

Chicago Fed Letter

Changing labor force composition and the natural rate of unemployment

by Daniel Aaronson, vice president and director of microeconomic research, Luojia Hu, senior economist and research advisor, Arian Seifoddini, senior associate economist, and Daniel G. Sullivan, director of research and executive vice president

This article discusses why changes in the composition of the labor force may have lowered the natural (or trend) rate of unemployment—the unemployment rate that would prevail in an economy making full use of its productive resources—to 5% or less. A lower natural rate may help explain why wage inflation and price inflation remain low despite actual unemployment recently reaching 5.5%—a figure only slightly above prominent estimates of the natural rate, such as that of the Congressional Budget Office (CBO). Demographic and other changes should continue to lower the natural rate for at least the remainder of the decade.

Over the past 15 years, labor force participation (LFP) has steadily declined. While some of this decline is likely due to the weak economy, the bulk of

it reflects demographics and other long-running trends.¹ It is perhaps less well appreciated that the magnitude (and even the sign) of the change in the trend LFP rate² differs significantly across demographic groups. These divergent trend rates have changed the composition of the labor force in a manner that should lower the natural rate of unemployment. For example, the trend LFP rate has fallen especially rapidly for teens—a group that always has very high

rates of unemployment. Likewise, the share of workers without any college

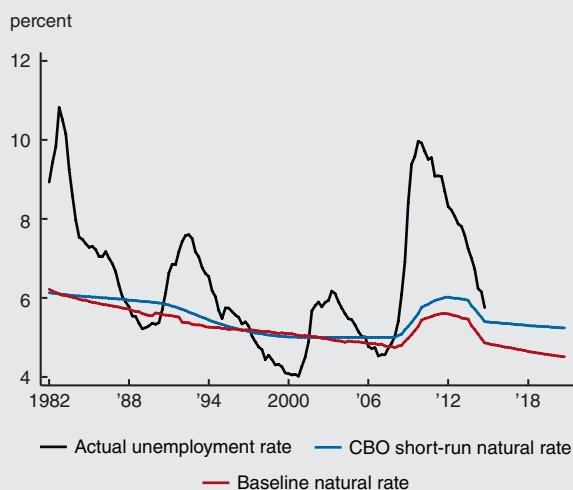
education—another group with higher-than-average unemployment—has also fallen significantly over time.

When we account in some simple ways for these demographic and educational changes, we find support for a natural rate at or just slightly below 5% at the end of 2014. Moreover, we estimate that absent major new developments, these forces will further lower the natural rate to around 4.4% to 4.8% by 2020.

The effect of demographic and educational changes

As is well known, the population is aging.³ The youngest baby boomers turned 50 in 2014, and roughly half of them are now in their sixties. Because this cohort is so large and because the LFP of older Americans has been rising, the share of the labor force aged 55 and older has grown markedly—from around 12.5% in the late 1990s to just over 22% in 2014. By contrast, because of both demographics and an especially pronounced decline in LFP, the share of the labor force under 25 has been shrinking. For example, teens made up almost 8% of the labor force in the

1. Actual and natural rates of unemployment



NOTE: See the text for further details on the two natural rates.

SOURCES: Authors' calculations based on data from the U.S. Bureau of Labor Statistics, *Current Population Survey*; and the Congressional Budget Office (CBO) from Haver Analytics.

2. Alternative estimates of the natural rate of unemployment

	2014:Q4	2017:Q4	2020:Q4
CBO short-run natural rate as of January 2015	5.4	5.3	5.2
Trend unemployment rate implied by			
Age, sex, and education change (baseline)	4.9	4.7	4.5
Age and sex change	5.0	4.9	4.8
Age, sex, education, and immigration change	5.0	4.8	4.6
Age, sex, and education change and CBO natural rate equal to actual rate in 2001	4.8	4.6	4.4
Age, sex, and education change with level estimated using inflation data	4.3	4.1	3.9

NOTES: All values are in percent. See the text for further details.

SOURCES: Authors' calculations based on data from the U.S. Bureau of Labor Statistics, *Current Population Survey*; and the Congressional Budget Office (CBO) from Haver Analytics.

early 1980s, but under half that share in 2014.⁴

Why does this matter for the natural rate of unemployment? Quite simply, because unemployment rates decline with age.⁵ Since 1982, the teen unemployment rate has averaged over 18%. By contrast, the unemployment rate for those aged 55 and older has averaged roughly 4%. Consequently, the labor force is increasingly composed of groups with low unemployment (e.g., 55 and older) and decreasingly composed of groups with high unemployment (e.g., teens), which suggests a declining natural rate.

Educational attainment has increased steadily since the early 1980s.⁶ Over that time, the share of the labor force 25 and older with at most a high school diploma has fallen by roughly 20 percentage points, while the share with at least a college degree has risen by 14 percentage points. Unemployment rates are much lower for those with college degrees,⁷ so this trend also suggests a declining natural rate.

To assess the likely magnitude of these compositional effects on the natural rate of unemployment, we calculate a trend unemployment rate implied by changes in the age, sex, and educational composition of the labor force using 1982–2014 data from the U.S. Bureau of Labor Statistics' *Current Population Survey* (CPS) and our estimates of

group-specific trend LFP rates.

Specifically, our trend unemployment rate holds the trend unemployment rate for every age-sex-education group fixed at its level in the second half of 2005, but allows groups' shares to vary over time as predicted by our model of LFP. The second half of 2005 is chosen as a base because it is the last time the actual unemployment rate was equal to the

CBO's estimate of the natural rate. That is, if one thinks the CBO had the estimate right in 2005, our calculations say what compositional change should mean for trend unemployment over time.

Research has suggested several factors that may have temporarily increased trend unemployment since the start of the Great Recession in December 2007, including 1) mismatch between employers' and workers' locations, 2) unusual difficulty of the long-term unemployed in finding jobs (perhaps because of stigma or lost human capital), and 3) public policies such as unemployment insurance extensions.⁸ Rather than estimate the impact of these factors ourselves, we rely on the CBO. According to the CBO's estimates, the short-run natural rate rose sharply from 5.0% in late 2007 to 6.0% in 2012, but has now fallen to 5.4% as labor markets have normalized. We adjust our trend unemployment rate implied by age, sex, and education to account for the CBO's estimate of changes to the natural rate since the end of 2007.⁹ This is our baseline.

Figure 1 (on the front) plots the actual unemployment rate (black line), along with our baseline natural rate (red line) and the CBO's estimate of the short-run natural rate (blue line). From 1982 through 2007, the total decline in our baseline natural rate is quite similar to that of the CBO's natural rate, though their paths are somewhat different.

The CBO's natural rate declined from 6.1% in 1982 to 5.0% by 2000 and then remained flat through 2007, whereas our baseline trend rate declined steadily from about 6.2% in the early 1980s to 4.8% in 2007.

We find that our age-sex-education adjustment (excluding the post-2007 CBO adjustment) causes the natural rate to decline by 0.37 percentage points in 2007–14 and by 0.63 percentage points in 2000–14, or, on average, about 0.04 percentage points per year over the past 15 years. In other words, the natural rate of unemployment would have been 0.37 percentage points lower in 2014:Q4 if the age, sex, and education composition of the trend LFP rate had remained the same as in 2007 and 0.63 percentage points lower if this composition had remained the same as in 2000.

We estimate our baseline natural rate of unemployment as of 2014:Q4 to be 4.9% (figure 2, second row)—0.5 percentage points lower than the CBO's estimate of the short-run natural rate (figure 2, first row). We project this rate to fall by about 0.06 percentage points per year through the end of the decade, reaching 4.5% at the end of 2020—0.7 percentage points below the CBO's estimate.¹⁰

Two broad assumptions underlie these simple calculations. First, demographics and educational attainment are fundamental determinants of unemployment, and thus, changes in them over time should drive overall levels of aggregate unemployment. Second, the unemployment rate was at its natural rate in late 2005. Both of these assumptions seem plausible, but neither is completely unassailable. Accordingly, in the next two sections, we explore the sensitivity of our results to alternative assumptions.

Sensitivity to different adjustment variables

First, we consider how our estimates change when we adjust the natural rate with alternative sets of variables.

While there is a strong inverse relationship between educational attainment and unemployment, Summers has argued against using educationally adjusted

natural rate series because they imply counterfactually high unemployment in earlier decades when educational attainment was much lower.¹¹ Similarly, Shimer has argued that observed cross-sectional differences in unemployment by educational attainment could simply reflect more-able people having chosen to get more education (i.e., a “selection effect”), instead of a causal effect from getting more schooling.¹² Our reading of the available evidence on education’s effect on wages runs counter to this argument.¹³ Still, the fact that unemployment rates were not high in the 1950s suggests that it is worth redoing our calculations using groups defined by only age and sex.

The results of this calculation are shown in the third row of figure 2. Evidently, when we adjust for only age and sex, the direction of the results is the same, but the magnitude of the change is somewhat smaller. Including the post-2007 CBO adjustment, our age-sex-adjusted natural rate as of the end of 2014 was 5.0%—a tenth higher than the rate with an education adjustment. We project this rate to fall by about 0.05 percentage points per year through the remainder of the decade, so that it stands at 4.8% by the end of 2020. From the differences in these two hypothetical rates’ paths, we infer that about three-quarters of the drop during the remainder of the decade will arise from changes in the age structure and the remainder from growth in educational attainment.

We also considered making an additional adjustment for changes in immigration (figure 2, fourth row). The expected direction of this additional adjustment is unclear, depending as it does on whether immigrants have lower unemployment than natives, *conditional* on age, sex, and education. However, we find that at the end of 2014, the age-sex-education-immigration-adjusted natural rate was 5.0%—0.1 percentage points higher than the version that does not adjust for immigration.¹⁴

Sensitivity to the natural rate’s starting level

The estimates reported thus far rely on the assumption that the unemployment

rate was at its long-run trend during the second half of 2005. As we noted, that seems plausible and accords with the CBO assessment, but other possibilities are worth considering.

One obvious alternative is that the actual unemployment rate was equal to the natural rate the previous time the CBO thought this was the case—during the second half of 2001.¹⁵ The fifth row of figure 2 shows that if unemployment was at its natural rate in 2001, our current estimate of the trend rate would be a tenth of a percentage point lower than our baseline path (second row).

A more theoretically appealing way to establish the overall level of the natural rate is with inflation data. Therefore, as an additional check on our results, we estimate a Phillips curve model that relates an inflation gap to its own lagged values, the unemployment rate gap, and short-term supply shock terms (relative import prices and energy prices). A combination of the coefficients from this model provides an estimate of how much our baseline path for the trend rate should be adjusted up or down to best fit the historical relationship between these variables.¹⁶ Our inflation gap measure is the deviation of annualized quarterly core inflation¹⁷ as measured by the Price Index for Personal Consumption Expenditures (PCE) from long-term inflation expectations.¹⁸ The model is estimated on data from 1982 through 2007, the period for which we can compute our natural rate series without adjusting for the effects of the Great Recession.

The results, shown in the sixth row of figure 2, suggest that the natural rate could be about a half of a percentage point lower than our baseline. It should be noted, however, that while using inflation data is appealing theoretically, in practice, the magnitude of the implied adjustment is imprecisely estimated, with a standard error of approximately 0.5 percentage points. This imprecision reflects the fairly weak relationship between inflation and unemployment gaps that is often reported in the literature.¹⁹ That said, various reasonable tweaks to our specification, such as using wage

rather than price inflation data, also suggest downward adjustments to the level of the natural rate. Therefore, we consider our preferred age-sex-education-adjusted estimates in the second row to be, if anything, a touch conservative.

Conclusion

While great progress has been made over the past few years, significant labor market slack remains. We estimate the natural rate at or below 5%, at least half of a percentage point below its actual level as of March 2015. This estimate of slack, in combination with labor market measures such as LFP and involuntary part-time workers (see note 1), may help explain why wage inflation and price inflation remain so low. Moreover, we estimate that absent major new developments, demographic and educational changes will persist, potentially reducing the trend unemployment rate to around 4.4% to 4.8% by 2020.

¹ See <https://www.chicagofed.org/publications/economic-perspectives/2014/4q-aaronson-et-al>.

² The trend LFP rate is the LFP rate consistent with the contemporaneous composition of the work force and an economy growing at its potential.

Charles L. Evans, *President*; Daniel G. Sullivan, *Executive Vice President and Director of Research*; Spencer Krane, *Senior Vice President and Economic Advisor*; David Marshall, *Senior Vice President, financial markets group*; Daniel Aaronson, *Vice President, microeconomic policy research*; Jonas D. M. Fisher, *Vice President, macroeconomic policy research*; Richard Heckinger, *Vice President, markets team*; Anna L. Paulson, *Vice President, finance team*; William A. Testa, *Vice President, regional programs, and Economics Editor*; Helen O’D. Koshy and Han Y. Choi, *Editors*; Julia Baker, *Production Editor*; Sheila A. Mangler, *Editorial Assistant*.

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- ³ See, e.g., <http://www.census.gov/prod/2014pubs/p25-1140.pdf>.
- ⁴ See figure A1 in web appendix, available at <https://www.chicagofed.org/~media/others/people/research-resources/aaronson-daniel/aaronson-et-al-cfl-338-appendix-pdf.pdf>.
- ⁵ See figure A2 in web appendix (see note 4).
- ⁶ See figure A3 in web appendix (see note 4).
- ⁷ See figure A4 in web appendix (see note 4). For example, over the past 30 years, the average unemployment rate for college graduates was 10 percentage points lower than for high school dropouts.
- ⁸ See, for example, the CBO's discussion of the natural rate of unemployment: <https://www.cbo.gov/sites/default/files/cbofiles/attachments/49892-Outlook2015.pdf>.
- ⁹ Specifically, we adjusted our hypothetical natural rate by $u_t^{hypo} + (u_t^{CBO-SR} - 5.0)$ for all years after 2007, where u_t^{CBO-SR} is the CBO's short-term natural rate; u_t^{CBO-SR} was constant at 5.0% in 2000–07.
- ¹⁰ Our previous work (see note 1) provides estimates of the natural rate that differ somewhat from those reported here. The main difference is that we now incorporate the CBO's latest estimate of its short-run natural rate, released in January 2015.
- ¹¹ Lawrence H. Summers, 1986, "Why is the unemployment rate so very high near full employment?," *Brookings Papers on Economic Activity*, Vol. 17, No. 2, pp. 339–383.
- ¹² Robert Shimer, 1999, "Why is the U.S. unemployment rate so much lower?," in *NBER Macroeconomics Annual 1998*, Ben S. Bernanke and Julio J. Rotemberg (eds.), Vol. 13, Cambridge, MA: MIT Press, pp. 11–61.
- ¹³ See, e.g., David Card, 1999, "The causal effect of education on earnings," in *Handbook of Labor Economics*, Orley C. Ashenfelter and David Card (eds.), Vol. 3A, Amsterdam: Elsevier / North-Holland, pp. 1801–1863.
- ¹⁴ Our calculation of a 0.1 percentage points immigration adjustment is based on a comparison of an immigration-adjusted versus a non-immigration-adjusted natural rate from 1994 through 2014, the period during which the CPS reports immigration status.
- ¹⁵ Unlike in the second half of 2005, the unemployment rate in the second half of 2001 was not exactly equal to the CBO's estimate of the natural rate. Accordingly, to establish a base for the natural rate series, we adjusted all age-sex-education unemployment rates in 2001:Q3 and 2001:Q4 proportionately to make the overall rate equal to the CBO's natural rate. These adjusted rates form the base for the natural rate calculation reported in the fifth row of figure 2.
- ¹⁶ In particular, call the estimates of the natural rate in figures 1 and 2 \hat{u} and assume the true natural rate $u_t^* = \hat{u}_t + u_0$. We try to pin down u_0 using a Phillips curve regression of the following form: $\Pi_t = \beta(u_t - u_t^*) + \gamma x_t + e_t$, where Π_t is the measure of the inflation gap, u_t is the actual unemployment rate, $u_t - u_t^*$ is the unemployment rate gap, x_t is the short-term supply shock variables, and e_t is an error term. (The parameters β and γ are the regression coefficients on the $(u - u^*)$ and x variables, respectively.) The equation can be rewritten as $\Pi_t = \alpha + \beta(u_t - \hat{u}_t) + \gamma x_t + e_t$. (The parameter α is the constant term.) Consequently, u_0 can be recovered from the ratio of the coefficients $-\alpha/\beta$ estimated from a regression of Π_t on a constant, $u_t - \hat{u}_t$, and x_t . Our inflation gap measure is defined as the deviation of actual inflation from its expectation in the prior period, which in turn is defined as a weighted average of past inflation and long-term inflation expectations. The adjustment factor $-\alpha/\beta$ reported in figure A5 of the web appendix (see note 4) is added to our baseline path (figure 2, second row) to get the path reported in the sixth row of figure 2.
- ¹⁷ Core inflation strips out the volatile food and energy prices.
- ¹⁸ These expectations are from the Philadelphia Fed's *Survey of Professional Forecasters'* ten-year Consumer Price Index (CPI) inflation rate, spliced with the *Hoey Survey's* CPI inflation forecasts for the years before 1991, and then adjusted for the long-run gap between CPI and PCE inflation.
- ¹⁹ See, e.g., Douglas Staiger, James H. Stock, and Mark W. Watson, 1997, "How precise are estimates of the natural rate of unemployment?," in *Reducing Inflation: Motivation and Strategy*, Christina D. Romer and David H. Romer (eds.), Chicago: University of Chicago Press, pp. 195–246.