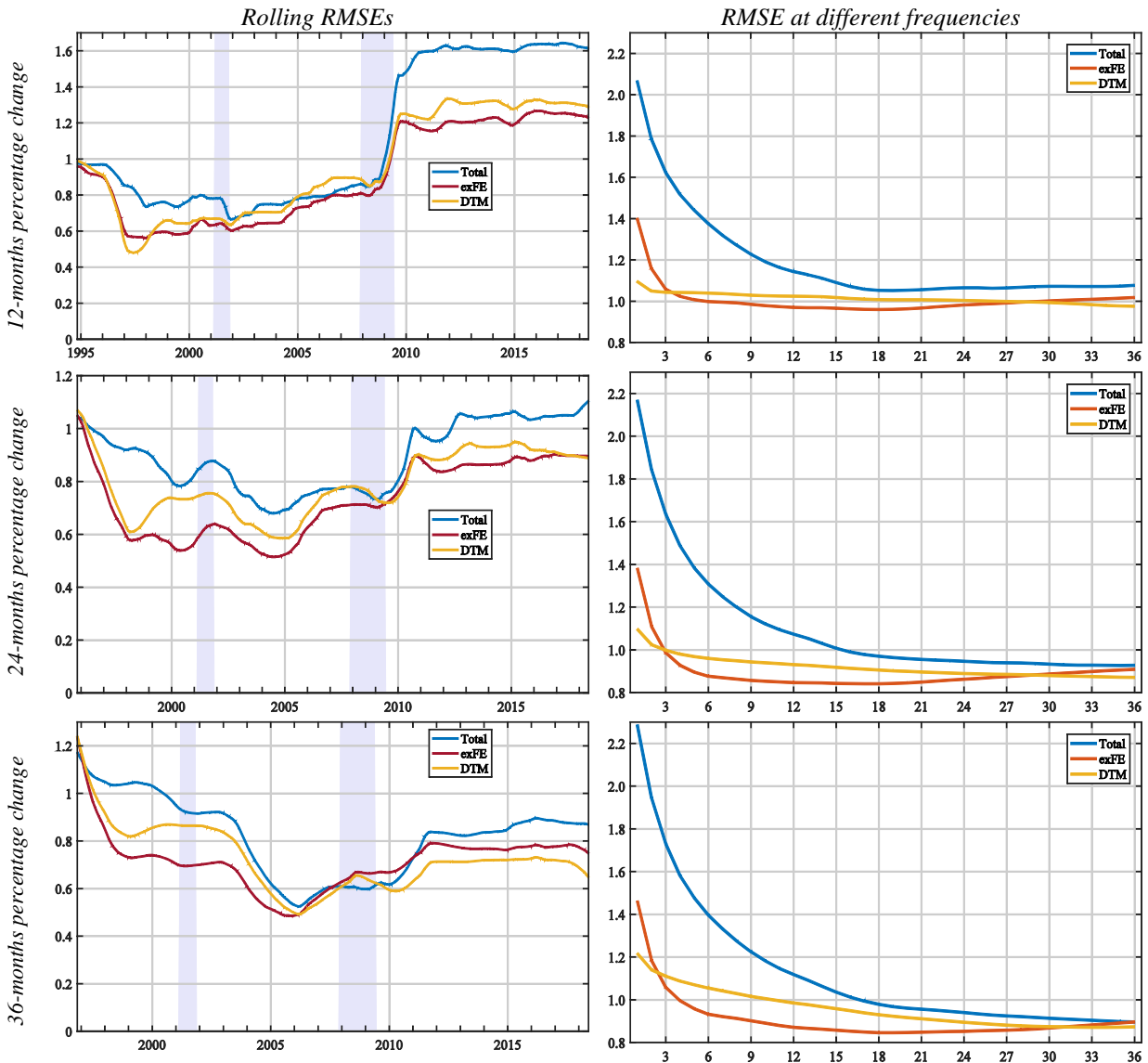
Figure A4. Real time forecast evaluation.
Different target variable



Note: The left panels show the 5-years rolling window root mean squared error of the h -month change of total (blue line), exFE (red line), and TM (yellow line) in predicting the 24-month change of total PCE inflation. Each point in the left panels represents the RMSE for the 5-year window ending at that date. The right panels show the root mean squared error when different number of months is used in constructing the core measure's inflation rate (i.e., s in formula 1). For example, the point corresponding to the number "6" on the x-axis represents the RMSE of the h -month total inflation has been predicted using the 6-month changes. "Total" stands for "Total PCE price". "exFE" stands for "PCE excluding food and energy". "DTM" stands for "Trimmed Mean PCE". **Source:** authors' calculations on Bureau of Economic Analysis (BEA) and Federal Reserve Bank of Dallas data.

Figure A5 shows results of a *pseudo*-real-time forecasting exercise, meaning that the forecasts are constructed using the current vintage, as opposed to the data available at each point in time.

Figure A5. Pseudo-real-time forecast evaluation.



Note: The left panels show the 10-years rolling window root mean squared error of the h -month change of total (blue line), exFE (red line), and TM (yellow line) in predicting the 24-month change of total PCE inflation. Each point in the left panels represents the RMSE for the 5-year window ending at that date. The right panels show the root mean squared error when different number of months is used in constructing the core measure's inflation rate (i.e., s in formula 1). For example, the point corresponding to the number "6" on the x-axis represents the RMSE of the h -month total inflation has been predicted using the 6-month changes. "Total" stands for "Total PCE price". "exFE" stands for "PCE excluding food and energy". "DTM" stands for "Trimmed Mean PCE". **Source:** authors' calculations on Bureau of Economic Analysis (BEA) and Federal Reserve Bank of Dallas data.