

## **How Much Slack Remains in Resource Utilization? Comparing the Staff's Unemployment Rate Gap with Alternative Measures**

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### **Introduction**

The staff now projects that the unemployment rate will average 5¾ percent in the current quarter, about ½ percentage point above our assumed natural rate of unemployment. Thus, as measured by the unemployment rate gap it appears that a modest amount of slack remains in the labor market. Of course, there is considerable uncertainty around this estimate, and the first section of this memo compares the staff's unemployment rate gap with several alternative gaps based on different approaches for estimating the natural rate of unemployment.

Although the staff believes the unemployment rate gap is usually the most useful *single* measure of slack, no one measure can ever be taken as a sufficient guide for monetary policy.<sup>2</sup> Accordingly, this memo also compares the staff's unemployment rate gap with a number of alternative indicators of economic slack, which we divide into three categories: output gaps, manufacturing capacity utilization, and other indicators of labor market conditions.

### **Unemployment rate gaps**

We use the staff's unemployment rate gap, the red line in Chart 1, as our baseline for comparison. However, as indicated by the 95-percent confidence interval (the shaded area, about  $\pm 1$  percentage point in 2014), there is considerable uncertainty around this estimate—and even this wide confidence interval likely understates the degree of uncertainty.<sup>3</sup> The additional lines in Chart 1 show unemployment rate gaps constructed from a few alternative measures of the natural rate of unemployment. Specifically, we consider measures from the Congressional Budget Office (CBO), the Survey of Professional Forecasters (SPF), and the Galí, Smets, and Wouters (2011) dynamic stochastic general equilibrium (DSGE) model.<sup>4</sup> We also consider the

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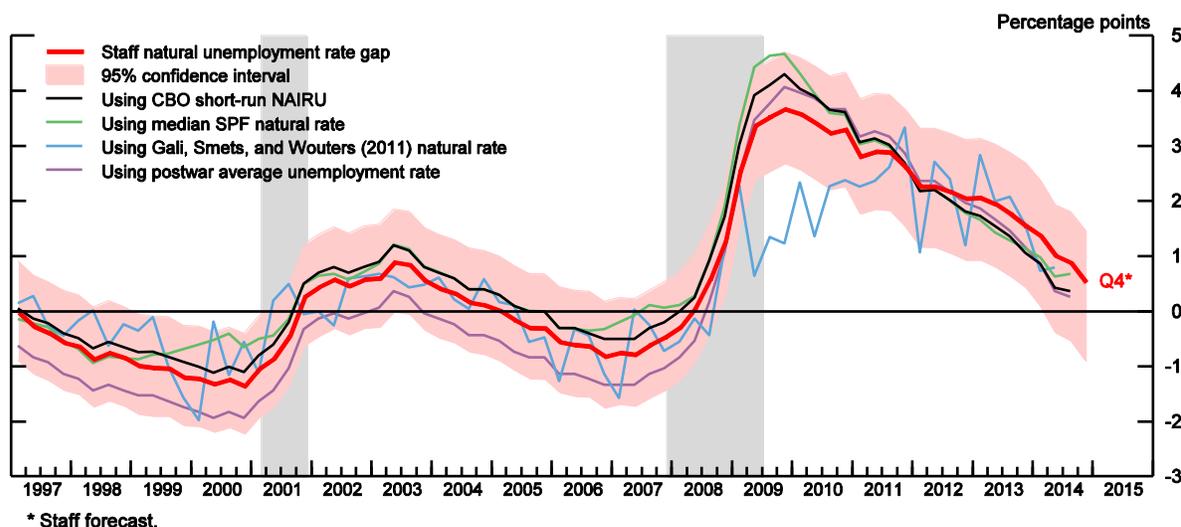
1. Norman Morin helped with analysis of the capacity utilization gap. We are grateful to Marc Giannoni (FRBNY) and Keith Sill (Federal Reserve Bank of Philadelphia) for providing us with output gap estimates from their models.

2. For a broader discussion about measures of slack, Fallick and Rudd, "The Staff's Assessment of Economic Slack," (Memo, August 2012) and Aaronson, Fallick, Nekarda, and Wascher, "Assessing Conditions in the Labor Market," (Memo, November 2012).

3. The confidence interval shown in Chart 1 reflects uncertainty around the natural rate of unemployment in the FRB/US state-space model given the data on which it is conditioned. However, this measure of uncertainty takes as given the model's structure and parameter settings and does not account for sampling uncertainty in the published unemployment rate. A more comprehensive measure that incorporated uncertainty about these elements would likely yield a wider confidence interval.

4. Congressional Budget Office, "An Update to the Budget and Economic Outlook: 2014 to 2024," (August

**Chart 1: Unemployment rate gaps**



postwar average of the unemployment rate as a proxy for its natural rate. Although the alternative gaps nearly always lie within the 95-percent confidence interval surrounding the staff’s gap, there are often differences across the various measures that could be meaningful for monetary policy. In the second quarter of 2014 (the last date for which all are available), these estimates of the unemployment rate gap indicated a bit less slack than the staff’s unemployment rate gap.

### Output gaps

The first category of alternative indicators of resource utilization that we consider is output gaps. We consider five estimates of the output gap—the difference between actual and potential output—derived from structural models used within the Federal Reserve System. These models employ a variety of different concepts of potential output, with correspondingly distinct concepts of the output gap.<sup>5</sup> For example, production-function output gaps are sensitive to gaps in labor and capital utilization, but take the existing capital stock as given, while Beveridge-Nelson output gaps also capture deviations of the capital stock from its stochastic trend. Flex-price potential output may further undergo efficient, but transient, deviations from its stochastic trend in response to the shocks hitting the economy.<sup>6</sup> While more detailed elucidation of these various

2014); Galí, Smets, and Wouters, “Unemployment in an Estimated New Keynesian Model,” NBER Working Papers 17084 (May 2011); Survey of Professional Forecasters, Federal Reserve Bank of Philadelphia (November 2014).

5. See Kiley, Reifschneider and Rudd, “An Overview of DSGE Models and Their Relationship to Other Analytical Approaches Used by Board Staff” (Memo, June 3, 2011) for a concise overview of several of these potential output concepts (production-function, flex-price, and Beveridge-Nelson).

6. More precisely, the production-function output gap is defined as the difference between actual output and the level of output that could be obtained with the current capital stock and production technology, but with labor inputs and capital utilization at their trend levels. A Beveridge-Nelson output gap is equal to the difference between actual output and its stochastic trend. Finally, a flex-price output gap is equal to the difference between actual output and the level of output that would prevail, given the shocks that have hit the economy over history, but in the absence of nominal rigidities and certain other distortions, such as financial frictions. A systematic discussion of the relations

output gap concepts lies outside the scope of this memo, we will indicate which estimates aim to measure the same output gap.

The upper-left panel of Chart 2 plots the staff's unemployment rate gap (the red line) together with these output gap estimates. To facilitate comparison with the unemployment rate gap, we transform the output gaps into roughly the same basis as the staff's unemployment rate gap.<sup>7</sup> Production-function output gaps from EDO and the FRB/US state-space model are plotted as solid lines.<sup>8</sup> The dashed lines represent alternative output gaps from three dynamic stochastic general equilibrium (DSGE) models used within the System: the EDO flex-price gap, PRISM, and a DSGE model recently developed by Del Negro, Giannoni, and Schorfheide and now used for policy analysis at the Federal Reserve Bank of New York (the FRBNY model).<sup>9</sup>

As is clear from their definitions, output gap measures are sensitive to a wide range of wedges between actual and potential inputs to production and thus need not, in principle, exhibit a tight relation with the unemployment gap. Indeed, as is evident from this panel, while the unemployment gap and all output gap measures exhibit broadly similar cyclical features, sizeable and persistent divergences between the unemployment gap and the various output gap measures are not infrequent, particularly in the case of the Beveridge-Nelson and flex-price gaps.

Nevertheless, in the third quarter of 2014, the EDO and FRB/US production-function output gaps were broadly consistent with the staff's unemployment rate gap. Specifically, the staff estimated that the unemployment rate gap in Q3 was 0.9 percentage point, while the transformed EDO production-function output gap was 0.5 percentage point and the transformed FRB/US output gap was 0.4 percentage point.

PRISM's Beveridge-Nelson output gap and FRBNY's flex-price gap indicate considerably more economic slack than does the staff's unemployment rate, as well as noticeably less narrowing of slack since the end of the Great Recession. In contrast, the EDO flex-price gap has narrowed more than the FRBNY flex-price gap since the trough and has tracked the staff's unemployment rate gap more closely.

In addition to the wide dispersion of estimates across models evident from the plot, there is also considerable uncertainty within each model. For example, in the FRB/US state-space model, the standard deviation around the model's recent estimates of the output gap is about ½ percentage

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among these gap concepts can be found in Kiley, "Output Gaps", *Journal of Macroeconomics*, vol. 37, 2013.

7. Specifically, we multiply the output gaps by  $-0.44$ , the sum of the coefficients relating the unemployment rate gap to the staff's output gap (and three lags) in the staff's Okun's law equation.

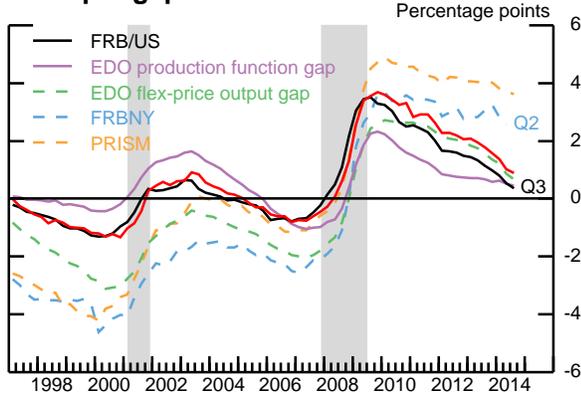
8. EDO is one of several DSGE models used routinely at the Federal Reserve Board and is described in FEDS working paper 2010-29. EDO is estimated under the assumption that monetary policy targets a production-function output gap.

9. PRISM (Philadelphia Research Intertemporal Stochastic Model) was developed at the Federal Reserve Bank of Philadelphia and is described in a Technical Appendix available on the Real-Time Data Research Center's website. PRISM emphasizes a Beveridge-Nelson output gap. The FRBNY model is described in Del Negro, Giannoni and Schorfheide, "FRBNY Staff Report 618 (May 2013, revised April 2014). The estimated monetary policy response function in the FRBNY model features a flex-price gap.

### Chart 2: Alternative Measures of Slack

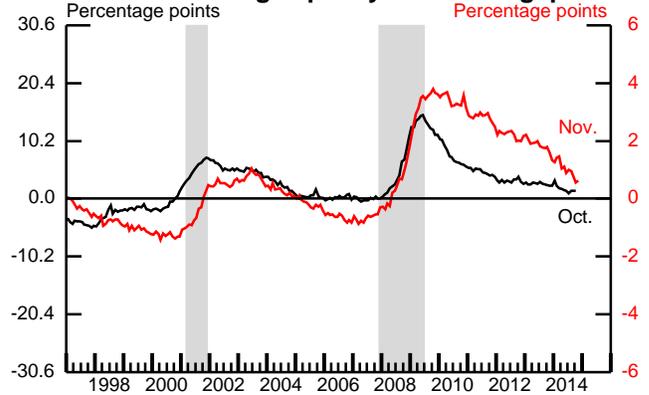
Red line in each panel is the staff's unemployment rate gap (right axis)

#### Output gaps\*



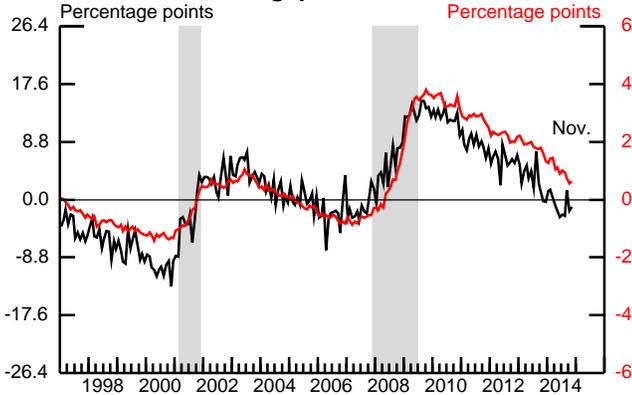
Source: FRB; PRISM: Federal Reserve Board Bank of Philadelphia, PRISM Model Documentation (June 2011); FRBNY: Federal Reserve Bank of New York Staff Report 618 (May 2013, revised April 2014).

#### Manufacturing capacity utilization gap\*



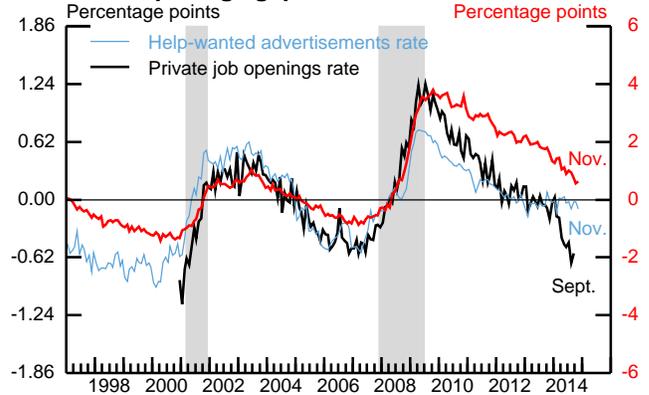
Source: Federal Reserve Board.

#### Jobs hard to fill gap\*



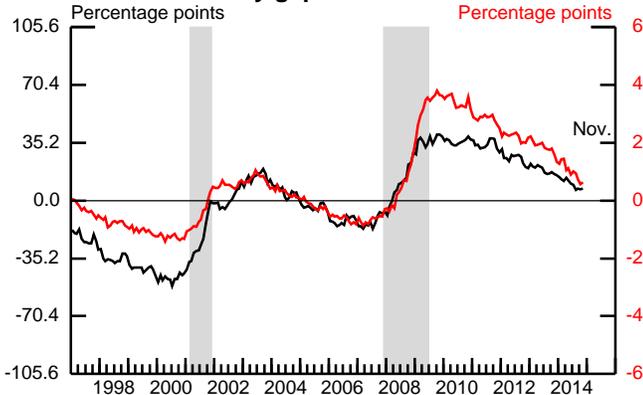
Note: Percent of small businesses surveyed with at least one "hard to fill" job opening. Seasonally adjusted by FRB staff.  
Source: National Federation of Independent Business, Small Business Economic Trends Survey.

#### Job openings gap\*



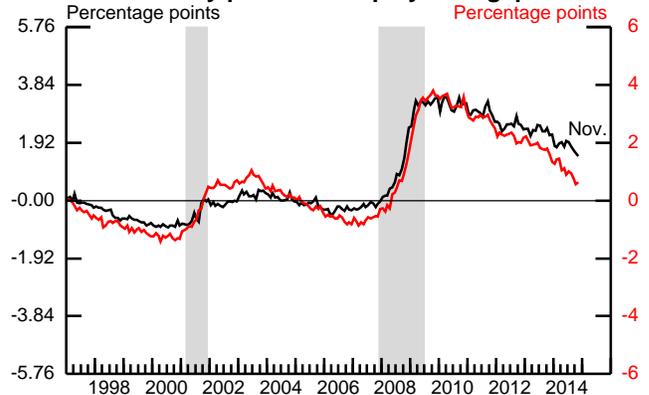
Note: Job openings rate is the number of job openings divided by employment plus job openings.  
Source: Job Openings and Labor Turnover Survey; U.S. Department of Labor, BLS, Current Employment Statistics.

#### Job availability gap\*



Note: Percent of households believing jobs are plentiful minus the percent believing jobs are hard to get.  
Source: Conference Board.

#### Involuntary part-time employment gap



Note: Percent of employment.  
Source: U.S. Department of Labor, Bureau of Labor Statistics, Current Population Survey.

Note: The shaded bars indicate a period of business recession as defined by the National Bureau of Economic Research. Output gaps are multiplied by -0.44 to facilitate comparison with the unemployment rate gap. Manufacturing capacity utilization gap is constructed by subtracting its average rate from 1972-2013. Other gaps were constructed by subtracting each series' average in 2004:Q4 and 2005:Q1.

\* Plots the negative of the gap to have the same sign as the unemployment rate gap.

point (in units of the unemployment rate gap). However, as in Chart 1, this confidence interval accounts only for the limited information about the output gap in the FRB/US model's data set and neglects several additional sources of uncertainty, notably uncertainty about the model's parameters and sampling uncertainty about the conditioning data. In the future, the staff hopes to be able to provide a more comprehensive accounting of these and other sources of uncertainty, including that regarding the model structure itself.

### **Capacity utilization**

Another measure of resource utilization is manufacturing capacity utilization (CU). As a proxy for the equilibrium rate of CU, we use its long-run average from 1972 to 2013 (78.7 percent). Subtracting this average from actual CU yields a measure of the CU gap, which we multiply by negative one, so that it has the same sign as the unemployment rate gap, and plot in the upper-right panel of Chart 2. CU was running at about 77 percent in the third quarter, just a bit below its long-run average. Thus, as of the third quarter, slack in the manufacturing sector appeared to be roughly in line with that indicated by the unemployment rate gap.

### **Labor market indicators**

The staff looks at a wide range of indicators when assessing labor market conditions. The remainder of Chart 2 shows four indicators that give some additional perspective about labor market slack beyond that provided by the unemployment rate gap: Small business' perceptions of hiring conditions, job openings posted by employers, households' perceptions of job availability, and involuntary part-time employment. Historically, these indicators have been highly correlated with the unemployment rate.

To facilitate comparison with the unemployment rate gap, we standardize each indicator by subtracting its average value over the two-quarter period from 2004:Q4 to 2005:Q1, the most recent period for which the staff judges the labor market to have been roughly in equilibrium.<sup>10</sup> For all indicators except involuntary part-time employment, we multiply the standardized indicators by negative one, so that they have the same sign as the unemployment rate gap. The left axis of each panel is scaled to show the same range, in standard deviations, as the unemployment rate gap (plotted against the right axis).

The middle row of Chart 2 plots two measures from business surveys. Small business' perceptions of hiring conditions, shown to the left, suggest there was less slack in Q3 than was indicated by the unemployment rate gap. On the right, private job openings from the Job Openings and Labor Turnover Survey (JOLTS)—the black line—improved markedly over the past year, although an alternate measure of job openings from the Conference Board—the blue

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10. Assuming that each indicator was in equilibrium during late 2004 and early 2005 and that the full-employment trend is constant over the period shown, these gaps should be comparable to the unemployment rate gap. To the extent that these assumptions are not valid—for example, if structural changes in the labor market have led to changes over time in the levels of these indicators at full employment—then the gaps presented here could be misleading.

line—has changed little. In isolation, both measures of job openings indicate a tighter labor market than does the unemployment rate gap. However, there is a long literature studying the relationship between job openings and unemployment (the Beveridge curve), which find that vacancies tend to recover more quickly than unemployment after recessions. Thus, it is difficult to say whether the relative tightness implied by job openings indicates that the labor market is tighter than the unemployment rate gap, or whether this behavior is consistent with the usual—albeit protracted—Beveridge-curve dynamics.

The Conference Board measure of households' perceptions of job availability, plotted in the lower-left panel of Chart 2, seems to be sending about the same signal for slack in Q3 as the unemployment rate gap. In contrast, the number of persons involuntarily working part-time hours (as a share of all employed persons), plotted in the lower-right panel, has improved considerably less than the unemployment rate gap since 2012, and its recent level suggests that more slack remains than indicated by the unemployment rate gap.

Additionally, as shown by the black line in Chart 3, there is a relatively wide gap between the actual labor force participation rate (LFPR) and the staff's estimate of its trend, and this gap has not narrowed, on net, in recent years. Although movements in the LFPR gap tend to lag the unemployment rate gap (possibly by a year or more), it is highly unusual to see essentially no improvement in the LFPR gap despite four years of labor market improvement. This suggests that the narrowing of the unemployment rate gap may overstate the take-up of labor market slack. Moreover, a recent *BPEA* paper by Aaronson et al. (2014) suggests that the decline in the LFPR trend may not be as steep as the staff judgmental forecast assumes, and thus a little more of the decline in participation may be due to cyclical factors.<sup>11</sup> For illustration, the blue line in Chart 3 plots the LFPR gap using an alternative trend taken from their paper. This gap is almost twice as wide as the staff's LFPR gap, suggesting an even greater degree of labor market slack.

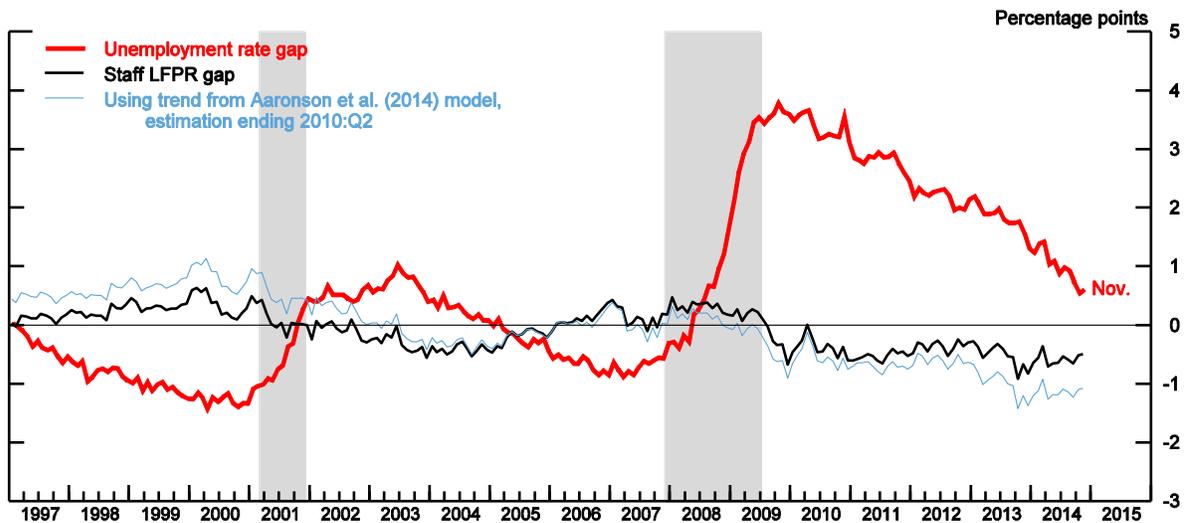
Finally, we note that these labor market indicators are not necessarily equally informative about slack. For instance, the elevated share of involuntary part-time employment or low rate of labor force participation represent additional margins of underutilized labor beyond that captured by the unemployment rate, whereas small business' perceptions of hiring conditions or households' perceptions of job availability are more indirect measures of resource utilization. Moreover, in addition to these indicators, the staff also looks at other measures of unemployment and underemployment, employment, quits, hires, and layoffs, as well as wage growth at the industry level and in the aggregate, when assessing labor market slack.<sup>12</sup>

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11. Aaronson, Cajner, Fallick, Galbis-Reig, Smith and Wascher, "Labor Force Participation: Recent Developments and Future Prospects," forthcoming, *Brookings Papers on Economic Activity*. The cohort-based model and their estimated LFPR trend are similar to the staff's. In this memo we use a variant of their baseline specification in which they ended estimation in the second quarter of 2010 rather than the second quarter of 2014.

12. Many of the indicators discussed here are included in the staff's labor market conditions index (LMCI), a dynamic factor model intended to summarize the change in labor market conditions. Because we do not view the LMCI as informative about slack, we did not include it in this memo.

**Chart 3: Unemployment rate and labor force participation rate gaps**



### Conclusion

All told, there is a wide range of estimates of slack, especially among output gap measures. Although considerable uncertainty attends these estimates, the production-function output gaps and many of the labor market indicators considered here are broadly in line with the staff’s assessment of slack based on the unemployment rate gap. However, there are a few notable exceptions. In particular, the JOLTS job openings rate suggests a much tighter labor market than does the unemployment rate gap. In contrast, the unusually wide labor force participation rate gap and elevated share of involuntary part-time work—margins of underutilization that are not captured by the unemployment rate gap—suggest that the unemployment rate gap somewhat *understates* the true degree of slack in the labor market at present. In addition, this memo does not consider the behavior of wages and prices. The absence to date of any appreciable acceleration in core consumer prices or a broad-based acceleration in labor costs may suggest that the alternative indicators we consider in this memo are understating the amount of slack remaining in the economy.