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Life in the Slow Lane: The Rate of Growth of Potential Output of the U.S. Economy

By John B. Shoven

This policy brief summarizes a presentation that I made to the 28th Annual Workshop for High School Teachers of Economics, sponsored by SIEPR and held August 3–7, 2015. I want to thank Gila Bronshtein for excellent research assistance. The author has benefited from discussions on closely related matters with Kenneth Arrow, Ben Bernanke, Bill Brainard, Greg Rosston, and David Wilcox. The views, conclusions, and mistakes are all mine.

Introduction

In terms of the long-run future of the U.S. economy, nothing is more important than how fast the economy can grow when its labor and capital resources are fully employed. The growth rate in potential (i.e., full employment) output determines how fast the standard of living can improve for Americans on average. It determines the burden of the federal debt and the severity of the financial challenges faced by the entitlement programs. One could even argue that it plays a role in the standing of the United States in geopolitical matters.

The purpose of this paper is to describe more completely what we mean by potential output, to determine how fast it has been growing over the past seven years since the onset of the Great Recession, and to compare that answer with the earlier rates of growth since 1990. The answer is that the rate of growth of potential output has slowed dramatically. We begin the process of explaining why that has happened, although more work needs to be done to really explain the slowdown. Two key aspects contributing to the

continued on inside...

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change in the rate of growth are the changing demographics of the American population and the educational attainment of different cohorts in the population.

The Great Recession

We start by looking at the performance of labor markets since January 2008, the period right before the Great Recession, the recession itself, and the long recovery from it up through July 2015. Usually, the aggregate unemployment rate is considered the most important indicator of the state of the labor market. The aggregate unemployment rate is the ratio of the number of Americans without a job, but who have been actively looking for one in the last four weeks, divided by the labor force, which includes the employed plus those unemployed according to the just mentioned criterion.

Importantly, the unemployment rate does not include those who are not employed and not actively looking for work and it does not include those who are involuntarily working part time when they would prefer a full-time job. There are other measures of unemployment that include workers who are too discouraged to look for work or who are in this involuntary part-time status. Despite these alternative statistics, the unemployment rate is certainly the single most important measure of labor market conditions.

Figure 1 shows the civilian unemployment rate over the last 7.5 years. The unemployment rate was about 5 percent in the first quarter of 2008, then skyrocketed to 10.0 percent by October 2009, when it began its relatively steady decline of slightly over 0.8 percent per year, reaching 5.3 percent in June 2015. By most accounts, the unemployment rate is now close to full employment levels and, hence, the Federal Reserve is considering raising interest rates for the first time in a long time. Other measures of unemployment have improved as well, although perhaps not to the same extent.

The story is quite different if you examine employment rates rather than unemployment rates. The overall employment rate, defined as the total number of employed people divided by the adult population, fell sharply from 62.9 percent in January 2008 to 58.5 percent in October 2009. As of July 2015, it had only very partially recovered to 59.3 percent. Some of its failure to recover is due to the aging of the baby boomers and the changing demographics of the U.S. population. Less sensitive to demographic shifts is the data displayed in Figure 2 showing the employment rate for prime-age adults between ages 25 and 54. Even for this group, the employment rate has only partially recovered to its pre-recession level.

Some of the reason for the incomplete recovery may be the expansion of those on disability insurance, but certainly there is room for additional factors such as the permanent or semi-permanent effect of the Great Recession in terms of discouraged

Figure 1
Unemployment Rate from January 2008 to July 2015

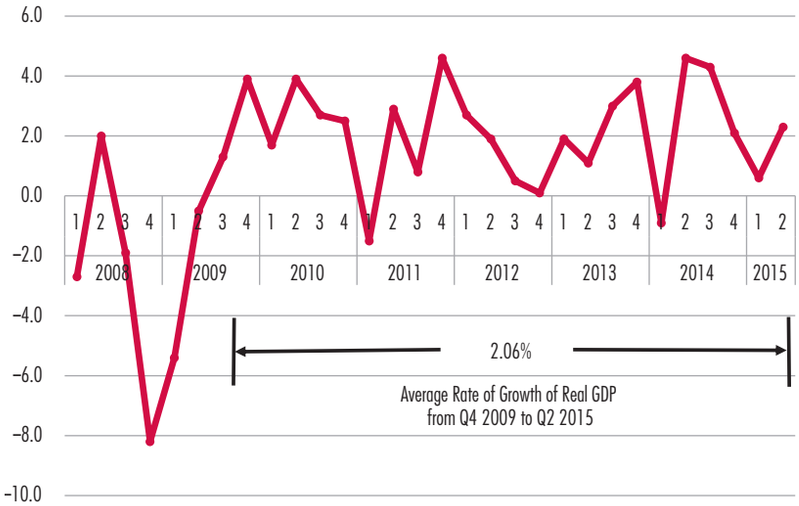
workers or early retirements. The graph suggests that there has been a significant growth in the percentage of prime-age adults who are outside of the labor force.

We begin to get to the rate of growth of potential output when we examine the rate of growth of actual real GDP that accompanied the steady decline in unemployment shown in Figure 1. As always, the quarter-to-quarter data jump around a lot, but the average compound growth rate of real GDP since the unemployment rate peaked in Q4 2009 has been just 2.06 percent. This is illustrated in Figure 3, which displays the July 2015 revised data of the Bureau of Economic Analysis.

If we were looking at this economic performance from the perspective of the 1990s or even 2001-2008, one would not have expected unemployment to go down at all with 2.06 percent real economic growth. Clearly, the economy has been growing faster than potential output with the unemployment rate falling from 10.0 percent to 5.3 percent (and even the employment rate shown in Figure 2 going up 2.2 percentage points during the recovery). That raises the question: How slowly is potential output growing if we have been taking up economic slack while growing at 2.06 percent? That is the main topic of this policy brief.

Figure 2
Employment to Population Ratio for Workers of ages 25–54

Figure 3
Quarterly Growth in Real GDP at Annualized Rates from Q1 2008 to Q2 2015



Potential Output

Potential output is a somewhat difficult concept. At any point in time, it is the level of GDP corresponding to full employment (of both labor and capital), but without causing accelerating inflation. In labor markets, the full employment rate of unemployment is usually estimated to be in the 5.0 to 5.5 percent range, the range that we are in now. The remaining

unemployment is viewed largely as frictional unemployment of people searching for work and between jobs. The important thing for this analysis is that the growth rate of potential output is such that if the economy grew at that pace, the unemployment rate would neither rise nor fall.

Slightly more technically, economists have come up with the concept of the "Non-Accelerating Inflation Rate of Unemployment" or NAIRU. Suffice it to say, that the NAIRU is the full employment rate of unemployment. And, the growth rate of potential output is the growth rate that the economy would experience if unemployment stayed constant at the NAIRU.

Figure 4
Unemployment Rate Has Been 5.5% Several Times Since 1990

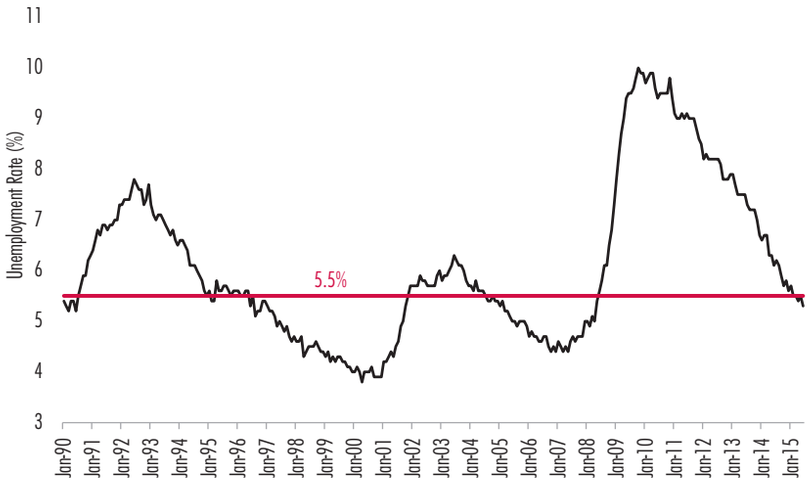
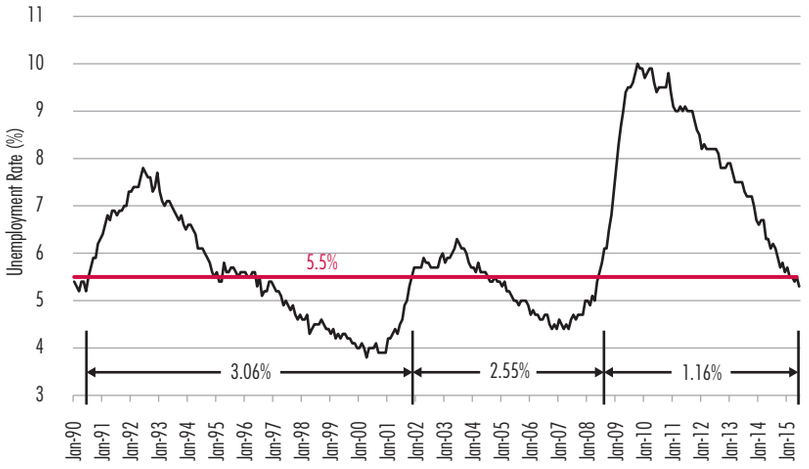


Figure 5
Rate of Growth of Potential GDP Has Slowed Dramatically Since Before Great Recession



Numbers shown for the 3 intervals are compound average annual growth rates in real GDP

An Analogy

Say you were driving on Highway 1 in California. You noticed that a 2007 Ford Explorer was 500 feet in front of you. Then, 40 minutes later, you noticed that the same vehicle was once again 500 feet ahead of you. You traveled 30 miles in the meantime, and you remembered enough middle-school mathematics to calculate your average speed as 45 miles per hour. Now, the question is how fast was the Ford Explorer going in the last 40 minutes? Of course, it has traveled the same distance over the same interval, so it has also averaged 45 miles an hour.

Now, let's relate this to determining the rate of growth of potential GDP in the U.S. Let's start by making an important assumption that the NAIRU has been stable at least over the last seven years. But, let's go all the way and assume that it has been stable since 1990. This is just a simplifying assumption and, of course, is not literally and precisely true. But, that is our assumption. Then, the growth rate of the economy over

a period where the starting and ending unemployment rate is the same would be equal to the rate of growth of potential output. Let's say, that at the beginning of the period the unemployment rate was 5.5 percent and at the end it was the same. Then the economy is in the same relative position with respect to the NAIRU and has grown at the same rate as potential output. I believe that the Ford Explorer analogy mentioned above is precisely applicable.

The Longer Run Performance of Labor Markets and Potential GDP

Figure 4 shows the longer run history of the unemployment rate and illustrates that the unemployment rate has been 5.5 percent at least six times since 1990.

We are going to examine four of those times: Q2 1990, Q4 2001, Q2 2008, and Q1 2015. By looking at how fast the economy grew between those four points in time, all with 5.5 percent unemployment and therefore the same relative position with respect to potential output, we will discover how fast potential output was growing over three different intervals. The answers are displayed in Figure 5.

The figure shows that potential output was growing at slightly more than 3 percent per year between Q3 1990 and Q4 2001 and at 2.55 percent per year between Q4 2001 and Q2 2008. The growth rate of real GDP between Q2 2008 and Q1 2015 was only 1.16 percent. Since the unemployment rate was the same at the beginning and end of the period, 1.16 percent is this technique's estimate for the recent rate of growth of potential output of the U.S. economy.

The Data and the Results

An advantage of this "Ford Explorer" approach to determining the rate of growth of potential output is that it requires very little data. In fact, it requires only the real GDP statistics for the beginning and the end of the period in question. Employment statistics are required in order to break the observed growth into employment growth and productivity growth. Population data allow us to convert GDP growth into growth in GDP per capita. All the data are shown in Table 1a and the corresponding growth rates are shown in Table 1b.[1]

The real GDP growth rate numbers of Table 1b are the same as those shown in Figure 5. The table further shows that much of the drop in the growth rate of potential output has been due to much slower growth in nonfarm employment. Productivity, measured here as output per nonfarm worker, also grew much more slowly in the most recent period than in the

1 The compound growth rates are determined by taking the geometric average of annual growth rates calculated as the nth root of the ratio of the final value to the initial value of GDP (or whatever is being measured) minus one, where n is the length of the interval in years.

Table 1a
Basic Macroeconomic and Demographic Data

	Real GDP ($billions)	Nonfarm Employment (millions)	Population (millions)
Q2 1990	8,981.7	109.839	249.05
Q4 2001	12,705.3	131.159	285.92
Q2 2008	14,963.4	137.803	303.62
Q1 2015	16,177.3	141.059	320.26

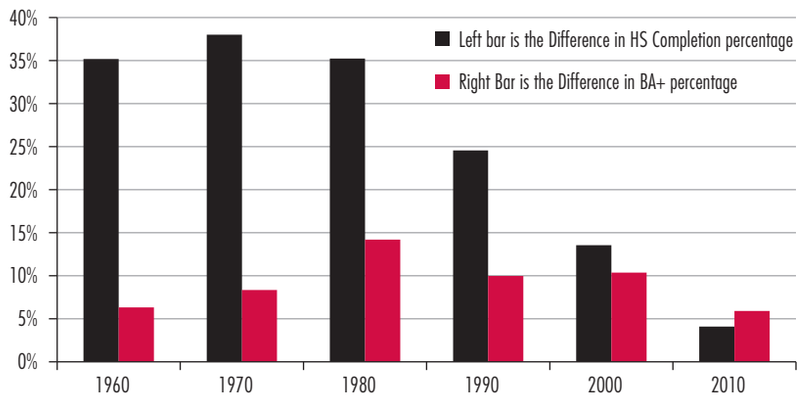
Table 1b
Compound Growth Rates

	Real GDP	Nonfarm Employment	Population	Productivity	GDP per capita
Q2 90 – Q4 01	3.06%	1.55%	1.21%	1.48%	1.83%
Q4 01 – Q2 08	2.55%	0.76%	0.93%	1.77%	1.61%
Q2 08 – Q1 15	1.16%	0.35%	0.79%	0.81%	0.37%

previous two periods, and per capita GDP growth slowed by at least three-fourths. The slowdown in employment growth, at the same level of unemployment, is largely due to demographics and the beginning of the retirement of the baby boomers. The slowdown in productivity is more difficult to attribute. There has been speculation that the mid-1990s to mid-2000s was a period of extraordinarily rapid productivity growth due to the Internet, information technology in general, online transactions, the adoption of robots in production, etc. (Gordon, 2014). The implication is that the pace of this IT and Internet advancement has slowed significantly in terms of its impact on productivity.

Another contributing factor to the slowdown in productivity growth, which has not received much attention, is that the annual education improvement of the American workforce has almost ground to a halt. In the last half of the 20th century, the average education of young people joining the workforce was substantially greater than the education of those retiring. This fact is suggested by the educational attainment difference between young American adults and those 55 and over from the Census Department as shown in Figure 6. In 1990, approximately 38 percent of the population 55 and over had not completed high school, whereas only about 14 percent of young adults between 25 and 34 were in that category. The difference in high school completion rates between young adults and those 55 and over in 1990 was 24 percent as shown in Figure 6. By 2010, the relatively well-educated baby boomers were retiring. Their years of education were very similar to those of young adults entering the workforce. The difference in high school completion rates between those 25-34 and those 55 and over dropped to 4 percent. This slowdown and near disappearance of the educational improvement of the workforce creates an important headwind for growth in productivity. The annual workforce education improvement (leading to higher quality workers) that we enjoyed in the last half of the 20th century is unlikely to occur again anytime soon.

Figure 6
Difference Between Education Attainment Levels of those 25–34 and those 55+



A More General Approach—Okun's Law

An advantage of the Ford Explorer approach that led to the result that potential output has been growing recently at 1.16 percent is that it is very simple and doesn't require many assumptions. In fact, the only assumption that was made is that the rate of unemployment corresponding to full employment (the NAIRU) was stable. A disadvantage is that it can be used only to address the rate of growth of potential output for periods where the initial and final rates of unemployment are the same.

An approach that allows the rate of growth of potential output to be determined for any interval of time is based on what is referred to as "Okun's Law"—after Arthur Okun, Chairman of the Council of Economic Advisers under President Johnson. Okun's Law could be termed "Okun's Rule-of-Thumb"

as it describes a statistical regularity between changes in the unemployment rate and changes in the rate of growth of output. When Okun first described the relationship in 1962 (Okun, 1962), he found that a decline in unemployment by 1 percentage point correlated with an extra 3 percentage points of growth in real GDP using data from the period 1947-1960. There were several reasons why output went up much more than unemployment went down. For instance, the decline in unemployment was usually accompanied by an increase in the labor force (fewer discouraged workers), an increase in hours worked per week, and more rapid productivity growth.

More recently (Abel and Bernanke, 2005), the connection between a decrease in the unemployment rate and an increase in output growth has been reported as 1 to 2 rather than Okun's original estimation of 1 to 3. There is substantial discussion in the literature about the stability or lack thereof of this coefficient (Plosser and Schwert, 1979; Owyang and Sekhposyan, 2012; Daly et al, 2014), but it is still considered a useful approach. One version of the Okun equation is

$$\frac{\Delta Y}{Y} = \Delta k - \Delta c \Delta u$$

where Y is actual real GDP, ΔY is the change in real GDP, k is the growth rate of potential output, Δu is the change in the unemployment rate, and is Okun's coefficient. I estimated the above equation using data from 1990 through 2007. The result was that Okun's coefficient is estimated as 1.5, meaning that it takes an extra 1.5 percent real GDP growth to correspond to a 1 percentage point fall in unemployment. This estimate, while smaller than Okun's original one, is consistent with the more recent studies. Solving the Okun equation for k yields

$$k = \frac{\Delta Y}{Y} + c\Delta u$$

Note that if Δu is zero (as in the Ford Explorer example), this equation says that the rate of growth of potential output equals the observed growth rate of real GDP (regardless of the value of c). The equation also implies that the rate of growth of potential output is less than the observed rate of actual GDP growth when unemployment is falling and it is more than observed growth when unemployment is rising.

Now we can estimate the rate of growth of potential GDP during the long and slow recovery from the Great Recession. The average observed rate of growth of GDP has been 2.06 percent between Q4 2009 and Q2 2015 (Figure 3) and the average annual rate of change of unemployment has been -0.838 percent (Figure 1). With c set to 1.5, the equation implies that the rate of growth of potential output has been 0.80 percent since unemployment peaked in Q4 2009. So, the Okun's Law approach implies that the rate of growth of potential output during the recovery was even slower than what we got for the longer Q1 2008 to Q1 2015 period in Table 1b. Okun's Law, with our new estimate of his coefficient, implies that potential output growth has been just 0.8 percent per year.

Using the Employment Rate Rather Than the Unemployment Rate

Both our basic approach and the Okun's Law calculation measure the state of the labor market using the unemployment rate. But, we saw mixed messages in figures 1 and 2. The unemployment rate has essentially fully recovered but the employment rate for prime-age adults has not returned to its pre-recession levels. One could certainly argue that the overall labor market was not as tight in Q1 2015 as it was in Q2 2008. To go back to the analogy, the Ford Explorer is further in front of us than it was at the beginning of the period and thus has gone faster in the meantime. If we put weight on the employment rate statistics, we would conclude that potential output has grown more than the 1.16 percent that the basic approach using only the unemployment rate implies.

We can posit an Okun's Law type of relationship between

the growth rate of real GDP and changes in the employment rate of prime-age adults. Consider the following equation:

$$\frac{\Delta Y}{Y} = k + b\Delta e$$

where Δe is the change in the employment to population ratio for 25- to 54-year-olds and b is the estimated coefficient connecting real GDP growth and the change in the prime-age employment ratio. The equation has some of the same properties as the Okun's Law equation that we just used. It implies that if $\Delta e = 0$, then the observed real growth rate is the rate of growth of potential output. And it says that the economy grows faster than potential output when the employment rate is increasing. We expect b to be greater than 1 for some of the same reasons that we expected the Okun coefficient to be greater than 1. When the employment rate goes up by 1 percent, we expect that the workweek would tend to lengthen and that productivity growth would tend to accelerate. Estimating this equation with 1990–2007 data leads to a value of 1.46 for b, very similar in magnitude to the estimate that we got for the Okun coefficient.

Now, we can solve for k. Between Q4 2009 and Q2 2015, the annual growth rate of real GDP averaged 2.06 percent. The increase in the prime-age employment rate averaged 0.38 percent. Using our estimated b coefficient of 1.46 and solving for k, I get a growth rate for potential output of 1.51 percent. Given that the employment rate has not recovered as completely as the unemployment rate, it should be no surprise that the implied growth rate for potential output is higher if we concentrate on the employment rate instead of the unemployment rate. Still, 1.51 percent is not exactly rapid growth.

Best Guess Regarding Growth Rate of Potential Output for the Next 5-10 Years

The first observation is that labor markets have tightened during the recovery featuring only 2.06 percent economic growth. Clearly, the rate of growth of potential output is well below 2.06 percent. Secondly, the U.S. economy grew at a rate of 1.16 percent between Q2 2008 and Q1 2015, both periods with 5.5 percent unemployment. That figure, 1.16 percent, is my best guess of how fast potential output has been growing and how fast it will grow over the next decade. The demographic factors at play for the past few years, particularly the retirement of the baby boomers, will continue. Maybe productivity growth will accelerate, but I don't see a compelling case to predict that.

We also did what amounts to sensitivity analysis by looking at other approaches. The traditional Okun's Law approach with a new estimate of the key coefficient gave us a growth rate of potential output of 0.80 percent for the recovery period, Q4 2009 to Q2 2015. When we focused on the employment rate rather than the unemployment rate, we developed a new Okun-like approach using the change in the employment rate of prime-age adults. The result of that exercise was an estimate of the growth rate of potential output between Q4 2009 and Q2 2015 of 1.51 percent per year. All of these figures are very low compared with the 1990s and the 2001 to 2008 period.

Why It Matters

Hopefully, by now you understand the title of this policy brief, "Life in the Slow Lane." I am taking as my central case the 1.16 percent growth rate shown in Table 1b. If that is how fast potential output will grow in the future, then the standard of living will only improve extremely slowly. With the growth rates of the 1990s and 2001-2008, the standard of living (output per person) would increase by 50 percent in 22 to 25 years. Roughly speaking, the standard of living would go up by 50 percent each generation. With the most recent growth rate of potential output and population, a 50 percent improvement in the standard of living would take more than 100 years. The combination of slow growth in the workforce and slow growth in productivity has put us squarely in the economic slow lane.

It is not just the slow growth

in the standard of living that we should be concerned about, but the burden of debt—increasingly held outside the United States—will be much larger as a fraction of GDP if output is on this slow growth path. Similarly, the financial problems of Medicare, Medicaid, and Social Security will be significantly more severe with the combination of slow labor force growth and productivity growth. And, as mentioned in the introduction, it is hard to believe that the U.S. position in world geopolitics can be maintained if our economy is growing at such a pedestrian pace.

The CBO Forecast

The Congressional Budget Office's *2015 Long Term Budget Outlook* (CBO, 2015) is hot off the press. It states "The CBO projects that real (inflation-adjusted) GDP will increase at an average annual rate of 2.2 percent over the next 25 years" (page 18). It sounds like a pretty humdrum projection, right? But, when you realize that employment is unlikely to be growing any faster than 0.5 percent, 2.2 percent overall growth would require output per worker to grow at roughly the rapid pace of 2001-08, 1.7 percent per year. That was when it appears that information technology made its greatest contribution to productivity. To me, at least, the CBO forecast seems optimistic implying that productivity will grow at double its recent pace, and the 1.16 percent that we derived for the period 2008-15 feels like a more realistic forecast for the near term future.

The Inadvertently Released Federal Reserve Projections

Even hotter off the press than the 2015 CBO long-term forecast is the Federal Reserve's staff projections that were discussed at the June 16-17, 2015, policy meeting and accidentally posted publicly less than two weeks later. The normal procedure would be to withhold the release of such information for five years. Table 2 shows the Federal Reserve's projections for a number of the macroeconomic variables that we have been using.

The table shows that the Federal Reserve staff thinks that potential output will grow at 1.61 percent in 2015 and that it will grow at an average of about 1.75 percent between 2016 and 2020. Equally important for the analysis of this policy brief, the Federal Reserve projects that the NAIRU, the full employment rate of unemployment, will be absolutely steady at 5.20 percent over the next five years. This is reassuring given our assumption that the NAIRU is stable. I view the accidentally released projections as broadly supportive of the analysis of this paper that the economy is likely to be stuck in the slow lane for quite some time.

The Hope—I am Wrong

There is plenty of uncertainty about future productivity gains. The hope is that the growth rate of output per worker will return to somewhere in the range of 1.5 to 1.7 percent per year, roughly the average of the 20 years before the

Table 2
Summary of Federal Reserve Staff Projections

	2015	2016	2017	2018	2019	2020
Real GDP Growth Rate	2.31	2.38	2.17	1.76	1.75	1.74
Inflation	1.33	1.52	1.78	1.90	1.92	1.94
Civilian Unemployment Rate	5.34	5.24	5.18	5.15	5.15	5.16
Federal Funds Rate	0.35	1.26	2.12	2.80	3.17	3.34
Potential GDP Growth Rate	1.61	1.72	1.72	1.81	1.78	1.83
NAIRU	5.20	5.20	5.20	5.20	5.20	5.20

Great Recession. The hope is that the transitory effects of the Great Recession are still being felt, but that they will fade away over the next five years or so. The long-term unemployment of members of the labor force and the underutilization of capital in the Great Recession could have caused both to "rust" and it just takes a while for capital and labor to recover from the period of involuntary idleness. Perhaps the employment rate and the labor force participation rate will continue to rebound. While possible, the idea that these key labor ratios still have a lot of room for improvement left in them after nearly six years of recovery isn't a sure thing. But, there is a hope.

Perhaps a better bet is that the productivity gains related to IT and technology will hit their stride again after a soft patch during the Great Recession and recovery. I think that we don't have a good handle on the causes of changes in the rate of productivity growth and that means that there is a chance that the next surprise will be a positive one. I would say that good luck and good policy might allow the full-employment economy to grow at 2.2 percent per year as the CBO projects. It is my hope, but it isn't my prediction.

2016 Election

The election campaign has just begun. One candidate, Jeb Bush, has made the rate of real growth of the economy the centerpiece of his platform. More power to him as this is an incredibly important topic. And, there is no doubt that economic policies could increase productivity growth and quite possibly even affect the growth rate of employment, at least for a while. In general, one would think that the way to improve productivity growth would be to institute a set of pro-investment policies, where investment is taken very broadly. This would include investment in K-12 and higher education, public and private infrastructure, basic research, and plant and equipment. Corporate tax reform has the potential to contribute.

Jeb Bush's stated goal is to achieve 4 percent real growth for a decade. Here is where economics, also known as the "dismal science," calls for a reality check. Remember our basic model in which output growth is equal to the growth in employment plus the growth in output per worker. It is extremely unlikely that the labor force will grow at even 1 percent per year, 0.5 percent would be more like it. It is also hard to see productivity growing at more than 3 percent per year for a decade—put it this way, it has never happened before. A more reasonable, but still ambitious, goal would be to achieve the 2.2 percent potential output growth rate forecast by the Congressional Budget Office. But, then again, I am not running for president!

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