Economic Growth and the Real Rate of Interest

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My wife, Gerie, and I are absolutely delighted to be back in Rhode Island, here at Bryant College. As much as I love St. Louis, Little Rhody, where I lived for almost a quarter century, sure feels like home.

I came to Rhode Island, to Brown University, in 1974. The economy was in the middle of a nasty recession. Interest rates began falling in mid-1974—temporarily as it turned out—but at that time rates as low as today’s seemed impossible. The rates in the market as I speak are at lows not seen since the 1950s in the United States. The one-year constant-maturity Treasury rate, for instance, averaged 1.22 percent during the third quarter of this year. A lower yield was last seen in 1954, 49 years ago.

In most market discussion, and in some Federal Reserve commentary as well, the current low interest rates are ascribed to easy monetary policy. The argument usually goes something like this: The Federal Open Market Committee (FOMC) lowered its target short-term nominal interest rate, the federal funds rate, to a low level, and all other market-determined interest rates followed. While this description is certainly accurate on one level, it is overly simplistic and masks a number of important issues. In particular, what is it about the economy today that permits the Fed to set the intended federal funds rate at such a low level? No one doubts that setting the funds rate at 1 percent in 1999 would have produced an explosive inflation.

The interest rates I’ve mentioned are nominal interest rates. A nominal rate contains a component meant to compensate investors for expected inflation over the holding period. I will concentrate this morning on real interest rates, for that is where the really interesting story lies today. Real interest rates are interest rates adjusted for expected inflation.

Most of the explanation of why nominal interest rates are so much below their level of 20 years ago is that inflation and expected inflation are much lower today than over most of the period since, say, 1970. However, although inflation and expected inflation have drifted down slightly over the last few years, the big story is that real rates have declined dramatically since 1999.

What determines real interest rates? How are these rates related to the pace of economic growth? And what does trend productivity contribute to the real rate of interest? These are several of the issues I’ll discuss this morning.

Before proceeding, I want to emphasize that the views I express here are mine and do not necessarily reflect official positions of the Federal Reserve System. I thank my colleagues at the Federal Reserve Bank of St. Louis for their comments. James B. Bullard, vice president in the Research division, provided especially valuable assistance. However, I retain full responsibility for errors.

REAL INTEREST RATES

Irving Fisher of Yale University was perhaps the most famous American economist in the first half of the twentieth century. One of his many contributions to economic science was his analysis decomposing the nominal interest rate into a real component and an inflation component. This decomposition was so powerful an idea that it remains with us today as a fundamental
principle for economists analyzing interest rate determination.

The decomposition is not hard to understand. Consider a 1-year Treasury security with a yield of 1.22 percent, the average in the third quarter. Suppose that one year from now the 12-month inflation rate turns out to be 1.0 percent. Then, that investment will realize a paltry 0.22 percent real yield, or inflation-adjusted yield. Should the inflation rate be 2.0 percent, then the real yield will be –0.78 percent.

Now consider an investor who is contemplating buying a Treasury security with a maturity of one year. The investor wants to be compensated for any decline in the purchasing power of money over the term of the investment, but can’t know the rate of inflation in advance. Thus the investor forms an expectation as to the rate of inflation. If the expected rate of inflation is high relative to the nominal yield on the bond, the investor will probably look for some other investment. This phenomenon appeared in spades in the late 1970s; fearing inflation, many investors shunned bonds and bid up the prices of land, fine art, gold, and other goods expected to retain value.

There is little question that expectations play a critical role in determining interest rates. Since inflation is controlled over the medium- to long-term by the Federal Reserve, expectations of future monetary policy are a key component of observed nominal interest rates. Today, and quite consistently in recent years, investors have been confident that the Federal Reserve will maintain low and stable inflation. For that reason, inflation expectations have been quite low. Based on market readings from the Treasury’s inflation-indexed securities, longer-term inflation expectations today are approximately 2 percent based on a 10-year maturity.

Although investors want to realize as high a real yield as possible, given the risk assumed, they may not in some circumstances be able to expect even a positive real yield. Today, the one-year nominal interest rate is about 1¼ percent while expected inflation, according to several measures, over the next year is about 1½ percent. Over a 10-year horizon, investors today expect inflation of about 2 percent and a real yield a bit above 2 percent. Four years ago, the expected real yield on Treasury securities was in the neighborhood of 4 percent. Apparently, investors do not see good opportunities to earn a substantial real yield today. What has happened?

THE REAL COMPONENT AND ECONOMIC GROWTH

I’ve been discussing the real yield on Treasury securities. Treasuries have zero default risk, or at least as close to zero as we’ll find. However, because of arbitrage, other, generally riskier, instruments will be priced to yield a suitable amount above this risk-free rate. In particular, investments in productive capital should have a real yield above the risk-free yield, but the two yields should fluctuate together over time because investors can choose what investments to make. What determines the real yield on productive capital? There is some well-established theory that helps to answer this question. However, the theory I’m about to discuss abstracts from important complications raised by uncertainty and connections among countries through international capital flows. Growth theory helps us understand fundamental economic forces but should not be interpreted as providing precise quantitative guidance.

Many people think about wealth in financial terms, but for some purposes that view can be misleading. Every financial asset is someone’s financial liability. For the world economy as a whole, then, financial wealth nets out to zero. Beyond financial wealth, American households own the nation’s capital stock, either directly or through ownership of financial claims on businesses. (Of course, some of the U.S. capital stock is owned by investors abroad, but I’ll neglect this fact as it is not important for the issue at hand.) This collection of real assets—buildings, machines, land, transportation equipment, highways, intangible capital, and so on—is the productive capital that, combined with labor, produces national output. The statistical measure of that output is gross domestic product (GDP). Calculations vary,
but estimates of the ratio of the value of the capital stock to one year’s GDP are in the neighborhood of 3. So, with U.S. GDP in current dollars running at an annual rate of just under $11 trillion, the U.S. capital stock is worth something approaching $33 trillion right now.

Economists analyze the relationship between inputs and output using the concept of a production function. The production function shows how inputs of capital and labor are combined to produce output. One of the features of the modern industrialized world is productivity improvement—that is, using the same inputs to produce higher output of goods and services. Technology is improving over time. This fact is no mystery to anyone who has lived in a growing economy for more than a few years. We see technological improvements all around us. Prices of goods like TVs and computers can decline because producers are constantly finding ways to create more output from inputs of labor and capital.

Total output grows from larger quantities of inputs and from higher output per unit of input. Because the standard of living is measured by consumption per capita, it is useful to measure total output per hour of labor input. Output per hour of labor input, or labor productivity, rises as more capital is employed relative to labor and as technological change raises output for any given amount of labor and capital.

If there were no shocks to the economy, a constant pace of productivity improvement combined with a constant rate of labor force growth would determine a balanced growth path for the economy. Along the balanced growth path, all markets in the economy are in equilibrium and expectations of the future are consistent with actual outcomes. And also along this balanced growth path, households holding the capital stock, either directly or through ownership of businesses, would receive a real return. What would the level of that real return be?

In standard models of economic growth, this real return turns out to be the rate of productivity improvement plus the rate of labor force growth. For the United States, business-sector productivity has improved at an annual rate of about 2½ percent in recent years. Estimates of the long-run rate of labor force growth are around 1 percent. Therefore, a value of 3½ percent is a good, back-of-the-envelope calculation concerning the long-run risk-free real rate of return in the U.S. right now. In a standard model, this would also be the long-run rate of output growth.

Let me try to provide some insight, at least qualitatively, into this result. First, from a household’s point of view, interest is compensation for delaying consumption. At a 4 percent rate of interest, for example, delaying one dollar’s worth of consumption for one year, and saving instead, permits consumption of $1.04 at the end of the year.

Now consider the role of population growth. A growing population needs a growing capital stock—factory buildings, machines, houses, schools, aircraft, highways, and so forth. If the capital stock does not grow, then the amount of capital per capita declines as population grows. To provide the growing capital stock, people and businesses must save—must forego current consumption out of current production. The higher is the rate of population growth, the higher must be the rate of saving and investment to equip the growing population with capital. A higher real interest rate persuades people to save more to provide capital for the growing population.

The role of productivity growth can be analyzed in similar fashion. Assume, as economists usually do, that a worker is paid his marginal product, at least in equilibrium. Suppose the worker’s output is worth $20 per hour today and, because of productivity growth, $21 per hour in one year. Would you prefer to work an hour when your pay is $20 or $21, which is 5 percent higher? The answer is obvious. But not all work can be delayed to next year. A higher real interest rate can persuade people to provide labor now. Working an hour now, saving and investing the hourly earnings of $20 at 5 percent interest yields $21 dollars in one year, the same amount that would be realized from delaying work for one year.

In short, the higher is population growth and the higher is productivity growth, the higher will be the equilibrium real rate of interest. The result that the real rate of interest is precisely equal to
the sum of population and productivity growth rates depends on the details of the model, but the general qualitative result makes a lot of intuitive sense.

The real rate calculation I have just completed is for a balanced growth path in a world of no uncertainty. It is only a benchmark since, of course, actual economies must adapt to shocks all the time. Unusual weather affecting agriculture, the rise and fall of industries, changing government policies and, yes, wars all have important impacts on the economy. Thus the economy is in a constant state of adjustment, and probably only rarely actually on a balanced growth path. The pace of technological change itself, and the rate of growth of the labor force, are not completely smooth processes. The usefulness of the balanced growth path concept is that when important disturbances occur, we have some idea about the state to which we expect the economy to return.

I think it is clear that many observers of the world’s industrialized countries have some type of theory like this in mind when thinking about interest rates and their relation to fundamental factors in the economy. In particular, it is not surprising that the United States, with positive population growth and robust productivity growth, has a higher real rate of interest than a country such as Japan, which faces the prospect of a long-term decline in population and has lower productivity growth than in the United States. Nor it is surprising that capital is flowing from Japan, where returns and capital requirements are relatively low, to the United States where returns and requirements are relatively high.

What are the implications for policymakers? Clearly, we must keep a sharp eye on productivity improvements when thinking about the appropriate level of nominal interest rates, because the real component of the nominal rate is driven by productivity in an important way. Some of the increases in productivity registered in the quarterly statistics recently have been quite extraordinary indeed. The prospects for continued productivity improvement also appear to be good. Eventually, but no one knows when, it seems likely that market interest rates will rise to reflect these fundamental real economic forces. We ignore these fundamentals at our peril.

**TREND BREAKS IN PRODUCTIVITY GROWTH**

Given the growth theory result, that the real rate of interest will equal the rate of productivity growth plus the rate of population growth, it is clear that analysis of changes in productivity growth is important for understanding changes in real interest rates. But recent behavior of interest rates and productivity growth only deepens the mystery. Productivity growth seems to have been rising at the same time real interest rates have been falling. Over the eight quarters ending with the second quarter of this year, productivity growth for the U.S. business sector has averaged 4.8 percent per year. The average over the last 12 quarters is 3.6 percent. The rate of productivity growth averaged about 2½ percent per year in the second half of the 1990s. On this calculation, the long-term real rate of interest should have increased by about 1 percentage point after 1999, instead of falling by about 2 percentage points.

Before I try to address this apparent anomaly, let’s go back in history a few decades. The period from the late 1940s to the late 1960s was a golden era for U.S. productivity growth. While actual measurements are volatile, the average pace of productivity improvement was clearly high during this period—perhaps in the neighborhood of 3 percent per year. But sometime in the late 1960s or early 1970s, productivity growth rates slowed substantially, a widely studied but poorly understood event that became known as the productivity slowdown. Productivity growth rates fell by half. This decline in productivity growth had a dramatic impact on the U.S. economy, as it meant that real income for the average household would improve much less rapidly than earlier. With a productivity growth rate of 3 percent, real household income doubles every 25 years; with productivity growth at 1.5 percent, real household income doubles every 48 years.
The decline in productivity growth should have had a direct impact on the risk-free real rate of interest, causing it to fall in the 1970s by an amount about equal to the decline in productivity growth. But nominal interest rates rose during the 1970s, because inflation increased. The increases in inflation were too large and volatile to allow us to see the decline in real interest rates associated with the productivity slowdown.

Is it a coincidence that inflation rose as productivity growth slowed starting in the early 1970s? There are certainly reasons to believe that part of the inflation run-up was in fact due to the slowdown in productivity growth. Declining productivity growth not only puts direct upward pressure on goods prices but also, by slowing trend output growth, makes it all too easy for policymakers to misread the state of the economy. Monetary policy was too expansionary in the 1970s, in part because policymakers overestimated the economy’s capacity to grow. Because productivity is notoriously difficult to measure, and available statistical measures are noisy, the realization that productivity growth was slower on a sustained basis, and not just as a short-run aberration, did not occur for some years after the slowdown began. In the meantime, expansionary monetary policy built an inflation problem into the economy. Failure to recognize the productivity growth slowdown is certainly not the whole story of monetary policy mistakes in the 1970s, but probably part of the story.

In any event, given the economic instability created by inflation in the 1970s and disinflation in the early 1980s, we certainly cannot characterize the U.S. economy during this period as growing along a balanced growth path. Real rates of interest were lower in the 1970s and higher in the 1980s, but these changes seem to have had more to do with inflation-forecasting errors and cyclical processes set up by inflation than with changes in long-run productivity growth.

The 1990s brought a pleasant and unexpected surprise: The trend rate of productivity growth rose significantly. And, as I’ve emphasized already, productivity growth has been even stronger over the last three years. Unexpected, persistent increases in productivity growth might have effects on inflation and monetary policy opposite to those created by the surprise shortfall in productivity growth in the 1970s.

During the early 1990s, U.S. inflation rates were higher than they are today, and the economy was in the midst of a recovery from the 1990-91 recession. At some point in the recovery process, usually dated 1995, the trend productivity growth rate increased. Again, because the data contain a lot of noise and because measurement issues are quite difficult, it was far from clear until several years after the event that the trend pace of productivity improvement had increased to about 2½ percent. Real household income would double every 30 years at this pace of productivity improvement.

During the last two years, nonfarm business sector productivity growth has averaged about 4½ percent at an annual rate. At this rate, real household income would double, astonishingly, every 16 years.

Two years is too short of a time to reach firm conclusions about persistent changes in the trend pace of productivity growth. And certainly, some of the productivity gains seem to be connected with an unwillingness of firms to hire additional labor over the last two years while they wait for economic conditions to improve. To the extent this is true, productivity gains may be lower when employment starts to grow at a sustained healthy pace.

Still, the earlier lessons with trend productivity changes and the impact those changes have on real interest rates and on the level of output consistent with balanced growth suggest caution. There is a distinct possibility that the underlying pace of productivity growth has increased again. If so, and if the FOMC does not make appropriate policy adjustments, inflation could drift away from current low levels. The short-run impact of higher productivity growth might be to lower the inflation rate, as rising output places downward pressure on prices. However, over the longer run, higher productivity growth will probably require higher interest rates. If monetary policy adjustments do not keep up with a rising equilibrium
real rate of interest, then the inflation rate may ultimately rise. However, my best guess is that the current stance of policy makes adequate allowance, offsetting the risk that the current low inflation will turn into a period of deflation, and Fed vigilance over the longer run will, I believe, keep inflation under control.

**SHORT-TERM REAL INTEREST RATES**

I’ve concentrated on the real rate of interest on longer-term bonds and on physical capital. Nevertheless, it is hard to ignore the fact that at a one-year maturity, the real rate of interest is about zero today. That rate, I believe, should be viewed as a transitory situation during the process of economic adjustment reflecting fundamental longer-term forces. Among these fundamental forces, the rate of productivity growth is certainly at the top of my list.

Policymakers do not have the luxury of calculating an interest rate theoretically consistent with a balanced growth path, as I did earlier, and then simply providing that interest rate to the market. It is useful to understand the economics behind the long-run balanced growth path, but those considerations provide little practical guidance for short-run monetary policy. Because of short- and medium-term shocks, the economy can wander away from its steady-state growth path and interest rates can depart from their long-run equilibrium values. The Fed would hinder rather than support a return to the equilibrium path were it to determine its interest rate stance only on the basis of the long-run equilibrium.

Four years ago, real interest rates were high because of the increase in productivity growth in the mid 1990s, and also because excessive optimism—excessive in retrospect, anyway—led to an unsustainable investment boom, which was particularly marked in the telecom and dot-com industries. Over the last several years, real rates have been low as the investment slump has gradually worked off excess capital stock and as a series of shocks—9/11 terrorist attacks, major bankruptcies, and corporate governance scandals—created a pervasive air of caution. These are oscillations around the economy’s long-run growth path.

Short-run adjustments in monetary policy have been of enormous help in damping the oscillations, but it is beyond the FOMC’s power at the current state of knowledge to eliminate the oscillations altogether.

As important as short-run policy adjustments are, if the FOMC focuses only on transitory disturbances and fails to understand the longer-run forces, it runs the risk of falling behind as the economy converges toward its balanced-growth path. That is part of the story behind policy mistakes in the 1970s. I do not know what the trend rate of productivity growth will turn out to be, but if it is in the neighborhood of 3 percent, then a reasonable guess on the equilibrium real rate of interest is about 4 percent—3 percent from productivity growth plus 1 percent from population growth. In the meantime, the Fed’s task is to promote as rapid a return to the long-run growth path as is consistent with maintaining a rate of inflation that is low and steady.

I’ve offered you my take on where the stance of monetary policy is today and on how the appropriate policy stance is likely to evolve in the future as events unfold. I’ve emphasized that fundamental real forces affecting the real rate of interest are likely to be critical to the long-run path of interest rates, but that the timing of interest rate changes is highly uncertain. Now I’d be pleased to take your questions.