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LABOR MARKET SLACK AND MONETARY POLICY

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ABSTRACT

In the wake of a severe recession and a sluggish recovery, labor market slack cannot be gauged solely in terms of the conventional measure of the unemployment rate (that is, the number of individuals who are not working at all and actively searching for a job). Rather, assessments of the employment gap should reflect the incidence of underemployment (that is, people working part time who want a full-time job) and the extent of hidden unemployment (that is, people who are not actively searching but who would rejoin the workforce if the job market were stronger). In this paper, we examine the evolution of U.S. labor market slack and show that underemployment and hidden unemployment currently account for the bulk of the U.S. employment gap. Next, using state-level data, we find strong statistical evidence that each of these forms of labor market slack exerts significant downward pressure on nominal wages. Finally, we consider the monetary policy implications of the employment gap in light of prescriptions from Taylor-style benchmark rules.

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1. Introduction

A fundamental cornerstone of modern macroeconomics is that the economy has a *balanced-growth path* that is characterized by stable inflation as well as steady growth of production and employment. In effect, if the economy becomes "overheated" and persistently exceeds its balanced-growth path, then the most notable symptom will be an acceleration of nominal wages and prices and hence inflation overshooting the central bank's target. Conversely, a persistent shortfall in economic activity and employment not only has substantial adverse effects on households' well-being but is also associated with downward pressure on wages and prices and hence with inflation falling persistently short of the central bank's target. Thus, ongoing assessments of the contours of the balanced-growth path—and of significant deviations from that path—are a crucial element of the design and communication of monetary policy, especially for a central bank with a legal mandate to foster maximum employment and price stability.[1]

In gauging movements in labor market slack over previous business cycles, macroeconomists have generally focused on the gap between the conventional unemployment rate (that is, the incidence of people who are out of work and actively searching for a job) and the "natural rate of unemployment" judged to be consistent with the balanced-growth path. In the wake of a severe recession and a sluggish recovery, however, the conventional unemployment gap can be a relatively poor or even misleading indicator of labor market slack. In particular, assessments of the shortfall of employment from the balanced-growth path should also incorporate the extent of *hidden unemployment* (that is, people who are not actively searching but who would rejoin the labor force if the job market were stronger) and the incidence of *underemployment* (that is, people working part time who want a full-time job).

In this paper, we begin by examining the evolution of U.S. labor market slack over recent years and show that underemployment and hidden unemployment currently account for the bulk of the employment gap. Our benchmark assessment of the current magnitude of the shortfall in U.S. employment—including the incidence of underemployment and hidden unemployment—is equivalent to about 3.3 million full-time jobs. Moreover, the uncertainty surrounding that assessment is clearly skewed to the upside, so the actual shortfall in employment might well be twice that large.

Recent Congressional Budget Office (CBO) analysis indicates that the potential labor force is currently expanding by about 50,000 to 60,000 individuals per month due to demographic

[1] The Federal Open Market Committee's Statement of Longer-Run Goals and Policy Strategy (adopted in January 2012 and reaffirmed annually since then) describes its mandated objectives of maximum employment and price stability as "generally complementary."

factors. Thus, if nonfarm payrolls continue to rise steadily by around 260,000 jobs per month (which has been the average pace over the past few quarters), then the employment gap might be eliminated toward the end of next year. In contrast, if the economic recovery decelerates and payroll growth slows to around 100,000 jobs per month (roughly similar to its pace during 2010 and most of 2011), then the employment gap would barely diminish at all over coming years.

Next, using state-level data, we find strong statistical evidence that underemployment and hidden unemployment each place significant downward pressure on wages.[2] Such results should not be surprising, because employers often fill a job vacancy by hiring a person who had previously been working part time (either at the same firm or elsewhere) or by hiring a person who has just rejoined the labor force (and hence wasn't being counted as unemployed), rather than having to bid up the wage of an incumbent full-time worker.

Recent data on U.S. nominal wage growth is fully consistent with our assessment that labor market slack remains substantial. As shown in the left panel of Figure 1, the average hourly earnings of all private nonfarm employees decelerated markedly in the wake of the Great Recession, and since 2010 nominal wage growth has remained mired at around 2 percent.[3] Indeed, the latest 12-month change (from March 2014 through March 2015) was 2.1 percent. The right panel of the figure shows the evolution of nominal wages for production and nonsupervisory workers, a measure that is less sensitive to movements in the upper range of the wage distribution and hence more informative about broader wage trends. Recent readings on this measure suggest some *slowing* in nominal wage growth over the past few quarters: The 12-month change through March 2015 was 1.75 percent, down about a half percentage point from its pace last summer.[4]

Finally, we consider the monetary policy implications of labor market slack using a variant of the simple rule that was analyzed extensively by Taylor (1999) and characterized as the "balanced approach rule" by Yellen (2012).

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[2] In a speech on January 15, 2015, Dennis Lockhart, the president of the Federal Reserve Bank of Atlanta, stated that economists at his institution have also "advanced the thesis that the elevated number of people working part time involuntarily is restraining wage growth."

[3] The same pattern is evident for other measures of labor compensation such as the employment cost index. Indeed, Robertson and Terry (2015) analyzed a range of indicators of nominal wage growth and concluded that "none of the characteristic-specific median growth rates we looked at are close to returning to prerecession levels. Lower-than-normal wage growth appears to be a very widespread feature of the labor market since the end of the recession."

[4] Lack of wage growth is also found in other BLS wage series. Median usual weekly earnings for full-time wage and salary workers grew by 1.9 percent in 2014 and by 1.7 percent in 2014:Q4. For all civilian workers, the employment cost index grew by 2.2 percent in both the third and fourth quarters of 2014.

2. Gauging Labor Market Slack

2.1 The Employment Gap

Our measure of the employment gap is the sum of three specific components.[5] First, the *unemployment gap* is the deviation of the conventional unemployment rate (labeled "U3" by BLS, the Bureau of Labor Statistics) from professional forecasters' consensus projections of its longer-run normal rate (as reported in semiannual Blue Chip surveys). Second, the *participation gap* is the deviation (in percentage points) of the actual size of the labor force from CBO assessments of the potential labor force; this shortfall corresponds to the notion of "hidden unemployment" described above. Third, the *underemployment gap* takes the BLS measure of people working part time for economic reasons (expressed as a fraction of the potential labor force) as a deviation from its 1994-2007 average and then converts this deviation into full-time equivalent (FTE) jobs.[6]

As shown in Figure 2, the U.S. employment gap has narrowed markedly over the past few years, along with each of its three components. Nonetheless, it is readily apparent that the conventional unemployment rate has *not* served as an accurate synopsis of the evolution of labor market slack. For example, the declining unemployment rate over the course of 2010 and most of 2011 was not induced by a pickup in job growth but instead reflected the extent to which many Americans gave up searching for work and departed from the labor force. In effect, the reduction in the unemployment gap was almost fully offset by an increase in the participation gap, and hence the overall employment gap showed very little improvement during that period.

Even more importantly, it is evident that the U.S. economic recovery remains far from complete in spite of apparently reassuring recent signals from the conventional unemployment rate. Indeed, while the unemployment gap has become quite small, the incidence of underemployment remains elevated and the size of the labor force remains well below CBO's assessment of its potential. In particular, the employment gap currently stands at 1.9 percent, suggesting that the "true" unemployment rate (including underemployment and hidden unemployment) should be viewed as around 7½ percent. Gauged in human terms, the current magnitude of the employment shortfall is equivalent to about 3.3 million full-time jobs.

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[5] This measure of the employment gap was introduced by Levin (2014).

[6] The FTE conversion factor is computed using BLS data on the average weekly hours of individuals working part time for economic reasons compared to the average weekly hours of individuals who are working full time.

Of course, the characteristics of the economy's balanced-growth path cannot be directly observed, and hence any particular assessment of the deviations from that path is necessarily subject to considerable uncertainty. In the context of a typical business cycle, such uncertainty might reasonably be judged as symmetric around the benchmark estimate. At the present juncture, however, it seems plausible that professional forecasters and analysts at policy institutions may have become overly pessimistic in gauging the extent to which the Great Recession caused permanent damage to the U.S. labor market. Consequently, the confidence bands around our current assessment of the employment gap may in fact be skewed to the upside, i.e., this assessment may well be an *underestimate* of the true magnitude of labor market slack. To examine that possibility, we now consider each of the individual components of the employment gap in turn.

2.2 The Unemployment Gap

CBO regularly produces assessments of the natural unemployment rate that would prevail if the economy were on its balanced-growth path.[7] More specifically, CBO defines the natural rate as the level of unemployment "arising from all sources except fluctuations in aggregate demand." In the wake of the Great Recession, CBO refined its analysis to gauge the extent to which the natural rate has been affected by transitory vs. persistent structural factors. Thus, over the past few years CBO has produced estimates of the *long-term natural rate*, a measurement that solely reflects the influences of longer-lasting structural factors.[8]

[7] These assessments are published in its annual *Budget and Economic Outlook* each January or February as well as in CBO's mid-year updates each August.

[8] Since 2011 CBO has also produced estimates of the *short-term natural rate*, which incorporates the effects of transitory structural factors. In 2014, CBO relabeled the "long-term natural rate" as the "underlying long-term rate of unemployment" and began referring to the "short-term natural rate" as simply "the natural rate." In the immediate aftermath of the Great Recession, the distinction between these two measures was quite substantial (with a peak difference of around 0.8 percentage points). As of 2015, however, the two measures are now identical; i.e., CBO has concluded that transitory structural factors are no longer having any significant influence on the natural rate of unemployment.

Surveys of professional forecasters generally do not collect information about their estimates of the natural rate of unemployment. However, forecasters routinely make longer-run projections regarding the path to which the economy is expected to converge over time, and such projections essentially reflect their assessments of characteristics of the balanced-growth path, including the growth rate of potential output and the natural rate of unemployment. In particular, Blue Chip longer-run surveys (which are conducted semi-annually in March and October) report on the consensus and range of forecasters' projections of the average unemployment rate 5 to 10 years ahead.[9]

As shown in Figure 3, the Blue Chip consensus longer-run outlook for unemployment as of early 2008 was 4.8 percent—virtually identical to CBO's assessment of the natural unemployment rate. In effect, analysts generally agreed that the unemployment gap at that juncture was effectively nil. Shortly thereafter, the actual unemployment rate skyrocketed upward, reaching 10 percent by late 2009. CBO then raised its assessment of the natural rate by just a notch, whereas professional forecasters evidently became much more pessimistic about the prospects for long-lasting damage to the labor market. The Blue Chip longer-run consensus outlook moved up to around 6 percent, and the top quartile of projections in that survey reached nearly 7 percent. By 2012, CBO had come to share much of that pessimism and hence marked up its estimate of the long-term natural rate to levels similar to those of the Blue Chip consensus.

Over the past few years, as the unemployment rate has declined steadily and wage inflation has remained subdued, professional forecasters have been gradually marking down their longer-run projections for the unemployment rate. In the Blue Chip longer-run survey published in March 2015, the consensus outlook for unemployment was 5.1 percent, while the bottom quartile has declined to 4.5 percent and the top quartile of projections now stands at 5.5 percent. Interestingly, that consensus outlook is identical to the midpoint of the central tendency of FOMC participants' longer-run unemployment rate projections that were released in conjunction with the March 2015 FOMC meeting. CBO's latest assessment of the long-term natural rate (published in late January) was a notch higher, at 5.4 percent.

It seems reasonable to infer that the uncertainty surrounding these assessments is skewed to the downside. Indeed, if unemployment declines further over coming quarters while wage inflation remains subdued, analysts will presumably make even further downward revisions to their assessments of the longer-run normal rate of unemployment. Thus, while our benchmark estimate of the unemployment gap is quite small, its true magnitude might well be substantially larger—perhaps by as much as three-fourths of a percentage point.

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[9] Blue Chip longer-run survey results are reported in the March and October editions of *Blue Chip Economic Indicators*, a publication owned by Aspen Publishers,

2.3 The Participation Gap

In conjunction with its estimates of potential output and the natural unemployment rate, CBO produces regular assessments of the historical and projected size of the *potential labor force*, that is, the balanced-growth path for the labor force that would prevail in the absence of aggregate demand shocks. In effect, given detailed projections for the size and demographic composition of the population (mainly drawing on the work of the Census Bureau), CBO's assessments of the potential labor force convey its analysis of how demographic and structural factors are likely to influence the evolution of labor force participation over time.

Figure 4 depicts the evolution of CBO's assessments of the potential labor force. As of January 2008, CBO estimated that the actual labor force (specifically, about 154 million people) was very close to its potential level; i.e., the participation gap was judged to be negligible. Moreover, at that juncture CBO projected that the potential labor force would expand at an annual pace of about three-quarters of a percent through 2012 and would then decelerate somewhat to an annual pace of about half a percent in subsequent years.[10]

In the wake of the Great Recession, the U.S. labor force actually decreased in size through mid-2011 and then resumed a moderate upward trajectory over the past few years. Nonetheless, from 2009 through 2013, CBO made only modest revisions to its assessments of the potential labor force. Most notably, CBO analysis indicated that the labor force had *exceeded* its potential size by about a full percentage point during the leadup to the financial crisis. However, CBO made roughly offsetting adjustments to the projected growth rate of the potential labor force, and hence the implications for the magnitude of the participation gap as of 2013 were essentially the same as implied by its January 2008 assessment.

In contrast, CBO has recently made substantial downward revisions to its assessments of the entire post-2008 trajectory for the potential labor force. In particular, CBO now judges that demographic and structural factors account for a larger share of the post-2008 decline in labor force participation than indicated by its previous analysis. Moreover, CBO has concluded that much of the cyclical decline in labor force participation has become irreversible; i.e., CBO now anticipates that only two-thirds of the individuals who departed from the workforce in the wake of the Great Recession will rejoin the labor force as the economy continues to strengthen.

Evidently, such judgments have crucial implications for gauging the current magnitude of the shortfall in U.S. employment. According to CBO's latest assessment of the potential labor

[10] As discussed in Erceg and Levin (2014), CBO's labor force projections in early 2008 were broadly consistent with the projections that were published by BLS in November 2007.

force, the participation gap currently stands at around 0.8 percent (which is the value that we used in constructing our benchmark estimate of the employment gap as shown in Figure 2). By contrast, CBO's outlook as of February 2013 implies a substantially larger participation gap of around 2.6 percent and hence that the employment gap is *nearly twice as large* as our benchmark estimate.

Breaking down the data by gender is also relevant for assessing the extent to which the post-2007 decline in U.S. labor force participation might be largely structural or irreversible. As shown in the first panel of Figure 5, the participation rate of males age 45 to 54 years was drifting downward during the late 1990s, but that trend was arrested and perhaps even reversed during the mid-2000s. Thus, there is evidently a substantial degree of uncertainty about the current magnitude of the participation gap for this demographic group. If one fits a linear trend over the decade ending in 2007, then the actual participation rate is now within a percentage point of that trend line—roughly similar to CBO's current assessment of the aggregate participation gap. By contrast, if one fits a linear trend over the five-year period ending in 2007, then the participation gap is around 3 percentage points, roughly consistent with the implications of CBO's assessments several years ago.

As shown in the second panel of Figure 5, the participation rate of females age 45 to 54 years was essentially flat from 2000 through 2007, and hence there is simply no basis whatsoever for attributing its post-2007 decline to structural factors. Rather, it seems evident that this decline resulted from the persistent weakness of the job market in the wake of the Great Recession. Moreover, the magnitude of that decline—about 2½ percentage points—is virtually identical to the drop in labor force participation of all prime-age adults (that is, age 25 to 54 years), who comprise the bulk of the U.S. labor force. In effect, this pattern bolsters the view that the Great Recession and its aftermath were largely responsible for the post-2007 decline in the U.S. participation rate, consistent with the conclusions of a number of recent empirical studies.[11]

Finally, it should be noted that the participation rate of males age 45 to 54 years has recently moved up by nearly a full percentage point, from 85.3 percent last spring to 86.2 percent in the latest BLS employment report. That development may reasonably provide some reassurance that the labor market damage from the Great Recession is *not* irreversible and that many other prime-age adults (both male and female) as well as younger adults will decide to rejoin the labor force if the job market continues to strengthen going forward.

[11] See D. Aaronson, Davis, and Hu (2012), Sherk (2012), Van Zondweghe (2012), Hotchkiss and Rios-Avila (2013), and Erceg and Levin (2014). For a contrary view, see S. Aaronson et al. (2014).

2.4 The Underemployment Gap

Gauging the underemployment gap seems relatively straightforward by comparison with the challenges of assessing the unemployment gap and the participation gap. As shown in Figure 6, the underemployment rate—that is, the incidence of people working part time for economic reasons (PTER) as a fraction of total employment—did not exhibit any trend over the period from 1994 through 2007. It seems implausible that the sudden rise in underemployment during the Great Recession was caused by demographic or structural factors. And individuals who are underemployed are clearly not "unemployable" (as some have suggested about the long-term unemployed or those who have dropped out of the workforce), since they are already working but simply can't find a full-time job. Indeed, BLS data indicate that the average person classified as PTER is working about 23 hours per week.

Moreover, it seems unlikely that structural factors are the primary reason why the incidence of underemployment has only declined gradually over the past few years. After all, if the economy were on its balanced-growth path and some employers preferred to shift their workforce toward a greater number of part-time positions, then those employers would need to offer a relatively higher wage to induce workers to take part-time jobs voluntarily—a phenomenon that is certainly not evident in the current job market.

In light of these considerations, it is striking that the underemployment rate has only moved about halfway back from its 2009 peak towards its pre-recession level. That pattern might well suggest that the overall magnitude of labor market slack may have diminished by a similar proportion. In particular, as shown in figure 2, the employment gap reached a peak of about 6 percent in early 2010. Consequently, it may be reasonable to infer that the employment gap currently stands at around 3 percent—that is, about a percentage point higher than our benchmark assessment. In effect, the evolution of the underemployment gap reinforces the view that the uncertainty surrounding our benchmark assessment of the employment gap is skewed to the upside.

3. The Wage Curve

We now move on to examine the extent to which measures of labor market slack over and above the unemployment rate impact wages. We do so following the approach taken by Blanchflower and Oswald (1994), using data from the merged outgoing rotation group (MORG) files extracted from the Current Population Survey (CPS). The CPS is collected monthly and is used to calculate the unemployment rate and other labor market aggregates

published monthly by BLS in the Employment Situation jobs release.[12] Data are available from 1990 to 2012, so with 50 states and the District of Columbia, there are 1,173 observations in total.[13]

Table 1 presents results using the log of hourly earnings as the dependent variable, whereas Table 2 uses weekly earnings. The results are essentially the same, so our discussion will focus on the results shown in Table 1.

As shown in column 1 of the panel labeled "Long-term unemployment," the lagged dependent variable has a coefficient of 0.7106, consistent with interpreting this regression specification as a wage curve rather than a Phillips curve; cf. Card (1995). The estimated coefficient of -0.0279 on the unemployment rate is negative and statistically significant, as indicated by the t-statistic of about 7. A simple computation indicates that the long-run unemployment elasticity of pay is -0.10, implying that a doubling of the unemployment rate is associated with a 10 percent decline in real wages.[14] As shown in column 2, these findings are not sensitive to the precise timing of the unemployment measure (using the rate in period t-1 instead of period t).[15] Moreover, the results reported here are essentially the same as what Blanchflower and Oswald (2005) found across many countries and datasets as well as the conclusions of Nikjamp and Poot (2005) in a meta-analysis of wage curve estimates.[16]

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[12] Respondents in the CPS are surveyed for four consecutive months (waves 1-4), and then after a four-month break are surveyed for another four months (waves 5-8). The wage questions are asked only in waves 4 and 8, which are referred to as the "outgoing rotations." Each of the annual MORG files has approximately 170,000 wage observations. Data are aggregated to the level of state and year cell including both hourly and weekly earnings as well as variables on age, gender, race, and schooling. This is exact aggregation and solves the Moulton problem. So a gender variable in the micro data file becomes a variable identifying the proportion of workers in a state in a particular year, and so on for the other variables. Mapped onto the file are data from the BLS on the participation rate as well as the proportion of the employed that is part time for economic reasons as well as the number of the unemployed who have been unemployed for less than 26 weeks, 26-52 weeks, and more than 52 weeks.

[13] Each regression includes the 19 personal control variables described in the previous footnote, as well as a lagged dependent variable that helps mitigate biases of uncertain sign and magnitude that could result from aggregation or missing variables. The start date of January 1990 is determined by the availability of the labor market status variables, whereas the wage data is available for prior years.

[14] Specifically, this elasticity is computed as $-0.0279/(1 - 0.7106) = 0.0964$.

[15] Likewise, as shown in Table 2, we obtain similar results when we use weekly earnings as the measure of nominal wage growth.

[16] Blanchflower and Oswald (1995, p. 357) stated: "Future work will have to begin to test for statistically significant differences among numbers that lie in a rough band from -0.05 to -0.20. It would probably be unwise to treat the minus-point-one rule as more than one of thumb."

The remaining columns of this panel confirm the findings of Blanchflower and Posen (2014). In particular, these regressions incorporate various measures of long-term unemployment that are never statistically significant. Evidently, the pace of wage growth is linked to the overall level of unemployment and does *not* depend on its composition, ie., the relative incidence of long-term vs. short-term unemployment.

The second section of the table called "Underemployment" provides some new results. As shown in the first two columns, the nonparticipation rate (that is, 100 minus the participation rate) has a negative and significant effect on wage growth, consistent with the findings of Blanchflower and Posen (2014).[17] Next, we incorporate the underemployment rate, i.e., the number of workers who say they are working part time for economic reasons as a percentage of total employment (as shown in figure 6). This coefficient estimate is also negative and significant, and its inclusion does not influence the statistical significance of the other key variables.[18]

Thus, we see that wage growth is pushed down by the unemployment rate, the nonparticipation rate, and the underemployment rate. Thus, while the unemployment rate may have been an adequate indicator of slack prior to the onset of the Great Recession, these other forms of labor market slack appear to be crucial in interpreting the sluggishness of nominal wage growth over the past few years, as shown in Figure 1.[19]

Figure 7 presents our interpretation of the relationship between nominal wage growth and the "true" unemployment rate (including underemployment and nonparticipation). In particular, we suspect that the wage curve is relatively flat at elevated levels of labor market slack, i.e., a decline in slack does not generate any significant wage pressures as long as the level of slack

[17] Paciorek (2015) found that many individuals who are out of the labor force appear to be relatively good candidates for construction employment, at least on the basis of their demographic characteristics. In particular, he suggests there may be "a large pool of people who would find construction work attractive but did not enter the industry during the bust years."

[18] The results are essentially the same in Table 2 using weekly earnings.

[19] See Bell and Blanchflower (2013a, 2013b, 2014) for further analysis of underemployment in the United Kingdom based on preferences over hours. Workers are asked in the Labour Force Survey, which is the equivalent of the Current Population Survey (CPS) in the United States, if they want more or fewer hours. These responses can be aggregated to the economy level. From 2000 to 2008 there was essentially no underemployment as the number of hours of those who wanted more hours approximately equaled the number of hours of those who wanted fewer hours. Since 2008 the numbers who want more hours dominate to such a degree that underemployment currently is approximately 1.8 percent on top of the unemployment rate itself. It also turns out that one-third of the extra hours currently come from full-time workers, suggesting the measure we use in the United States is an underestimate of the true amount of underemployment by around 50 percent. The likelihood is that when the economy returns to full employment these "desired" additional hours will disappear.

remains large. As noted above, our benchmark analysis indicates that the true unemployment rate is currently around 7½ percent—a notable decline from its peak of more than 10 percent but still well above its longer-run normal level of around 5 percent. Thus, the shape of the wage curve can explain why nominal wage growth has remained stagnant at around 2 percent over the past few years even as the employment gap has diminished substantially. Moreover, our interpretation suggests that nominal wages will not begin to accelerate until labor market slack diminishes substantially further and and the true unemployment rate approaches its longer-run normal level of around 5 percent.

4. Monetary Policy Implications

No macroeconomic model provides a completely satisfactory description of any economy in the real world. Indeed, the limitations of existing macroeconomic models have been underscored by the incidence of relatively large and persistent forecast errors in many advanced economies over the past few years.[20] Thus, rather than relying on the monetary policy implications of any single macroeconomic model, it seems sensible to consider simple reference rules that provide reasonably robust performance across a range of plausible models. Such rules can serve as valuable benchmarks in the decision-making process and in explaining those decisions to the public.[21]

Following the seminal analysis of Taylor (1993), a simple rule-of-thumb for adjusting the level of the federal funds rate can be expressed as a weighted sum of four components: the equilibrium real interest rate, the actual inflation rate, the inflation gap (that is, the deviation of inflation from the central bank's inflation objective), and the level of resource slack.[22] We discuss each of these components in turn.

The equilibrium real interest rate (r^*) is defined as the short-term real interest rate at which the economy evolves along its balanced-growth path and inflation remains stable at the central bank's objective. As with other properties of the balanced-growth path, the value of r^* cannot be directly measured but must be inferred from observed economic and financial data. In our analysis, the value of r^* is given by the consensus outlook in the Philadelphia Fed's Survey of Professional Forecasters (SPF) regarding the 5-to-10-year ahead projection

[20] See Romer and Romer (2014).

[21] See Taylor (1993), Taylor and Williams (2010), Levin and Taylor (2013), and Levin (2014).

[22] In mathematical terms, $i_t = r^* + \pi_t + \quad (\pi_t - \pi^*) + \quad gap_t$, where i_t denotes the target federal funds rate, r^* denotes the equilibrium real interest rate, π_t denotes the inflation rate, π^* denotes the central bank's inflation target, gap_t denotes the level of resource slack, and the coefficients and indicate how much the target funds rate should be adjusted in response to the inflation gap $(\pi_t - \pi^*)$ and to resource slack (gap_t), respectively.

for the average value of the 3-month Treasury bill rate less the PCE inflation rate. Thus, using the results of the latest SPF (published in February 2015), we set $r^* = 1.25$ percent.[23]

Inflation and the inflation gap. The FOMC has established an inflation objective of 2 percent, expressed in terms of the price index for personal consumption expenditures (PCE). In measuring actual inflation, we mitigate the influence of transitory price shocks by focusing on the 12-month percent change in the core PCE price index (that is, excluding food and energy prices). In the latest reading, this measure of inflation was 1.31 percent, and hence the inflation gap was 0.69 percent.

Resource slack. In light of our foregoing analysis, we measure resource slack in terms of the total employment gap. In addition to our benchmark estimate, we consider the implications of several alternative assessments of labor market slack.

For the sake of brevity, our analysis focuses on one specific rule-of-thumb that was analyzed extensively by Taylor (1999). This rule prescribes the level of the federal funds rate as the weighted sum of the equilibrium real interest rate, the current inflation rate, the inflation gap, and the level of resource slack, with weights of 1.0, 1.0, 1.5, and 1.0, respectively. This specification has been shown to provide a reasonably balanced approach to fostering the stability of inflation and economic activity, and hence Yellen (2012) characterized it as the "balanced approach rule."

As shown in Table 3, this policy rule prescribes a target federal funds rate of about a quarter of a percent using our benchmark estimate of the employment gap. However, the implied funds rate is notably lower for other reasonable assessments. Indeed, using the potential labor force projection of CBO from February 2013 (illustrated in Figure 4) along with a natural rate of 4.8 percent (consistent with analysts' pre-crisis projections), the employment gap is nearly twice as high at around 4 percent, and the funds rate prescription is nearly 2 percentage points below zero.

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[23] This value of the equilibrium real interest rate is about 25 basis points lower than the median of FOMC participants' longer-run real interest rate projections in the FOMC's latest *Summary of Economic Projections* (published in mid-March).

Table 1: U.S. State-Level Panel on Hourly Wages, 1990-2012

Long-Term Unemployment						
$Wage_{t-1}$	0.7106	0.6835	0.7101	0.6822	0.7060	0.6834
	(360.00)	*(340.65)*	*(350.92)*	*(340.56)*	*(350.53)*	*(340.60)*
Unemployment $Rate_t$	-0.0279		-0.0266		-0.0240	
	(60.98)		*(50.51)*		*(50.32)*	
Unemployment $Rate_{t-1}$		-0.0365		-0.0404		-0.0364
		(90.47)		*(80.50)*		*(80.04)*
% Unemployed >26 $weeks_t$			-0.0001	0.0002		
			(0.45)	*(10.39)*		
% Unemployed >52 $weeks_t$					-0.0004	-0.0000
					(10.88)	*(0.05)*
Adjusted R^2	0.9945	0.9947	0.9945	0.9947	0.9945	0.9947
Underemployment						
$Wage_{t-1}$	0.6825	0.6610	0.6534	0.6607	0.6534	0.6225
	(330.55)	*(320.67)*	*(320.04)*	*(320.42)*	*(320.40)*	*(290.85)*
Unemployment $Rate_t$	-0.0256			-0.0064		
	(60.46)			*(10.25)*		
Unemployment $Rate_{t-1}$		-0.0339	-0.0351		-0.0210	-0.0178
		(80.73)	*(90.18)*		*(40.27)*	*(30.64)*
Non-Participation $Rate_t$	-0.0956	-0.0830		-0.0906	-0.0823	
	(40.94)	*(40.33)*		*(40.75)*	*(40.33)*	
Non-Participation $Rate_{t-1}$			-0.0954			-0.0925
			(50.06)			*(40.97)*
Underemployment $Rate_t$				-0.0213	-0.0149	
				(50.87)	*(40.22)*	
Underemployment $Rate_{t-1}$						-0.0199
						(50.59)
Adjusted R^2	0.9948	0.9947	0.9948	0.9947	0.9948	0.9949

Note: All equations include 50 state dummies, 22 year dummies; 15 schooling variables plus age, gender and two race variables. All variables are in natural logarithms. Each regression uses 1,173 observations. Each coefficient's t-statistic is shown below in parentheses. Source: BLS and CPS MORG files.

Table 2: U.S. State-Level Panel on Weekly Wages, 1990-2012

Long-Term Unemployment						
$Wage_{t-1}$	0.6499	0.6561	0.6840	0.6560	0.6790	0.6840
	(340.36)	*(310.75)*	*(340.21)*	*(310.73)*	*(330.68)*	*(340.21)*
Unemployment $Rate_t$	-0.0441		-0.0443		-0.0405	
	(90.17)		*(70.70)*		*(70.55)*	
Unemployment $Rate_{t-1}$		-0.0449		-0.0460		-0.0364
		(90.31)		*(70.87)*		*(70.71)*
% Unemployed >26 $Weeks_t$			-0.0000	0.0001		
			(0.08)	*(0.34)*		
% Unemployed >52 $Weeks_t$					-0.0004	-0.0000
					(10.53)	*(0.08)*
Adjusted R^2	0.9924	0.9924	0.9924	0.9924	0.9924	0.9924
Underemployment						
$Wage_{t-1}$	0.6499	0.6268	0.6125	0.6128	0.6032	0.5821
	(330.74)	*(290.47)*	*(280.75)*	*(290.46)*	*(280.75)*	*(260.26)*
Unemployment $Rate_t$	-0.0424			-0.0151		
	(80.90)			*(20.54)*		
Unemployment $Rate_{t-1}$		-0.0423	-0.0443		-0.0162	-0.0264
		(80.81)	*(90.35)*		*(20.77)*	*(50.04)*
Non-Participation $Rate_t$	-0.1238	-0.1155		-0.1207	-0.1172	
	(50.37)	*(40.99)*		*(50.36)*	*(50.19)*	
Non-Participation $Rate_{t-1}$			-0.1499			-0.1457
			(60.62)			*(60.54)*
Underemployment $Rate_t$				-0.0314	-0.0313	
				(70.29)	*(70.48)*	
Underemployment $Rate_{t-1}$						-0.0259
						(60.61)
Adjusted R^2	0.9926	0.9926	0.9927	0.9929	0.9929	0.9929

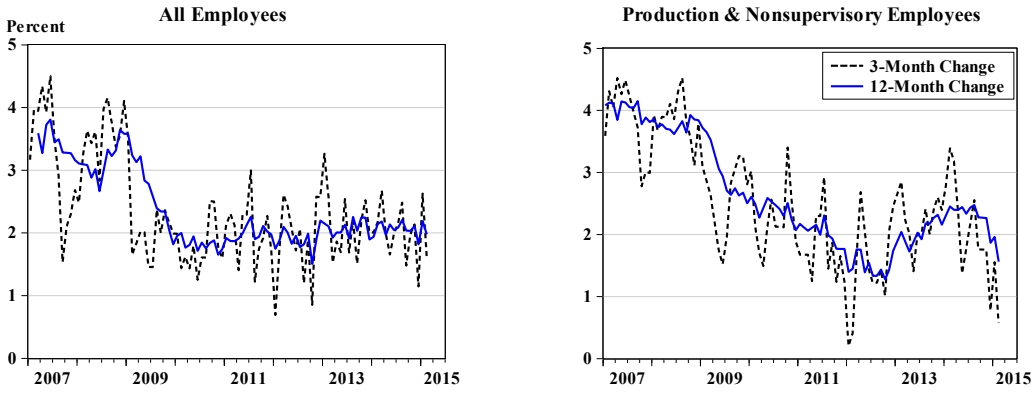
Note: All equations include 50 state dummies, 22 year dummies; 15 schooling variables plus age, gender and two race variables. All variables are in natural logarithms. Each regression uses 1,173 observations. Each coefficient's t-statistic is shown below in parentheses. Source: BLS and CPS MORG files.

Table 3: Prescriptions of the "Balanced Approach" Rule Under Alternative Assessments of the Employment Gap

Assessment	Employment Gap	True Unemp. Rate	Funds Rate Prescription
Benchmark estimate	1.9	7.4	0.29
Lower natural rate *(4.8 percent)*	2.2	7.7	-0.01
Higher potential labor force *(CBO 2013)*	3.6	9.1	-1.44
Higher potential labor force and lower natural rate	3.9	9.4	-1.74

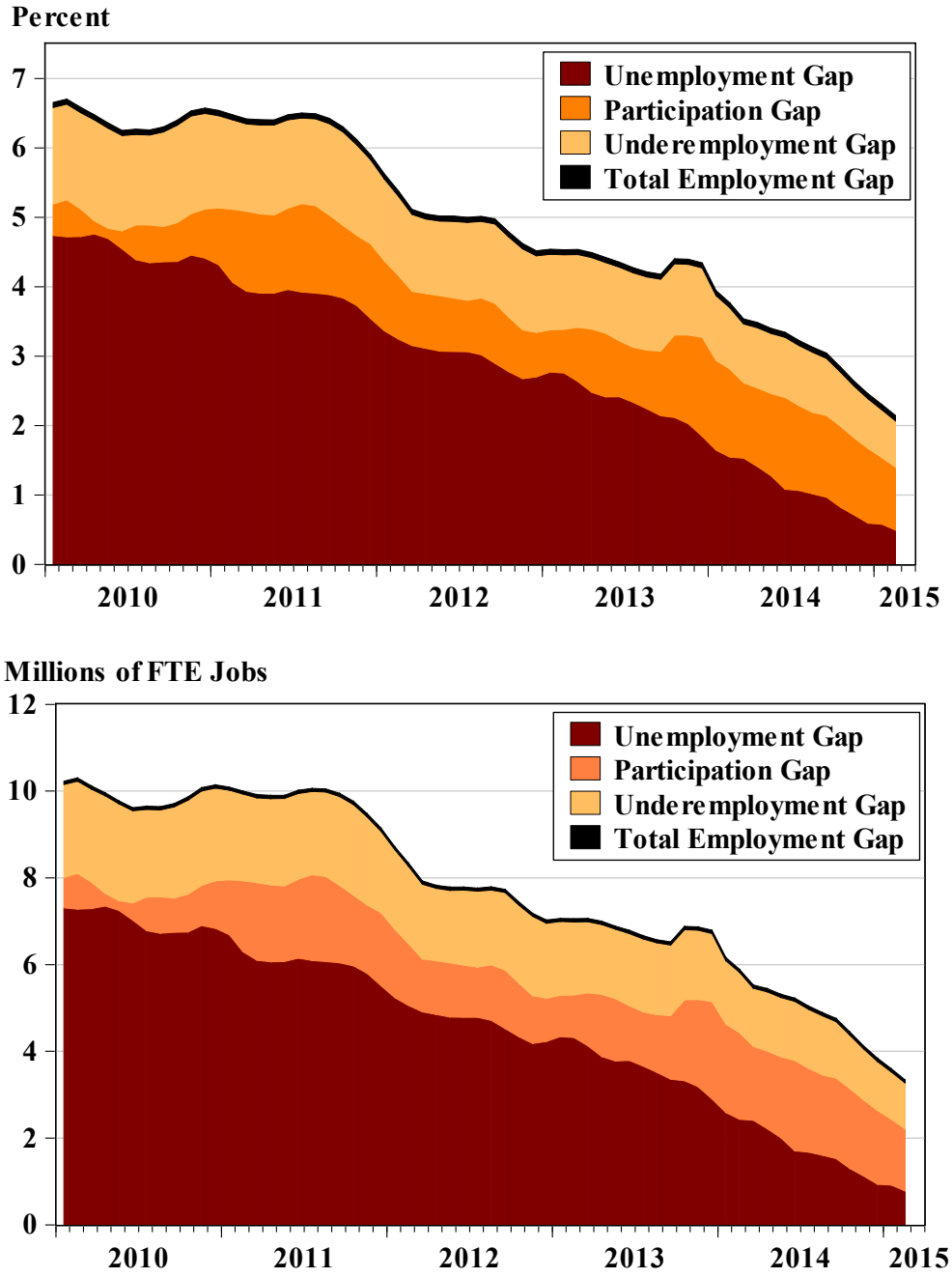
Source: BLS, CBO, and authors' calculations.

Figure 1: The Recent Evolution of U.S. Nominal Wage Growth



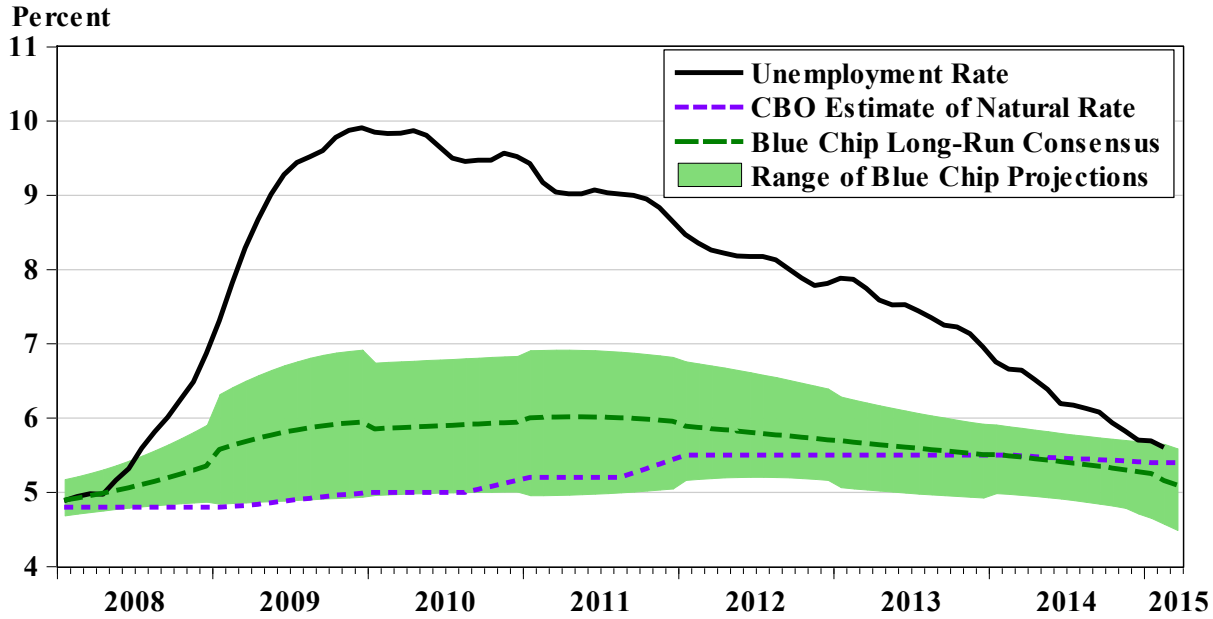
Note: The left panel depicts the growth rate of average hourly earnings for all U.S. private nonfarm employees, and the right panel depicts the corresponding growth rate for production and nonsupervisory employees. Each panel depicts the annualized three-month change (solid line) and the 12-month change (dashed line) over the period from Jan. 2007 to Feb. 2015. Source: BLS.

Figure 2: Benchmark Assessment of the Employment Gap



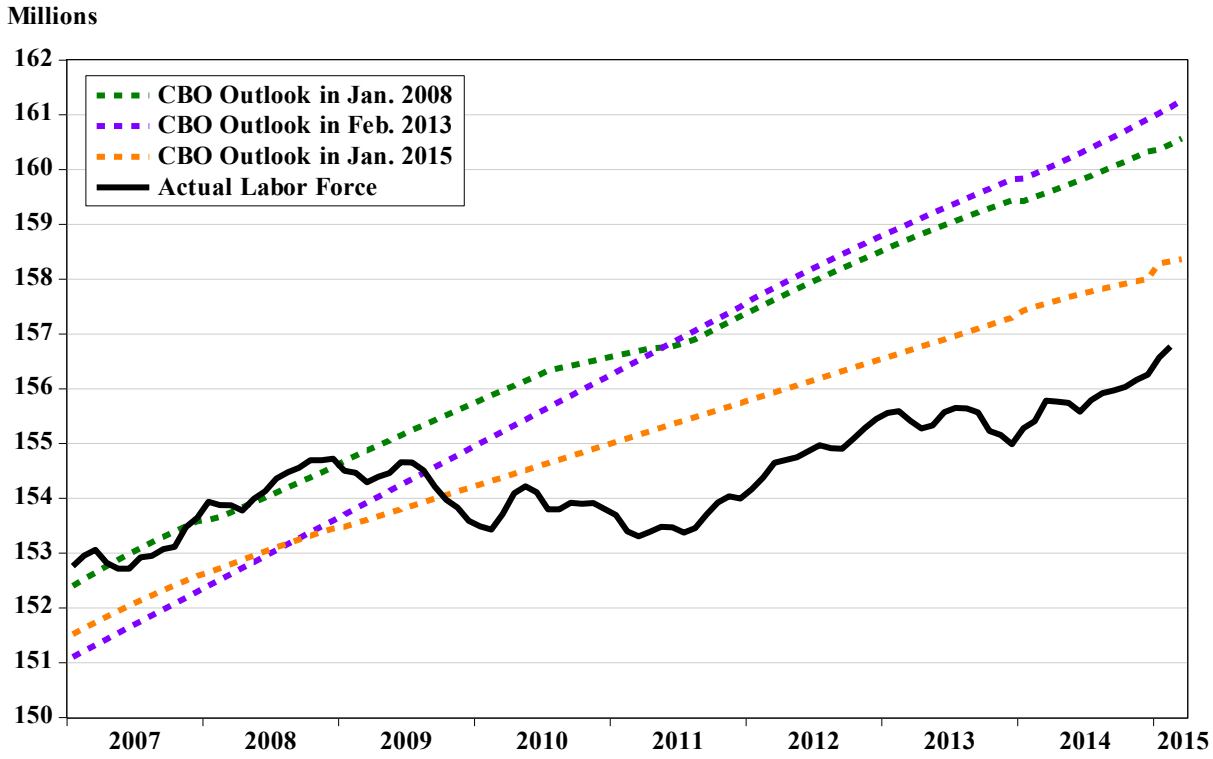
Note: This figure depicts the recent evolution of the U.S. employment gap in proportion to the potential labor force (top panel) and in millions of FTE jobs (bottom panel). In each panel, the dark-shaded area denotes the unemployment gap, the medium-shaded area denotes the participation gap, the light-shaded area denotes the underemployment gap, and the solid line denotes the total employment gap; all series are shown as three-month moving averages. Source: BLS, CBO, and authors' calculations.

Figure 3: Evolving Assessments of the Unemployment Gap



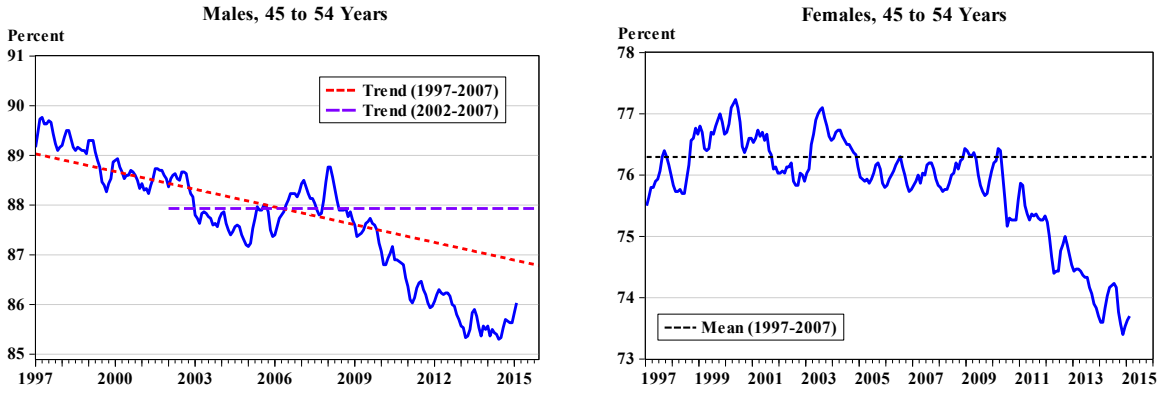
Note: The solid line denotes the three-month moving average of the U.S. unemployment rate (U3) from January 2008 to February 2015. The short-dashed line denotes the evolution of CBO's assessments of the long-run natural rate. The long-dashed line denotes the Blue Chip consensus (that is, the mean projection) for the unemployment rate five to 10 years ahead, while the upper and lower limits of the shaded area represent the average projections in the top and bottom quartiles, respectively. Source: BLS, CBO, Blue Chip, and authors' calculations.

Figure 4: Evolving CBO Assessments of the Potential Labor Force



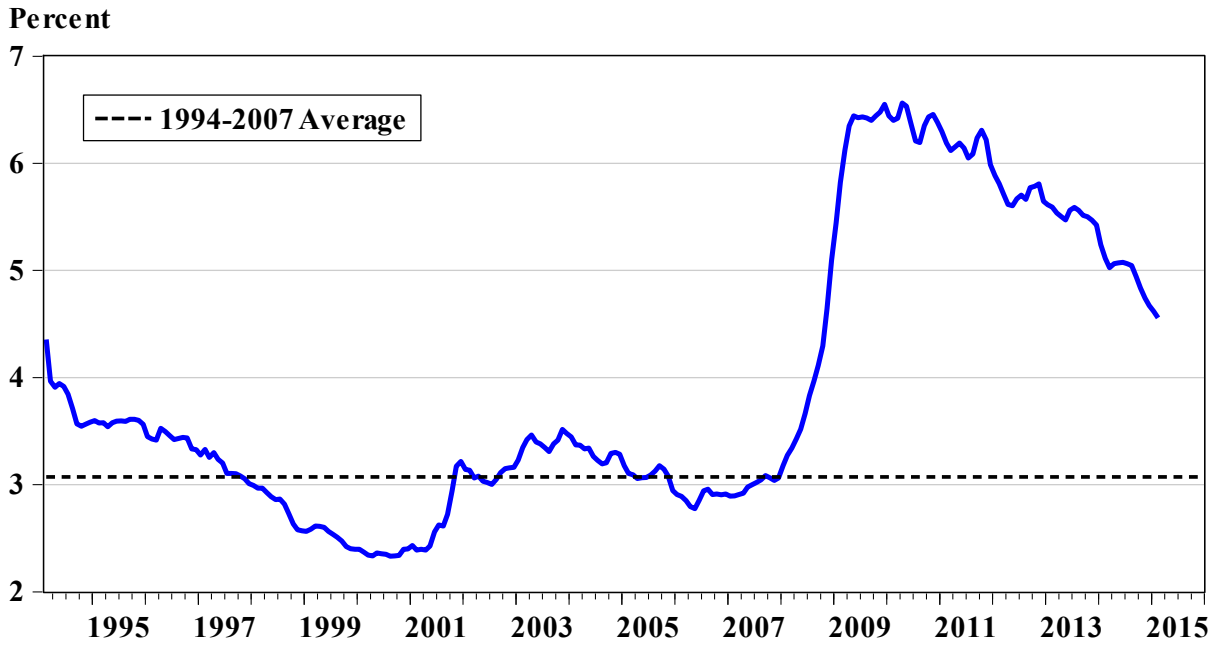
Note: The solid line denotes the three-month moving average of the U.S. labor force from January 2007 to February 2015, and the dashed lines denote the CBO's assessments of the potential labor force as of January 2008 (short-dashed), February 2013 (medium-dashed), and January 2015 (long-dashed). Each CBO series has been adjusted to incorporate subsequent revisions to BLS population controls. Source: BLS, CBO, and authors' calculations.

Figure 5: Evidence on Participation Trends by Gender



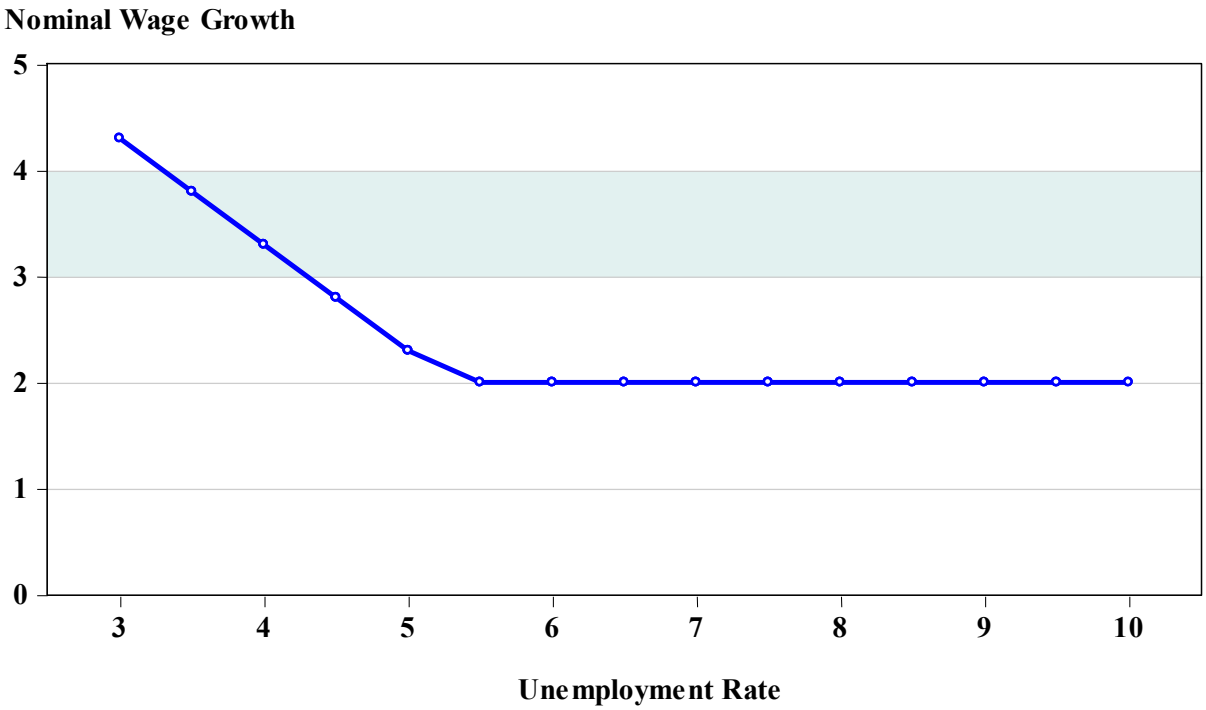
Note: The left panel depicts the three-month moving average of the labor force participation rate of males age 45 to 54 years (solid line), along with linear trends fitted to observations from 1997 to 2007 (short-dashed line) and 2002 to 2007 (long-dashed line). The right panel depicts the three-month moving average of the labor force participation rate of females age 45 to 54 years (solid line), along with its mean value from 1997 to 2007 (dashed line).
Source: BLS and authors' calculations.

Figure 6: The Underemployment Gap



Note: This figure depicts the three-month moving average of the number of people employed part time for economic reasons as a fraction of total employment (solid line) and the mean value of that ratio from 1994 to 2007 (dashed line). Source: BLS and authors' calculations.

Figure 7: A Stylized Representation of the Wage Curve



References

Aaronson, D., Davis, J., Hu, L. 2012. "Explaining the Decline in the U.S. Labor Force Participation Rate." Chicago Fed Letter #296, Federal Reserve Bank of Chicago.

Aaronson, S., Cajner, T., Fallick, B., Galbis-Reig, F., Smith, C., Wascher, W. 2014. "Labor Force Participation: Recent Developments and Future Prospects." *Brookings Papers on Economic Activity*.

Bell, D., Blanchflower, D. 2013a. "How to measure underemployment?" Peterson Institute for International Economics Working Paper 13/2, August.

Bell, D., Blanchflower, D. 2013b. "Underemployment in the UK revisited." *National Institute Economic Review*, 224:F8-F22.

Bell, D., Blanchflower, D. 2014. "Labour market slack in the UK." *National Institute Economic Review*, 229:F4-F11.

Blanchflower, D., Oswald, A. 1994. *The Wage Curve*. Cambridge, MA: MIT Press.

Blanchflower, D., Oswald, A. 2005. "The wage curve reloaded." NBER Working Paper #11338.

Blanchflower, D., Posen, A. 2014. "Wages and Labor Market Slack: Making the Dual Mandate Operational." Peterson Institute for International Economics Policy Brief 14-10.

Card, D. 1995. "The wage curve: a review." *Journal of Economic Literature*, 33:785-799.

Erceg, C., Levin, A. 2014. "Labor Force Participation and Monetary Policy in the Wake of the Great Recession." *Journal of Money, Credit and Banking*.

Federal Open Market Committee. 2014. "Statement on Longer-Run Goals and Monetary Policy Strategy." Available at: *http://www.federalreserve.gov/monetarypolicy*.

Hotchkiss, J., Rios-Avila, F. 2013. "Identifying Factors behind the Decline in the Labor Force Participation Rate." *Business and Economic Research* 3:257-275.

Levin, A., Taylor, J. 2013. "Falling Behind the Curve: A Positive Analysis of Stop-Start Monetary Policies and the Great Inflation." In: *The Great Inflation*, Bordo, M., Orphanides, A., eds. Chicago, IL: University of Chicago Press.

Levin, A. 2014. "The Design and Communication of Systematic Monetary Policy Strategies." *Journal of Economic Dynamics and Control*.

Nijkamp, P., Poot, J. 2005. 'The last word on the wage curve?' *Journal of Economic Surveys*, 19:421-450.

Paciorek, A. 2015. "Where Are The Construction Workers?" FEDS Notes, February 26, Board of Governors of the Federal Reserve System.

Robertson, J., Terry, E. 2015. "What's (Not) Up with Wage Growth?" *Macroblog*, Federal Reserve Bank of Atlanta, February 17.

Romer, C., Romer, D. 2014. "Program Report: The NBER Monetary Economics Program." NBER Research Report 1,1–7.

Sherk, J. 2012. "Not Looking for Work: Why Labor Force Participation Has Fallen During the Recession." *Backgrounder* 2722, Heritage Foundation Center for Data Analysis.

Svensson, L. 2013. "The Possible Unemployment Cost of Average Inflation below a Credible Target." Forthcoming, *American Economic Journal: Macroeconomics*.

Taylor, J. 1993. "Discretion versus Policy Rules in Practice." *Carnegie-Rochester Conference Series on Public Policy* 39:195–214.

Taylor, J. 1999. "A Historical Analysis of Monetary Policy Rules." In: Taylor, J. (Ed.), *Monetary Policy Rules*, Chicago, IL: University of Chicago Press.

Taylor, J., Williams, J. 2010. "Simple and Robust Rules for Monetary Policy." *Handbook of Monetary Economics*.

Van Zandweghe, W. 2012. "Interpreting the Recent Decline in Labor Force Participation." *Economic Review*, Federal Reserve Bank of Kansas City, 5-34.

Yellen, J. 2012. "Perspectives on Monetary Policy." Remarks given at the Boston Economic Club, June 6. See http://www.federalreserve.gov/newsevents/speech/yellen20120606a.htm .