Define the following rates where, e.g., a value of 5.0 denotes 5 percent. All quarterly rates are defined as quarterly averages of the monthly rates with latest vintage (i.e. non real-time) data.

\(U3_t\): Seasonally adjusted civilian unemployment rate from the U.S. Bureau of Labor Statistics (BLS) in quarter \(t\), also known as U-3.

\(U3_t^{CBO,LR}\): Underlying long-term rate of unemployment from the Congressional Budget Office in quarter \(t\).

\(U6_t\): Seasonally adjusted labor underutilization measure U-6 from the BLS in quarter \(t\).

\(ZPOP_t\): The labor utilization called ZPOP defined by Atlanta Fed researchers John Robertson and Ellyn Terry in a September 2015 macroblog entry\(^1\). It is the share – multiplied by 100 – of the working-age population that is working full time, is voluntarily working part-time, or doesn’t want to work any hours. The monthly values are defined as 100 - \(invZPOP_m\).

\(invZPOP_m\): 1 minus the share of the civilian noninstitutional population ages 16+ years in one of the following 3 categories: 1) unemployment, 2) part-time for economic reasons, 3) not in the labor force but want a job. Each of these 3 number of persons series are seasonally adjusted, the first two by the BLS and the third by the Atlanta Fed. This share is then multiplied by 100.

\(invZPOP_t\): The quarterly average \(\frac{1}{3} \sum_{j=0}^{2} invZPOP_{m+j}\) where \(m\) is the first month of quarter \(t\).

Denote the first quarter of 1994 as quarter \(t=1\), the second quarter of 1994 as quarter \(t=2\), etc. Suppose we have actual and nowcasted quarterly data through quarter \(T\). For each \(x \in \{U3, U6, invZPOP\}\) define

\[
\bar{x} = \frac{1}{T} \sum_{t=1}^{T} x_t
\]

\[
\sigma_x = \sqrt{\frac{1}{T} \sum_{t=1}^{T} (x_t - \bar{x})^2}
\]

Define

\[
zU3_t^{CBO,LR} = \frac{U3_t^{CBO,LR} - \bar{U3}}{\sigma_{U3}}
\]

\[
U6_t^{CBO,LR} = zU3_t^{CBO,LR} \sigma_{U6} + \bar{U6}
\]

\[
invZPOP_t^{CBO,LR} = \frac{zU3_t^{CBO,LR} \sigma_{invZPOP} + invZPOP}{\sigma_{invZPOP}}
\]

Then the underemployment gap for U-3 is defined as

\[
U3gap_t = zU3_t^{CBO,LR} - U3_t
\]

and the underemployment gaps for U-6 and invZPOP are defined by

\[ U6\text{gap}_t = \frac{\sigma_{U3}}{\sigma_{U6}} (U6_{t}^{CBO,LR} - U6_t) \]

\[ invZPOP\text{gap}_t = \frac{\sigma_{U3}}{\sigma_{invZPOP}} (invZPOP_{t}^{CBO,LR} - invZPOP_t) \]

By construction, the three gaps have the identical means over the post-1993 period but not exactly the same standard deviations. Each of the three gaps is multiplied by 2 to put it on a scale similar to CBO’s real GDP gap.