

A St. Louis Fed Perspective on Long-Term Economic Growth

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In the United States today we have in front of us exciting news on economic growth. It now appears that the painful period of unusually slow productivity growth in the 1970s and 1980s is behind us. The increase of output per hour of labor input has been high enough over the last few years that it is increasingly reasonable to believe that the United States has indeed turned the corner on productivity growth. This picture is reinforced by the extensive anecdotal reports from all across the country. But—and this is an important “but”—there is still considerable uncertainty about this conclusion, and in any event we have to be very careful to be realistic about the magnitude of the increase in productivity growth. My purpose today is to discuss this issue of productivity growth and the implications of higher growth for monetary policy.

As with so many other topics in economics, the place to start is with Adam Smith. More than 200 years ago, in his *Wealth of Nations*, Smith explained where economic growth comes from:

The annual produce of the land and labour of any nation can be increased in its value by no other means, but by increasing either the number of its productive labourers, or the productive powers of those labourers...The productive powers of the same number of labourers cannot be increased, but in consequence either of some addition and improvement to those machines and instruments which facilitate and abridge labour; or of a more proper division and distribution of employment.

Smith was the first to argue with clarity that a nation's wealth was in the output of its people, not the gold in its vaults. And Smith certainly understood the tremendous importance of productivity growth; he sought to convince his readers that competitive markets generated wealth and that many restrictive government policies made England poorer.

I have an intense interest in growth both as a citizen and a policymaker. As a citizen, I'd like to see higher output per worker to enrich the lives of people everywhere. New technologies are removing some of the drudgery from our jobs and making work more interesting. I do not scoff at material improvements such as the second car, the vacation home, and so forth, but I do want to emphasize how important improvement in material well-being has been for vastly greater participation in cultural activities that have historically been enjoyed by only a small segment of the population.

In short, I'm going to take for granted, in today's remarks, that growth that people want is a good thing. I'm not going to get bogged down in philosophical arguments over how much growth is in fact good for us.

Before I get into these issues, it is important that I issue a disclaimer. The views I express here are my own and do not necessarily reflect official positions of the Federal Reserve System. I've had a lot of help with these remarks from colleagues in the Research Department of the St. Louis Fed; they deserve credit for the strengths of my argument. I'll retain credit for the errors.

WHY GROWTH MATTERS

The importance of economic growth is easy to demonstrate. During the 1950s and 1960s, output per hour of labor input grew by about 3 percent per year. At that rate, output per hour would double in about 23 years. From 1973 to 1990, output per hour in the nonfarm business sector grew at a rate of only 1.04 percent per year. At that rate, it takes 67 years for output per hour to double. Currently, it appears that output per hour is growing at a rate of about 2 percent per year, which doubles in 35 years. Even a small amount of extra growth yields astonishing gains for the United States. With an extra quarter percentage point of growth, GDP would be about \$300 billion higher after a little more than 10 years. The impact on the federal deficit alone would be on the order of \$60 billion.

Because the growth in real wages and, therefore, the standard of living, depends on productivity growth, these intervals for productivity to double at various growth rates translate quite easily into per capita income. It makes an enormous difference to our society whether income is doubling every 23 years, or every 67 years. Individuals, and society as a whole, are much better off when the median-income family can enjoy a standard of living that the upper-income family enjoyed a generation or two earlier.

MONETARY POLICY AND ECONOMIC GROWTH

Since Adam Smith's day, we've filled in some of the details on how the economy grows, and amassed a huge amount of empirical information. We have not, however, improved upon Smith's fundamental framework for understanding economic growth. Growth comes from more labor and capital, improvements in capital, and improvements in the organization of the production process. As with so many things, Smith had it right. The only amendment flowing from advances in economic knowledge this century—and it is an important amendment—is our greatly increased understanding of the importance of human capital.

A proposition universally accepted by monetary economists is that monetary policy has relatively little to do with long-term economic growth, as long as the inflation rate remains modest. I believe that low inflation is better than not-so-low inflation, but I am not one who makes the extravagant claim that zero inflation yields enormous benefits over some modest rate of inflation. Monetary policy can contribute to general economic stability; and a stable, less cyclical economy probably raises long-term growth somewhat, and is in any event desirable for its own sake. Central banks also make valuable contributions to the efficiency and safety of the payments system, which is an essential piece of infrastructure for a modern economy.

Still, as important as these central bank responsibilities are, it is clear that the central government's activities have far more to do with growth than anything the central bank does. The soundness and efficiency of the legal system, the degree of safety of citizens, tax policy, government spending and regulation, all affect long-term economic growth to a vastly greater degree than central-bank policy.

Long-term economic growth, however, is terribly important to monetary policy in a different way. Here is the monetary policy issue as I see it. *If we knew how to set the rate of inflation directly, then we should just choose a zero rate and be done with it.* (My guess is that zero inflation, properly measured, translates to something like 1 to 1^{1/2} percent annual increase in the consumer price index as the Bureau of Labor Statistics constructs that index today.) But the Fed can't set the rate of inflation directly; that is not possible in a market-based economy.

Suppose, though, that the Fed could set the rate of inflation directly. Interest rates would then rise and fall as credit demands fluctuated. Fluctuations in interest rates, as with fluctuations in individual prices and wages, are an inherent feature of an efficient market economy.

Here, then, is the problem the Fed faces. Given that the Fed cannot directly control the rate of inflation, it must focus on some policy instrument it *can* control and adjust that instrument as best

it can to achieve a low and steady rate of inflation and a stable economy. The Fed has chosen to focus on the federal funds rate; at the end of every meeting, the Federal Open Market Committee, the Fed's main policymaking body, sets an intended fed funds rate. To administer the federal funds rate policy, we must form an opinion on the growth prospects for the economy. We have no choice.

Why do we have no choice? I may bore you with a familiar proposition, but we have to get it on the table to be sure that the rest of these remarks make sense. Suppose the Fed fixed the federal funds rate at an unchanging level. If that level were too low, the inflation rate would start to rise. As inflation rose, the real rate of interest—the difference between the (assumed) fixed nominal federal funds rate and the rate of inflation—would fall. The lower real rate of interest would add to borrowing demand and push the inflation rate even higher. In an effort to hold the interest rate at the target level, the Fed would create additional liquidity. Money growth would rise, and then rise some more. The price level would explode without limit.

The reverse is also true. If the funds rate is set too high, the price level would implode, and the real economy would end up in depression.

Of course, the federal funds rate is not fixed. But if the Federal Reserve adjusts the intended federal funds rate too slowly, then the process I have just sketched works the same way. During inflation, the real rate of interest falls, increasing inflationary pressures. During deflation, the real rate rises, increasing deflationary pressures. The federal funds rate policy instrument must be adjusted in timely fashion for monetary policy to yield a stable economy. This proposition is well supported by both economic theory and actual experience. So, put very bluntly, we know that a federal funds rate fixed for all time, or adjusted too slowly, is an invitation to disaster.

How does the Fed decide the timing and degree of fed funds rate adjustments? I will tell you that there is far less science behind our decisions than I would like. I think I can safely say that every member of the FOMC would like to feel more certain about when and how much to adjust

the intended federal funds rate than he or she does feel. The bottom line is that in the course of fulfilling our FOMC responsibilities, we have to judge the probable strength or weakness of the economy. We want the economy to grow as fast as its resources and productivity permit, but to form a view on the appropriate fed funds rate I have to form a view on the economy's growth prospects.

HOW FAST CAN THE U.S. ECONOMY GROW TODAY?

Many have argued recently that the long-run growth potential of the U.S. economy has improved. Some even claim revolutionary improvement. One of the reasons economics is called the “dismal science” no doubt is economists' propensity to throw cold water on the more glamorous and attention-getting theories about the economy. I feel compelled to do a little of that sometimes, but today I want to tell you why I regard myself as a relative optimist about growth.

We must at the outset be clear about the numbers. Optimists and pessimists among serious students of economic growth are not as far apart as the popular press would have you believe. Pessimists believe that the underlying growth of labor productivity remains bogged down at about the level of the 1970s and 1980s. That rate is in the range of 1 to 1½ percent per year. Optimists believe that the growth rate of productivity has risen to the 2½ to 3 percent range, which translates into average GDP growth in the 3 to 4 percent range over the next few years. Although I am an optimist on growth, my instincts as a policymaker compel me to concentrate on the midrange of informed opinion. That to me is the appropriate basis for policy decisions.

DECOMPOSING GROWTH

Let me put Adam Smith's comments about growth into more modern language: There is broad agreement among economists that the main factors that enable an economy to grow are:

ECONOMIC GROWTH

- The growth of the quantity of *labor* input.
- The growth of the quantity of *capital* input.
- The rate of improvement in the processes that turn inputs into outputs.

It's not hard to understand that the total value of what an economy produces will increase if the number of people working increases or if some people acquire valuable skills through education or on-the-job learning. Similarly, providing workers with more physical capital will increase their output; a worker can dig a longer ditch in a day with a backhoe than with a shovel. Economists have a pretty good handle on these things, both conceptually and quantitatively.

The mystery lies in that third category, "improvements in processes." One might call it "technological progress" or "innovation," but that does little more than rename it. It's a bit different than output per hour, which is what people often mean by productivity. Output-per-hour data combine the effects of investment and technological improvements.

I'd like to keep these effects separate today, because they are really two separate things to economists. We have no direct way to measure the contribution of that third category other than by subtracting the contributions of increased quantities of labor and capital from output. That exercise gives us the residual category that economists call "total factor productivity."

What ends up in that residual category? Well, it's a little like art—we know it when we see it. Total factor productivity soaks up the effects of everything from rearranging a warehouse so that popular items are near the loading dock to sweeping changes introduced by innovations like electricity or computers. It shouldn't surprise us that it is difficult to measure the contents of the pigeonhole where we dump the effects of fuzzy but profound concepts like "creativity" and "innovation." Nevertheless, history offers some lessons about these things, which I'll get to shortly.

GROWTH FROM INPUTS

So where has U.S. growth come from? First the big picture—the last 50 years. Between 1948

and 1997, output in the private business sector grew by a factor of five. Increasing quantities of labor and capital accounted for roughly 60 percent of that increase, leaving about 40 percent of post-war growth "explained" by growth of this mysterious total factor productivity. The split is roughly the same for manufacturing.

On the labor side, a couple of important events need to be factored into our thinking about the next decade or two. First, of course, was the baby boom, which greatly increased labor-force growth. But that source of labor growth is no longer in the pipeline.

Second, we saw a dramatic increase in women entering the labor force. Just after World War II, only 31 percent of women were in the labor force. That number is now more than 60 percent. A back-of-the-envelope calculation suggests that this single factor accounts for about a tenth of postwar growth. Although women's labor force participation rates are still 15 percentage points below men's—about 60 percent compared to 75 percent—they have flattened out in the last few years. Even if the women's rate does catch up to the men's in the long run, we are not looking at the kind of boost we got from this source during the last 50 years. Bottom line: we're unlikely to see a burst of growth from more people going to work.

Business investment in plant and equipment has been a bit more important contributor to post-war economic growth than labor inputs. Moreover, the prospects for investment as a source of growth appear favorable. In general, I think there is wide understanding that bad policy—tax policy, financial policy, environmental policy, trade policy—can profoundly affect a firm's incentive to invest in productive assets. Too often in the past, conflicting policy goals have been resolved without regard for economic efficiency. Although I think we still have a long way to go in this regard, we are today more likely to see innovative policies like tradable pollution permits. This kind of market-based approach is far less damaging than the style of regulation that says simply that "thou shalt not pollute more than 3 parts per billion."

THE PRODUCTIVITY SLOWDOWN

That brings us back to the mystery component—the component that we call total factor productivity. The fact that this component accounted for about 40 percent of growth over the last half century hides one of the most important and longest-running stories in macroeconomics, the productivity slowdown that started around 1970. Economists still debate the causes of this slowdown. Some are convinced that the explanation lies in the energy crises of the 1970s; some believe that a policy environment unfriendly to business bears much of the blame. Others point to the higher inflation rate of the 1970s, and still others to environmental controls. We have more theories than data points.

In any case, the growth rate of total factor productivity did fall by half during the 1970s, and the decline was even more dramatic for manufacturing than for the economy as a whole.

Has this slowdown ended? At first glance, the answer appears to be no. Looking at data for the entire business sector, it appears that the slowdown in the growth rate of total factor productivity has continued. That means that the higher growth of output per hour of labor input—labor productivity—in recent years reflects the investment boom—more capital—rather than a higher growth rate of total factor productivity.

The claim that productivity growth has not increased doesn't seem right, though, does it? We see productivity improvements all around us. Indeed, in manufacturing it is apparent that most of the productivity slowdown *has* evaporated.

There are two ways to interpret this recent discrepancy between manufacturing and overall business productivity growth. You might conclude that manufacturing really has been more innovative—streamlining production processes and so forth. There is probably some truth to that, but if it's the whole story, the rest of the private sector is doing very badly. My observations suggest that innovation and improved productivity are all around us—in manufacturing and elsewhere.

A second angle on these numbers is to think about whether the measurement of productivity

is distorted. Zvi Griliches, who is one of the leading researchers in this area, argues that the part of the economy he calls “reasonably measurable” has declined from about half to less than 30 percent since World War II. The problem is that much of the economy produces things that are extremely difficult to measure, and the share of this sector—services, broadly speaking—keeps growing. Moreover, the productivity slowdown appears to be persisting in these difficult-to-measure industries. Griliches's bottom line is that outside of sectors like agriculture and manufacturing, where it's more or less possible to count things in order to measure output, we should be extremely suspicious of productivity numbers.

WHAT THE PAST TELLS US ABOUT THE FUTURE OF PRODUCTIVITY

What about the future? We see new electronic technology all around us. I would guess that most of you are carrying some of it with you right now. News stories about the Internet are incessant. One would surely be justified in suspecting that all of this represents a productivity revolution of sorts. And I am partly sympathetic to this view.

In the macroeconomic sphere, though, revolutions take decades. Most people call that evolution. I believe that information technology will be a genuine engine of growth for decades, but there hasn't been and won't be a sudden swerve toward some sort of “new economy.” The history of “general-purpose technologies,” as economists call them, tells us why evolution is a better word.

One such general-purpose technology, electricity, has been studied extensively by economic historian Paul David. According to David, less than 5 percent of mechanical power in the nation's factories was provided by electric motors in 1899. It took about 20 years for that number to rise to 50 percent. David addressed two interrelated questions about the spread of electricity use in general and the use of electric motors in particular. First, why was the adoption rate so low? Second, what is special about the spread of a general-purpose technology like electricity?

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Think about what a factory was like before the electric motor. There was typically a single source of mechanical energy: a water wheel or, later, a steam engine. This energy had to be distributed around the plant by mechanical means—gears, drive shafts, belts and pulleys. Because of the number of interconnected moving parts, this system was expensive to build, inflexible and dangerous. But the initial expense was a sunk cost, and once in place the system didn't cost much to run. So in most cases it didn't make sense to scrap an old plant until it physically wore out, even though the new technology was markedly superior. Electric motors spread rapidly in industries that were expanding, but elsewhere the old technology continued to prevail. There is a tremendous amount of inertia in this sort of thing. That is the first lesson about the spread of technology: It's simply too expensive for an industrial economy to rearrange its production and scrap a large part of its capital stock overnight, no matter how exciting the new technology is.

But the ramifications of the electric motor for manufacturing, when it was finally adopted, were immense. Mechanical energy didn't have to be distributed from a central source; you just put a motor where you needed it, so you could easily reconfigure the production process. The production process could be physically stretched out, allowing the development of a true assembly line. New factory structures needed only to keep the rain off; they no longer needed bracing for heavy, rapidly moving power-distribution machinery. Maintenance could be performed on a single machine, without shutting down the entire factory. Those of you with a mechanical engineering background can probably find a hundred more reasons why the electric motor was such an important invention.

All of these advantages were clear in principle at the turn of the century, but each business had to figure out how to adapt the technology to its needs (as well as needing to amortize older investments). Thus, though the impact of electricity on manufacturing and daily life was profound, it was spread over many years.

A more recent example illustrates a slightly different theme. When the laser was invented in 1957, no one recognized it as a general-purpose technology. Indeed, Bell Labs didn't even patent its invention. For some years, the laser was regarded as an extremely specialized tool. In fact, it was biding its time, waiting for complementary developments in the semiconductor industry. When inexpensive semiconductor lasers became available, the laser became ubiquitous. Though we tend to connect the laser with gee-whiz inventions and weapons, probably its most profound effect on the U.S. economy is the humble bar-code reader, which was not practical before cheap lasers. I don't have to explain to this audience how this innovation has altered the economic landscape in retail stores, libraries, the post office, even Red Cross blood collection. Virtually anywhere we need to keep track of the movement of physical objects, you'll see bar codes of one sort or another.

Of course, cheaper and cheaper computing power enables wider spread of bar-code scanners, just as bar-code scanners allow businesses to bring computing power to bear on inventory control, marketing and sales. Who'd have imagined that their combined power would be most visible in the grocery checkout lane? That's the second big lesson about technological change that I take from economic history: It's hard to predict the biggest effects until you're right in the middle of them.

Today, we are in the middle of the adoption cycle for a remarkable set of technological innovations in microprocessors and communications. It is difficult to believe that these things will not spur economic growth. But let's not kid ourselves: We have yet to figure out what to do with all of this computer power and the Internet, and it's not going to happen overnight. In effect, we must write the economic software for this technology. That will take a long time, and we won't understand how it has shaped our economy until it has already happened. That seems to be the way these things have always been.

SUMMARY

I'll finish by summarizing the argument. Long-term economic growth is a terribly important subject for the United States, indeed for every country. The central bank is really a bit player in the growth process, provided inflation is kept relatively low. The gains from low inflation are worth seeking, but we should not overestimate their importance compared to government tax, spending and regulatory policies.

The goal of monetary policy, in my view, should be to keep the rate of inflation low and as steady as possible. The Federal Reserve should not have a rigid view about the equilibrium rate of unemployment or the economy's growth potential. I want the unemployment rate to be as low, and the economy's growth as high, as government policies, the ingenuity of the business community, and the preferences of workers and their families will permit.

Nevertheless, the Federal Reserve, in setting the intended federal funds rate, cannot avoid making some judgments about the economy's growth potential. I've shared with you my thinking about the economy's current growth potential. I am sure that the economy will end up doing better or worse than my best estimate today, but I have given you my best reading on it.

I hold what I think is a balanced, but essentially optimistic, view. When we examine the data carefully, it is hard for me to believe that the economy's long-run growth potential is as high as the growth rate of real GDP over the last few years. Some recent growth has come from adding workers at a pace that is unlikely to continue, and some of the measured increases in output per hour of labor input seem likely to be transitory. On the other hand, the view that nothing has happened seems contradicted by data and by a host of anecdotal reports over the last few years. My best judgment is that the productivity slow-

down of the 1970s and 1980s is over. However, we have to be realistic about the magnitude of the improvement. With all of the optimism that so marks U.S. culture, and with our satisfaction about the fine performance of the economy in recent years, we must not allow ourselves to be lulled into wishful thinking.

I'll finish with an observation of special relevance to manufacturing. It has always been true, and is true today, that swings in aggregate demand have a greater effect on manufacturing than on the economy as a whole. I know that certain manufacturing industries have suffered from soft demand since the Asian crisis took hold in the summer of 1997. Manufacturing will recover in due time as Asia recovers, and I sincerely hope that time comes soon. But the aggregate economy is doing well, and in my assessment of monetary policy the Fed must always focus on what is appropriate for the economy as a whole, even though particular sectors depart from the average. These may be industrial or geographic sectors; California, for example, recovered slowly from the 1990-91 recession.

Clearly, if monetary policy is too expansionary for too long, we will have an inflation problem. Policy will then have to turn restrictive, perhaps sharply so. Some believe that could be the situation today. If policy errs in the other direction, by being too restrictive, the economy will sag and manufacturing will suffer disproportionately. The Fed walks a fine line. Some of manufacturing and much of agriculture are not sharing fully in today's general prosperity. I understand that, and wish it were otherwise. I am nevertheless convinced that if anything that I do contributes to destabilizing the general economy, I will not be doing manufacturing and agriculture a favor. A stable aggregate environment is in the long-run interest of all of us.