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

$$zU3_t^{CBO,LR} = \frac{U3_t^{CBO,LR} - \overline{U3}}{\sigma_{U3}}$$

$$U6_t^{CBO,LR} = zU3_t^{CBO,LR}\sigma_{U6} + \overline{U6}$$

$$invZPOP_t^{CBO,LR} = zU3_t^{CBO,LR}\sigma_{invZPOP} + \overline{invZPOP}$$

Then the underemployment gap for U-3 is defined as

$$U3gap_t = U3_t^{CBO,LR} - U3_t$$

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[1] See http://macroblog.typepad.com/macroblog/2015/09/the-zpop-ratio-a-simple-take-on-a-complicated-labor-market.html.

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

$$U6gap_t = \frac{\sigma_{U3}}{\sigma_{U6}}(U6_t^{CBO,LR} - U6_t)$$

$$invZPOPgap_t = \frac{\sigma_{U3}}{\sigma_{invZPOP}}(invZPOP_t^{CBO,LR} - invZPOP_t)$$

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.