

Inflation Nowcasting: Frequently Asked Questions

This document accompanies the technical working paper “[Nowcasting U.S. Headline and Core Inflation](#)” by Edward S. Knotek II and Saeed Zaman. See the paper for more details and references.

Could you walk through the model (technical)?

For more on the model, see the [working paper](#). Here, we very quickly go through the key elements of the model used to compute the inflation nowcasts, focusing more on practical implementation than technical details.

Let T denote quarters and t denote months, such that within some quarter T there are months $t=1, 2, 3$. Quarterly inflation π_T is usually measured at seasonally adjusted annualized rates as $\pi_T = 100[(P_T / P_{T-1})^4 - 1]$, where $P_T = (1/3)(P_{T,t=1} + P_{T,t=2} + P_{T,t=3})$. Monthly inflation is expressed in nonannualized terms as $\pi_t = 100(P_t / P_{t-1} - 1)$. Thus, if we have nowcasts or forecasts of monthly inflation rates, we can fill in the missing price levels for the months within a given quarter to compute quarterly inflation.

We denote nowcasts or forecasts for a variable x by using the notation $f(x)$. In what follows, we set $J=12$, $\tau=24$, and $\tau_L=60$.

Core CPI inflation. Suppose we have monthly core CPI inflation data through month $t-1$, $\pi_{t-1}^{\text{Core CPI}}$. We recursively forecast monthly core CPI inflation using J -month moving averages, so the forecast for month t is $f(\pi_t^{\text{Core CPI}}) = (1/J) \sum_{j=1, \dots, J} \pi_{t-j}^{\text{Core CPI}}$, and forecasts for months $t+1, t+2, \dots$ follow.

Core PCE inflation. Suppose we have monthly core PCE inflation data through month $t-1$, $\pi_{t-1}^{\text{Core PCE}}$. If we have core CPI inflation through month t (data, not a forecast) but are missing core PCE inflation in month t , we bridge from core CPI inflation to core PCE inflation. That is, using a rolling window of length τ , we estimate the regression model

$\pi_t^{\text{Core PCE}} = \beta_0 + \beta_1 \pi_t^{\text{Core CPI}} + e_t$, then use the estimated coefficients and the actual reading on $\pi_t^{\text{Core CPI}}$ to obtain $f(\pi_t^{\text{Core PCE}})$. If we do not have more core CPI inflation data than we have core PCE inflation data, or if we’ve already bridged all the available core CPI inflation data, then we recursively forecast monthly core PCE inflation $f(\pi_{t+k}^{\text{Core PCE}})$, $k \geq 0$, using J -month moving averages.

CPI food inflation. Suppose we have monthly CPI food inflation through month $t-1$, $\pi_{t-1}^{\text{Food CPI}}$. As with core inflation, we recursively forecast monthly CPI food inflation $f(\pi_{t+k}^{\text{Food CPI}})$, $k \geq 0$, using J -month moving averages.

PCE food inflation. Suppose we have monthly inflation in the PCE price index for food and beverages purchased for off-premises consumption through month $t-1$, $\pi_{t-1}^{\text{Food Off Premises PCE}}$. If we have monthly inflation in the CPI for food at home (not just food) in month t , $\pi_t^{\text{Food at Home CPI}}$, we bridge it over to the PCE-equivalent concept by setting $f(\pi_t^{\text{Food Off Premises PCE}}) = \pi_t^{\text{Food at Home CPI}}$. If we do not have more CPI data than PCE data, or if we’ve already bridged it, we recursively forecast $f(\pi_{t+k}^{\text{Food Off Premises PCE}})$, $k \geq 0$, using J -month moving averages.

Gasoline inflation. Letting $P_t^{\text{Gasoline (NSA)}}$ denote the average of available weekly gasoline prices within a month t before any seasonal adjustment, we compute monthly gasoline inflation

$\pi_t^{\text{Gasoline (NSA)}} = 100(P_t^{\text{Gasoline (NSA)}} / P_{t-1}^{\text{Gasoline (NSA)}} - 1)$. We seasonally adjust the series to make it useful: if $\pi_{t-j}^{\text{Gasoline CPI}}$ is monthly inflation in the (seasonally adjusted) CPI for gasoline in month $t-j$, we define the seasonal factor in month t to be $sf_t = (1/3) \sum_{j=1, \text{ year}, 2 \text{ years}, 3 \text{ years}} (\pi_{t-j}^{\text{Gasoline (NSA)}} - \pi_{t-j}^{\text{Gasoline CPI}})$ and then use it to derive our measure of seasonally adjusted monthly gasoline inflation: $\hat{\pi}_t^{\text{Gasoline}} = \pi_t^{\text{Gasoline (NSA)}} - sf_t$. To augment our gasoline price data, let P_t^{Oil} be the average of available daily oil prices within a month t . Mechanically, we extend the monthly oil price series by one observation by setting P_{t+1}^{Oil} to the last available daily observation. Using a rolling window of length τ_L , we estimate the first-stage regression $P_t^{\text{Gasoline (NSA)}} = \alpha + \beta P_t^{\text{Oil}} + e_t$; let $g(P_t^{\text{Gasoline (NSA)}})$ denote the predicted gasoline prices based on the regression coefficients and the actual monthly oil prices. Next, we estimate the second-stage regression $[P_t^{\text{Gasoline (NSA)}} - g(P_t^{\text{Gasoline (NSA)}})] = a[P_{t-1}^{\text{Gasoline (NSA)}} - g(P_{t-1}^{\text{Gasoline (NSA)}})] + e_t$, using the same rolling window. We match the length of $g(P_{t+1}^{\text{Gasoline (NSA)}})$ to the length of the oil price series using the first-stage regression coefficients, and then derive forecasts of $f(P_{t+1}^{\text{Gasoline (NSA)}})$ based on the second-stage regression coefficient. Finally, we compute monthly inflation in the non-seasonally adjusted gasoline prices and then seasonally adjust the data as described above to produce a set of $f(\pi_{t+k}^{\text{Gasoline}})$, $k \geq 0$. Due to release lags, we typically have one or two more months of gasoline inflation nowcasts or forecasts than we have CPI and PCE inflation data.

CPI inflation. Suppose we have monthly CPI inflation data through month $t-1$, π_{t-1}^{CPI} . We estimate the regression model $\pi_t^{\text{CPI}} = \beta_0 + \beta_1 \pi_t^{\text{Core CPI}} + \beta_2 \pi_t^{\text{Food CPI}} + \beta_3 \pi_t^{\text{Gasoline}} + e_t$ using a rolling window of length τ . In nowcasting months $t, t+1$, etc., if we have an estimate of $f(\pi_{t+k}^{\text{Gasoline}})$ for some $k \geq 0$, we use it along with the coefficients we just estimated and the estimates of $f(\pi_{t+k}^{\text{Food CPI}})$ and $f(\pi_{t+k}^{\text{Core CPI}})$ produced earlier and to derive the nowcast of $f(\pi_{t+k}^{\text{CPI}})$. If we do not have an estimate of $f(\pi_{t+k}^{\text{Gasoline}})$, we recursively forecast $f(\pi_{t+k}^{\text{CPI}})$, $k \geq 0$, using J -month moving averages.

PCE inflation. Suppose we have monthly PCE inflation data through month $t-1$, π_{t-1}^{PCE} . If we have monthly CPI inflation *data* (not a forecast) through month t , we bridge it to nowcast PCE inflation by estimating the regression model $\pi_t^{\text{PCE}} = \beta_0 + \beta_1 \pi_t^{\text{CPI}} + e_t$ using a rolling window of length τ , then use the estimated coefficients and the actual reading on π_t^{CPI} to obtain $f(\pi_t^{\text{PCE}})$. Going forward for some month $t+k$, if we have an estimate of $f(\pi_{t+k}^{\text{Gasoline}})$, we first estimate the regression model $\pi_t^{\text{PCE}} = \beta_0 + \beta_1 \pi_t^{\text{Core PCE}} + \beta_2 \pi_t^{\text{Food Off Premises PCE}} + \beta_3 \pi_t^{\text{Gasoline}} + e_t$ using a rolling window of length τ , and then use those estimated coefficients along with estimates of $f(\pi_{t+k}^{\text{Gasoline}})$, $f(\pi_{t+k}^{\text{Food Off Premises PCE}})$, and $f(\pi_{t+k}^{\text{Core PCE}})$ produced earlier to derive the nowcast of $f(\pi_{t+k}^{\text{PCE}})$. Finally, if we do not have an estimate of $f(\pi_{t+k}^{\text{Gasoline}})$, we recursively forecast $f(\pi_{t+k}^{\text{PCE}})$ using J -month moving averages.