

# FRBSF ECONOMIC LETTER

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## How Big Is the Output Gap?

The output gap measures how far the economy is from its full employment or “potential” level that depends on supply-side factors of the economy: the supply of workers and their productivity. During a boom, economic activity may for a time rise above this potential level and the output gap is positive. During a recession, the economy drops below its potential level and the output gap is negative. In theory, the output gap can play a central role in monetary policy deliberations and strategy. First, one of the goals of the Federal Reserve is to maintain full employment, which corresponds to an output gap of zero. Second, the output gap is a key determinant of inflation. A positive output gap implies an overheating economy and upward pressure on inflation. A negative output gap implies a slack economy and downward pressure on inflation. But, there is a catch: we can’t directly measure potential output or the output gap. Instead, economists estimate them using statistical and economic models.

These estimates vary depending on the model and data used, and there is no general consensus on which method is best. This is not merely a theoretical problem. Orphanides (2002) argues that during the 1970s the Fed believed the output gap to be much more negative than it actually was, which led policy makers to take action that overheated the economy and contributed to an inflationary surge. Accurately measuring the current output gap is especially difficult given that data are subject to revision and estimates of potential output evolve as more data become available. These challenges are particularly acute in times of severe economic turmoil of the kind we are experiencing now. This *Economic Letter* examines measurement of potential output, focusing on how big the output gap—and the resulting downward pressure on inflation—is today.

### Competing estimates of potential output

One standard estimate of potential output is that of the Congressional Budget Office (CBO 2001), which bases its calculations on estimates of the component parts of potential output. By definition, potential output is the product of potential output per worker (“productivity”) and the total number of workers when the economy is at full employment (“labor

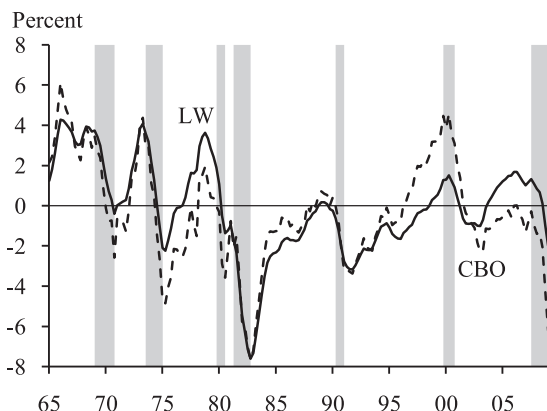
supply”). The CBO analyzes the factors that affect the level of potential productivity—including workers’ education and experience and available capital and technology—as well as factors that affect the supply of labor. The percent difference between real GDP and the estimate of potential output is the output gap.

In the first quarter of 2009, the output gap fell to -6.2%, according to the CBO estimate. This large negative output gap reflects sizable declines in real GDP relative to the CBO’s estimate of potential output growth of about 2½% over the past three quarters. The dashed line in Figure 1 shows output gap estimates based on the most recent CBO calculations of potential output from 1965 through the first quarter of 2009.

Any method of estimating potential output depends on numerous assumptions that are subject to uncertainty and error. One particularly important CBO assumption is that the growth rate of potential output does not fluctuate dramatically in the short-run. In contrast, alternative economic theories suggest the determinants of potential output are constantly in flux, reflecting changes in productivity and labor supply (Edge, Kiley, and Laforge 2008).

One approach that allows for short-run fluctuations in the growth rate of potential output is provided by Laubach and Williams (2003). Their method uses the Phillips curve, a model of the positive relationship

**Figure 1**  
Estimates of the output gap



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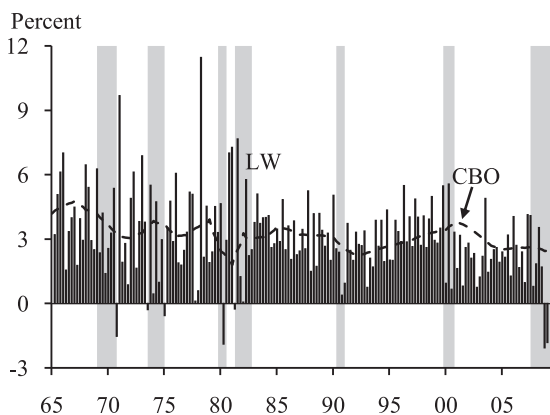
between inflation and the output gap, to uncover movements in the output gap over time. This model uses core price inflation, which excludes volatile food and energy prices. Core inflation above the model's prediction implies a positive output gap. Likewise, core inflation below the model's prediction implies a negative output gap.

The Laubach and Williams estimates of the output gap generally look similar to those of the CBO, but sizable discrepancies between the two arise over the most recent decade. The solid line in Figure 1 shows the retrospective estimates of the output gap using the Laubach and Williams (LW) approach. The CBO estimate shows a large positive output gap developing in the late 1990s, reaching 4½% by mid-2000. The Laubach and Williams estimates, in contrast, indicate that the output gap was about zero on average over this period and reached only 1½%, one-third as large as the peak CBO gap. Because inflation was relatively stable despite the booming economy during this period, the Laubach and Williams model implies that the output gap was small with potential output growing in line with real output. The second discrepancy occurs over the past seven years. Over this period, the CBO output gap estimates are consistently more negative than the Laubach and Williams estimates. The Laubach and Williams estimates look at the rise in core inflation and show a very different picture of positive output gaps and an overheating economy.

The Laubach and Williams estimate of the output gap in the first quarter of 2009 is -2%, one-third as large as the CBO estimate. The Laubach and Williams model interprets the recent modest declines in core price inflation as a sign that the output gap is negative but not nearly as large as the CBO estimates. One possible explanation for the difference in output gaps is that core inflation has been temporarily boosted by factors other than the output gap and the Laubach and Williams model is in a sense "fooled" into thinking that the output gap is small. A second possible reconciliation is to hypothesize that the effect of the output gap on inflation has declined sharply in recent years, perhaps due to structural changes in the economy and monetary policy. If this is true, then the large negative output gap will exert relatively modest downward pressure on inflation going forward.

The Laubach and Williams model offers the alternative explanation that potential output has fallen significantly. The dashed line in Figure 2 shows the annualized quarterly growth rate of the CBO estimate of potential GDP. The bars show the corresponding Laubach and Williams estimates. What is most striking is the roughly 2% annual rate de-

**Figure 2**  
Estimates of potential output growth



cline in potential output over the past two quarters, compared to the CBO estimate of about a *positive* 2½% growth rate. The large decline in the Laubach and Williams estimates of potential output is highly unusual, even in severe recessions.

### Supply shocks

Movements in potential output reflect changes in the economy's supply side, either in terms of productivity or labor supply. Productivity has continued to grow reasonably well during the current recession, in stark contrast to past recessions, when productivity typically declined. Indeed, using Gali's (1999) method of identifying changes in potential productivity, we find that during this recession potential productivity has actually increased at an above-trend rate. We then look at the factors determining labor supply. The CBO's estimate of potential output depends on its estimate of the natural rate of unemployment, that is, the rate of unemployment consistent with full employment. The CBO currently estimates the natural rate to be 4.8%. Note that it is above zero because there are always some workers who are between jobs or who have just entered the labor force and have yet to find a job. The natural rate cannot be directly observed, so it suffers from many of the same estimation problems as potential output.

Some other labor market indicators imply a much smaller output gap. Table 1 shows output gap estimates based on several indicators during the current recession, transformed using standard statistical methods to be comparable to the CBO estimates. The various output gap measures were all around zero when the recession started at the end of 2007. As seen in the table, the output gap based on the CBO estimate of full employment has fallen to -5.6%. Not surprisingly, this is close to the CBO estimate of the output gap. Also, the very low rate of capacity utilization in the manufacturing sector indicates a sizable negative gap. But, the estimation of maxi-

**Table 1**  
**Alternative estimates of the output gap**

	2007:Q4	2008:Q4	2009:Q1
CBO	-1.0	-4.2	-6.2
Laubach-Williams	1.1	-1.0	-2.0
Capacity utilization	0.1	-3.2	-4.9
CBO unemployment-based	0.0	-3.6	-5.6
Job market perceptions	-0.5	-2.5	-3.1
Business survey	-0.5	-2.5	-3.5
Job vacancies	-0.1	-2.9	-3.9

imum capacity in the manufacturing sector is subject to the same issues as estimating potential output, especially in a period when the U.S. auto industry is undergoing substantial restructuring.

By contrast, the other three indicators—based on a survey of households about the difficulty of finding jobs, a survey of businesses on the difficulty of filling positions, and the rate of job vacancies—suggest an output gap in the first quarter of 2009 of around  $-3\frac{1}{2}\%$ , in between the Laubach and Williams and CBO estimates. These alternative output gaps have declined about 3.1 percentage points so far during the recession, nearly the same decrease implied by the Laubach and Williams estimates and much smaller than the decrease implied by the CBO's estimates.

One interpretation of these alternative labor market indicators is that the natural rate of unemployment has risen significantly during the recession and is now considerably higher than the CBO estimate. Phelps (2008) points out that the current recession was preceded by overexpansion in the housing and financial sectors, and that it will take considerable time for excess labor and resources to be reabsorbed into other parts of the economy, suggesting the natural rate of unemployment may remain elevated for a number of years. A rough calculation based on the three alternative labor market indicators suggests the natural rate of unemployment may currently be around 6%. This apparent rise in the natural rate of unemployment may help explain the lack of a sharp decline in core price inflation and the weak Laubach and Williams estimates of potential output growth.

### Conclusion

Standard estimates of the output gap indicate that we are already in the second worst recession of the past

50 years. Based on past experience, this recession should cause a significant decline in core inflation. But so far core inflation has fallen relatively little, hinting that there may be less slack in the economy—and thus a smaller output gap—than standard estimates predict. This conclusion is supported by alternative measures of the output gap. These findings suggest that the current recession may have been accompanied by sharp declines in potential output due in part to a rise in the natural rate of unemployment. One inference is that the downward pressure on inflation—and therefore the risk of deflation—may be significantly smaller than implied by standard estimates of the output gap.

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### References

- Congressional Budget Office. 2001. "CBO's Method for Estimating Potential Output: An Update," August.
- Edge, Rochelle M., Michael T. Kiley, and Jean-Philippe Laforte. 2008. "Natural Rate Measures in an Estimated DSGE Model of the U.S. Economy." *Journal of Economic Dynamics and Control* 32, pp. 2512–2535.
- Gali, Jordi. 1999. "Technology, Employment, and the Business Cycle: Do Technology Shocks Explain Aggregate Fluctuations?" *American Economic Review* 89, pp. 249–271.
- Laubach, Thomas, and John C. Williams. 2003. "Measuring the Natural Rate of Interest." *Review of Economics and Statistics* 85(4, November) pp. 1063–1070.
- Orphanides, Athanasios. 2002. "Monetary Policy Rules and the Great Inflation." *American Economic Review, Papers and Proceedings* 92(2, May) pp. 115–120.
- Phelps, Edmund. 2008. "U.S. Monetary Policy and the Prospective Structural Slump." Speech to the 7th Annual BIS Conference on Monetary Policy, Luzern, Switzerland.

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