820 First Street NE, Suite 510, Washington, DC 20002

Tel: 202-408-1080 | Fax: 202-408-1056 | pathtofullemployment.org | www.cbpp.org | offthechartsblog.org

March 24, 2015

Labor Market Slack and Monetary Policy[1]

By David G. Blanchflower and Andrew T. Levin

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.[2]

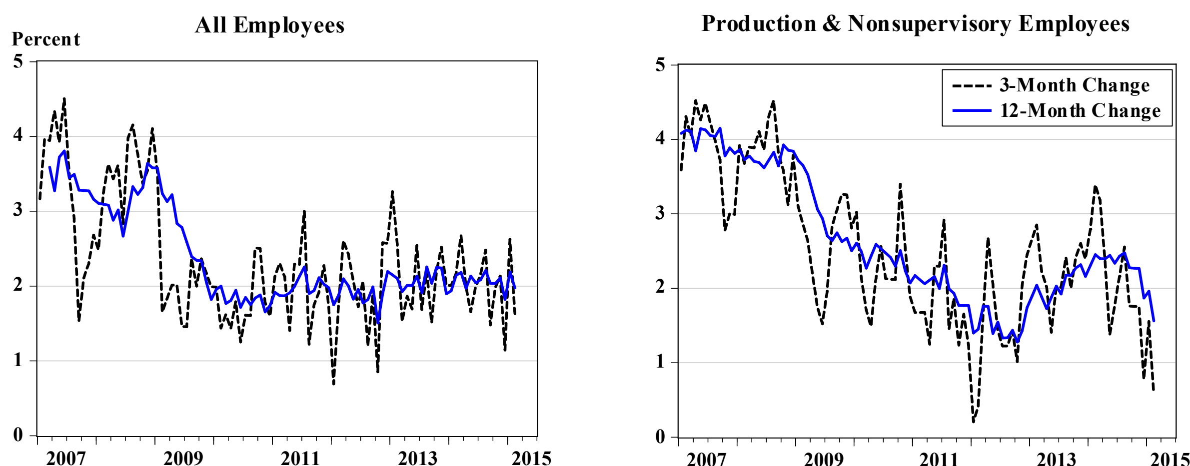
In gauging movements in labor market slack over previous business cycles, macroeconomists have generally focused on the gap between the conventional unemployment rate (that is, the incidence of people who are out of work and actively searching for a job) and the "natural rate of unemployment" judged 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 in-

[1]David G. Blanchflower is the Bruce V. Rauner professor of economics at Dartmouth College, a professor of economics at the University of Stirling, a research associate of the National Bureau for Economic Research, and a program director and research fellow at the Institute for the Study of Labor (IZA). Andrew T. Levin is currently an adviser in the Research Department at the International Monetary Fund, and he will be joining the Dartmouth faculty as a professor of economics in July 2015. We appreciate many invaluable conversations with Laurence Ball, Jared Bernstein, Christopher Erceg, Melinda Pitts, Adam Posen, Lars Svensson, and John Taylor. Nonetheless, the views expressed here are solely those of the authors and do not necessarily reflect the views of the International Monetary Fund or of any other person or institution.

[2]The FOMC'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." See FOMC, "Statement on Longer-Run Goals and Monetary Policy Strategy, 2014, available at *http://www.federalreserve.gov/monetarypolicy.*

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 non-supervisory employees. Each panel depicts the annualized 3-month change (solid line) and the 12-month change (dashed line). Source: BLS and authors' calculations.

corporate 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 that the actual shortfall in employment might well be twice as 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 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 conventional unemployment, underemployment, and hidden unemployment each exert significant downward

pressure on nominal wages.[3] Such results should not be surprising, because employers may fill a job vacancy by hiring (a) someone who had been out of work and actively searching for a job; (b) someone who had been working part-time, either at the same firm or elsewhere; or (c) someone who had just rejoined the labor force and hence wasn't being counted as unemployed.

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.[4] Indeed, the latest 12-month change (from February 2014 through February 2015) was 1.975 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 tail of the wage distribution and hence more informative about broader wage trends. Recent readings on this measure point to a significant *decline* in nominal wage growth over the past few quarters: The 12-month change through February 2015 was just 1.6 percent, down nearly a full percentage point from the pace of wage growth last summer, and the latest annualized three-month change was only 0.8 percent.[5]

Finally, we consider the monetary policy implications of labor market slack using a variant of the simple rule that has been extensively studied by Taylor and characterized as the "balanced approach rule" by Yellen.[6] This analysis indicates that the initiation of monetary policy tightening would be premature at the present time. Indeed, such a policy move would be a serious mistake in light of substantial downside risks to the current economic outlook.[7] Rather, liftoff from the zero lower bound should be deferred until labor market slack has diminished substantially further and inflation has moved up significantly closer to the FOMC's 2 percent inflation goal.

---

[3] 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."

[4] The same pattern is evident for other measures of labor compensation such as the employment cost index. Indeed, J. Robertson and E. Terry ("What's (Not) Up with Wage Growth? *Macroblog*, Federal Reserve Bank of Atlanta, February 17, 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."

[5] Average hourly earnings of production and nonsupervisory workers increased from $20.77 in November 2014 to $20.80 in February 2015–a measly raise of just 3 cents. 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 over the course of last year and by 1.7 percent in the fourth quarter. For all civilian workers, the Employment Cost Index (ECI) grew by 2.2 percent in both the third and fourth quarters of 2014.

[6] This rule was initially analyzed by J. Taylor, "A Historical Analysis of Monetary Policy Rules, in J. Taylor, ed., *Monetary Policy Rules* (University of Chicago Press, 1999). Its characterization as a "balanced approach rule was given by J. Yellen, "Perspectives on Monetary Policy, remarks given at the Boston Economic Club, June 6, 2012 *(http://www.federalreserve.gov/newsevents/speech/yellen20120606a.htm)*.

[7] According to the US Census Bureau, retail sales declined in three consecutive months: -0.9 percent in December 2014, -0.8 percent in January 2015, and -0.6 percent in February 2015.

Gauging Labor Market Slack

The Employment Gap

Our measure of the employment gap is the sum of three specific components.[8] First, the *unemployment gap* is the deviation of the conventional unemployment rate–labeled "U3" by the Bureau of Labor Statistics (BLS)–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.[9]

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 around 1.9 percent, suggesting that the "true" unemployment rate (including underemployment and hidden unemployment) should be viewed as around $7\frac{1}{2}$ percent. Gauged in human terms, the current magnitude of the employment shortfall is equivalent to about 3.3 million full-time jobs.

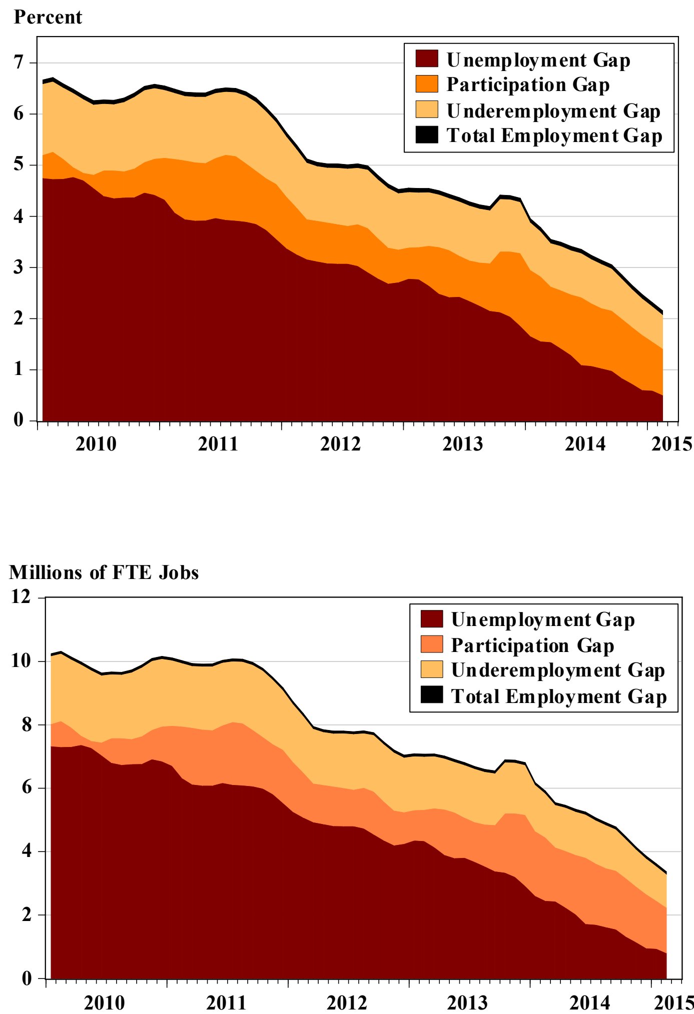
Of course, the characteristics of the economy's balanced-growth path cannot be directly observed, and hence any particular assessment of the deviations from that path is necessarily subject to considerable uncertainty. In the context of a typical business cycle, such uncertainty might reasonably be judged 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,

[8] This measure of the employment gap was introduced by A. Levin, "The Design and Communication of Systematic Monetary Policy Strategies, Journal of Economic Dynamics and Control (2014).

[9] 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.

FIGURE 2

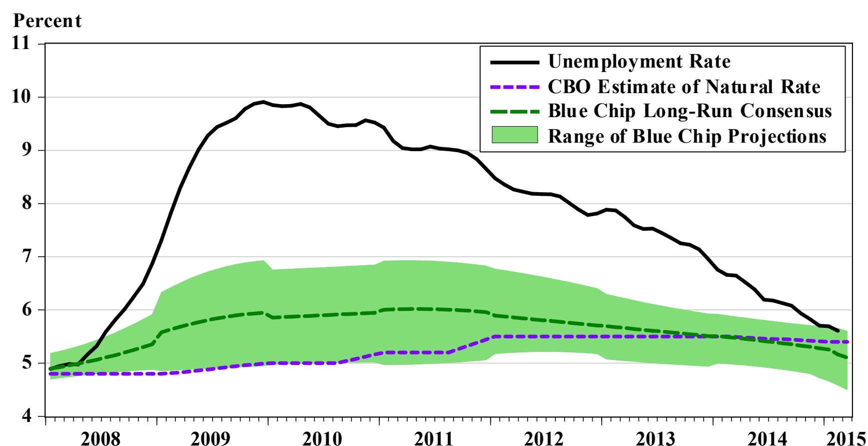
Benchmark Assessment of the Employment Gap



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 of these 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 5 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: Source: BLS, *Blue Chip Economic Indicators*, and authors' calculations.

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.

The Unemployment Gap

CBO regularly produces assessments of the natural unemployment rate that would prevail if the economy were on its balanced-growth path.[10] 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*, which solely reflects the influences of longer-lasting structural factors.[11]

[10]These assessments are published in CBO's annual *Budget and Economic Outlook* document each January or February as well as in its midyear updates each August.

[11]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

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.[12]

As shown in Figure 3, the Blue Chip's longer-run consensus outlook in 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 upwards, 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 nominal wage inflation has been subdued, professional forecasters have been gradually marking down their longer-run unemployment projections. 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 $4\frac{1}{2}$ percent and the top quartile of projections now stands at $5\frac{1}{2}$ 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.

The Participation Gap

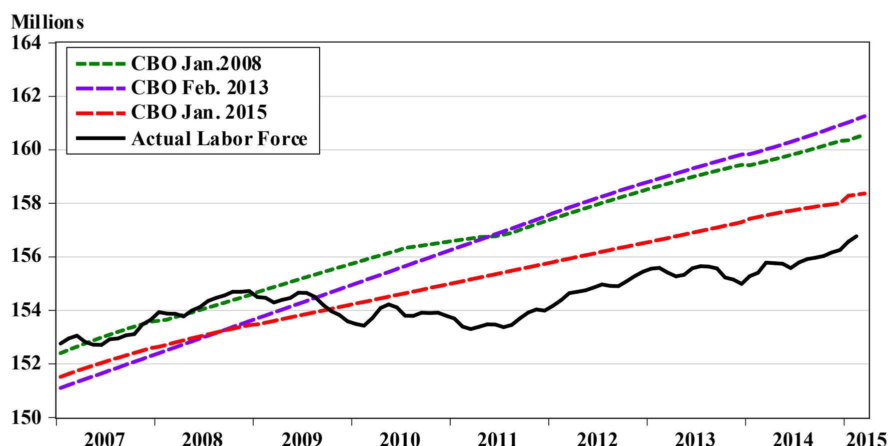
In conjunction with its estimates of potential output and the natural unemployment rate, CBO produces regular assessments of the historical and projected size of the *potential labor force*, that is, the balanced-growth path for the labor force that would prevail in the absence of

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.

[12]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. Copyright (c) Aspen Publishers, Inc. All rights reserved.

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.

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.[13]

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 lead-up 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

[13] As discussed in C. Erceg and A. Levin ("Labor Force Participation and Monetary Policy in the Wake of the Great Recession, *Journal of Money, Credit and Banking*, 2014), CBO's labor force projections in early 2008 were broadly consistent with the projections that were published by BLS in November 2007.

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 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.

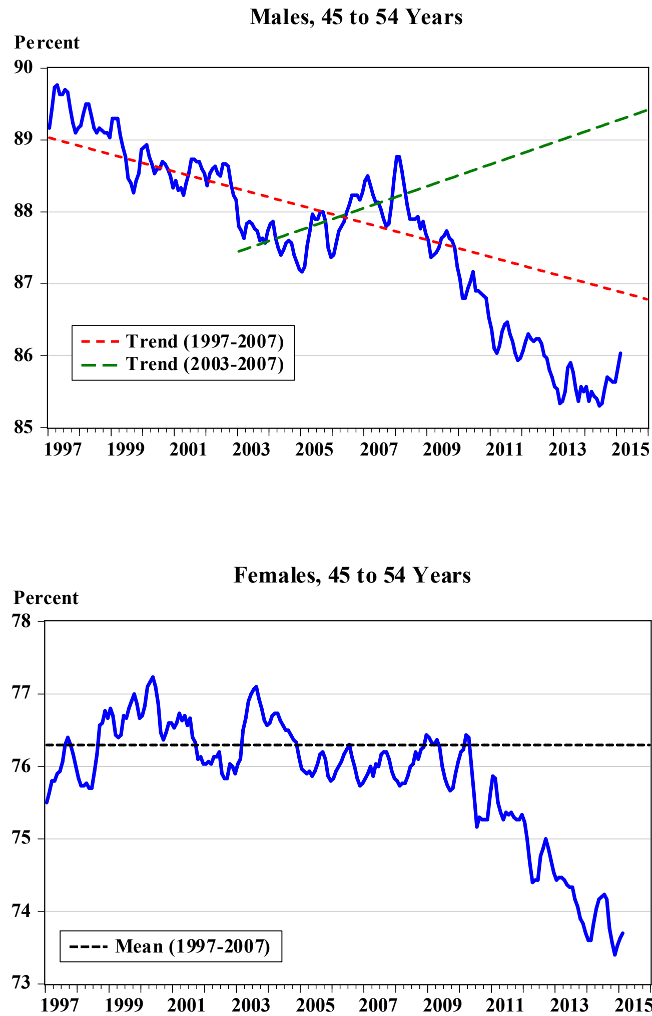
Breaking down the data by gender is also relevant for assessing the extent to which the post-2007 decline in U.S. labor force participation might be largely structural or irreversible. As shown in the left panel of Figure 5, the participation rate of males age 45 to 54 years was drifting downward during 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 right 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 $2\frac{1}{2}$ percentage points–is virtually identical to the drop in labor force participation of all prime-age adults (that is, aged 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.[14]

[14]See D. Aaronson, J. Davis, and L. Hu, "Explaining the Decline in the U.S. Labor Force Participation Rate, Chicago Fed Letter #296, Federal Reserve Bank of Chicago, 2012; J. Sherk, "Not Looking for Work: Why Labor Force Participation Has Fallen During the Recession, Backgrounder 2722, Heritage Foundation Center for Data Analysis, 2012; W. Van Zondweghe, "Interpreting the Recent Decline in Labor Force Participation, *Economic Review*, Federal Reserve Bank of Kansas City, 5-34, 2012; J. Hotchkiss and F. Rios-Avila, "Identifying Factors Behind the Decline in the Labor Force Participation Rate, *Business*

FIGURE 5

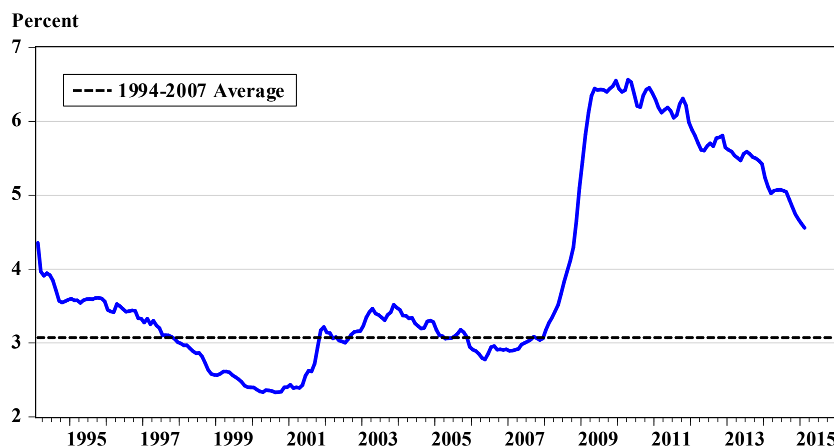
Disaggregated Evidence on Participation Trends



Note: The left panel depicts the three-month moving average of the labor force participation rate of males aged 45 to 54 years (solid line), along with linear trends fitted to observations from 1997 to 2007 (short-dashed line) and 2003 to 2007 (long-dashed line). The right panel depicts the three-month moving average of the labor force participation rate of females aged 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 over the period from 1994:1 to 2007:12. Source: BLS and authors' calculations.

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, rising 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.

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.

---

and Economic Research 3:257-275, 2013; and C. Erceg and A. Levin, "Labor Force Participation and Monetary Policy in the Wake of the Great Recession. For a contrary view, see Aaronson et al., "Labor Force Participation: Recent Developments and Future Prospects, *Brookings Papers on Economic Activity*, 2014.

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.

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, using data from the Merged Outgoing Rotation Group (MORG) files extracted from the Current Population Survey (CPS).[15] The CPS is collected monthly and is used to calculate the unemployment rate and other labor market aggregates published monthly in the BLS in the Employment Situation jobs release.[16] Data are available from 1990-2012, so with 50 states and the District of Columbia, there are 1,173 observations in total.[17]

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.

[15] D. Blanchflower and A. Oswald, *The Wage Curve* (Cambridge, MA: MIT Press, 1994).

[16] 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 only asked 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.

[17] 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 1990 is determined by the availability of the labor market status variables, whereas the wage data is available for prior years; hence the inclusion of a lagged dependent variable does not constrain the length of our sample.

TABLE 1

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

1) Long-Term Unemployment

	(1)	(2)	(3)	(4)	(5)	(6)
$Wage_{t-1}$	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

2) Underemployment

	(1)	(2)	(3)	(4)	(5)	(6)
$Wage_{t-1}$	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

	(1)	(2)	(3)	(4)	(5)	(6)
1) 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
2) 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.

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 as a Phillips curve.[18] The estimated coefficient of -0.0279 on the logarithm of the unemployment rate is negative and statistically significant, with a t-statistic of around 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.[19] 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). Moreover, the results reported here are essentially the same as what Blanchflower and Oswald found across many countries and datasets and are also consistent with the conclusions reached by Nikjamp and Poot in a meta-analysis of wage curve estimates.[20]

The remaining columns of this panel confirm the findings of Blanchflower and Posen.[21] 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, i.e., the relative incidence of long-term vs. short-term unemployment.

The second panel 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 statistically significant effect on wage growth, consistent with the findings of Blanchflower and Posen.[22] Next, we incorporate the underemployment rate, which is defined as 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.[23]

Evidently, 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, all of these forms

---

[18] D. Card, "The Wage Curve: A Review, *Journal of Economic Literature* 33:785-99.

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

[20] Blanchflower and Oswald, *The Wage Curve*; D. Blanchflower and A. Oswald, "The wage curve reloaded, NBER Working Paper #11338, 2005; P. Nijkamp and J. Poot, "The Last Word on the Wage Curve? *Journal of Economic Surveys* 19: 421-50, 2005. Blanchflower and Oswald (*The Wage Curve*, 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".

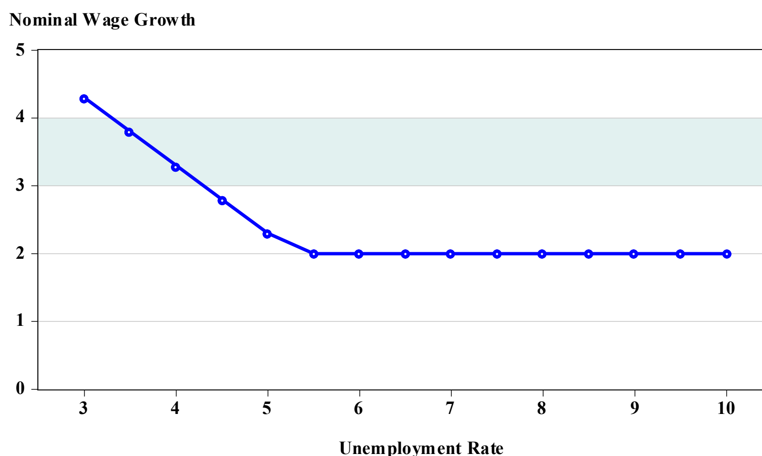
[21] D. Blanchflower and A. Posen, "Wages and Labor Market Slack: Making the Dual Mandate Operational, Peterson Institute for International Economics Policy Brief 14-10, 2014.

[22] Blanchflower and Posen, "Wages and Labor Market Slack; A. Paciorek ("Where Are the Construction Workers? FEDS Notes, Board of Governors of the Federal Reserve System, February 26, 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."

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

FIGURE 7

A Stylized Representation of the Wage Curve



Note: The shaded area depicts the range for nominal wage growth that Federal Reserve Chair Yellen has described as "normal." Source: authors' calculations.

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.[24]

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 remains large. As noted above, our benchmark analysis indicates that the true unemployment rate is currently around $7\frac{1}{2}$ 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 unem-

[24]See D. Bell and D. Blanchflower ("How to Measure Underemployment? Peterson Institute for International Economics Working Paper 13/2, August 2013; "Underemployment in the UK Revisited, *National Institute Economic Review*, 224:F8-F22, 2013; "Labour Market Slack in the UK, *National Institute Economic Review*, 229:F4-F11, 2014) for more on underemployment in the United Kingdom based on preferences over hours. Workers are asked in the Labour Force Survey, which is the equivalent of the CPS in the United States, if they want more or less hours. These responses can be aggregated to the economy level. From 2000 to 2008 there was no underemployment as the number of hours of those who wanted more hours approximately equaled the number of hours of those who want 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 US is an underestimate of the true amount of underemployment by around 50 percent.

ployment rate approaches its longer-run normal level of around 5 percent.

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.[25] Thus, rather than relying on the monetary policy implications of any single macro 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.[26]

Following the seminal analysis of Taylor, 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 banks inflation objective), and the level of resource slack.[27] 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 banks 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 Feds Survey of Professional Forecasters (SPF) regarding the 5-to-10-year ahead projection 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.[28]

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

---

[25] See C. Romer and D. Romer, “Program Report: The NBER Monetary Economics Program, National Bureau of Economic Research Report 1,17, 2014.

[26] See J. Taylor, “Discretion Versus Policy Rules in Practice, *Carnegie-Rochester Conference Series on Public Policy* 39:195214, 1993; J. Taylor and J. Williams, “Simple and Robust Rules for Monetary Policy, *Handbook of Monetary Economics*, 2010; A. Levin and J. Taylor, “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, 2013; and A. Levin, “The Design and Communication of Systematic Monetary Policy Strategies.

[27] Specifically, such a rule can be expressed as follows: $i_t = r^* + \pi_t + \alpha(\pi_t - \pi^*) + \beta gap_t$, where i_t denotes the target federal funds rate, r^* denotes the equilibrium real interest rate, π_t denotes a smoothed measure of inflation, π^* denotes the inflation objective, gap_t is a measure of resource slack, and the coefficients α and β indicate how much the interest rate should be adjusted in response to the inflation gap $(\pi_t - \pi^*)$ and to resource slack, respectively. See J. Taylor, “Discretion Versus Policy Rules in Practice.

[28] 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 latest SEP (published in mid-March).

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, *Blue Chip Economic Indicators*, CBO, SPF, and authors' calculations.

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.[29] 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 particular specification has been shown to provide a reasonably balanced approach to fostering the stability of inflation and economic activity, and hence Yellen characterized it as the "balanced approach rule.[30]

As shown in Table 3, this policy rule prescribes a target federal funds rate of about $\frac{1}{4}$ percent using our benchmark estimate of the employment gap. However, the implied funds rate is notably lower for other reasonable assessments. Indeed, using CBO's February 2013 projection for the potential labor force (as depicted 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

[29] J. Taylor ("A Historical Analysis of Monetary Policy Rules, in J. Taylor, ed., *Monetary Policy Rules*, University of Chicago Press, 1999) reported on a comprehensive analysis of the performance of simple policy rules across a wide range of macroeconomic models.

[30] Yellen, "Perspectives on Monetary Policy.

points below zero.

This analysis indicates that initiating the process of monetary policy tightening would be premature at the present time. Indeed, such a policy move would be a serious mistake in light of substantial downside risks to the current economic outlook. Rather, liftoff from the zero lower bound should be deferred until labor market slack has diminished further and inflation has moved up closer to the FOMCs 2 percent inflation goal.