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The U.S. Long-Term Growth Rate: Has it Increased?

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Summary

The pace of long-term growth is the bulwark of a rising living standard, and even small rises in this trend will generate large gains in material well-being from one generation to the next. The pace of economic growth also has important implications for tax revenues and outlays for pension funding. Since 1995 the U.S. economy has experienced a strong acceleration of economic growth, propelled by a resurgence of productivity growth. Is this the beginning of a new era for economic growth? Has the computer and communications revolution begun to pay productivity dividends? Economic theory and evidence do not suggest that long-term growth is likely to show a great degree of variability, although some increase is possible. Detailed analysis of recent U.S. productivity growth gives an uncertain picture of whether current growth shows the degree of dispersion across sectors of the economy to propel the economy at a far faster long-term pace. This product will not be updated.

Introduction

The pace of U.S. economic growth accelerated over the period between 1996 and 1999, jumping to an average annual rate of 4.3% from the 3.1% average annual rate recorded over the 1992 to 1996 period. This acceleration has happened without any apparent overheating of the economy, coming late in an economic expansion and occurring without generating upward pressure on inflation. The bulk of this acceleration is explained by a surge in productivity growth. This is unusual, for productivity typically starts out strong in the early years of an economic expansion and steadily settles down as the expansion proceeds. Output per hour, over the last 3 years has been rising at over a 3.0% annual pace, well above the 1.5% to 2.0% pace thought typical at this mature stage of the economic expansion.

Some would argue that the jump in the rate of productivity growth is not a transitory event, but rather the early evidence of a permanent upward shift of the economy's long-term growth rate. The likely cause is thought to be the computer and communications revolution now beginning to bear productive fruit. If this is so, it would be a substantial milestone for the U.S. economy, reversing the sizable slow-down in productivity advance

and the rate of long-term growth that has been characteristic of the U.S. economy since the early 1970s, and presaging a substantial increase in the speed of advancement of our national living standard.

The pace of long-term growth is the bulwark of a rising living standard, and even small rises in this trend will generate large gains in material well-being from one generation to the next. For example, since 1973 the growth rate of per capita GDP has averaged 1.8%. At that rate, the level of per capita income doubles every 39 years. Increase that rate only one-half percentage point to 2.3% and the level of per capita GDP doubles every 31 years. Boost the trend growth rate a full percentage point to 2.8% and the level of per capita income doubles every 25 years. Looked at from a different perspective, the slow-down in economic growth that began in the early 1970s has reduced real income per person in U.S. by nearly 20% relative to what it would have been if growth had proceeded at the pre-1970s pace.

Yet, raising the long-term growth rate a full, or even a half, percentage point may be a difficult task. Economic history does not give much reason to be optimistic about achieving that degree of change. Evidence reveals that the U.S. and most other industrial nations have not sustained long-term growth rates of real per capita GDP nearly as high as 3.0 %. Nor in many cases, including that of the U.S., has the trend growth rate revealed sizable variation. Moderate fluctuations have occurred, but their precise cause is often unclear and their duration is uncertain. It may be that the rapid growth of the early post-war decades was an aberration and the slower rate of long-term growth since the early 1970s a historically more normal pace. If so, a substantial long-term acceleration is unlikely.

This report will examine the issue of whether the U.S. economy in the late 1990s shifted up to a faster long-term rate of growth. As a first step, we will briefly review what economic theory tells us about the determinants of long-term growth. Next, the historical record of U.S. growth is considered. Finally, based on what theory and evidence suggest, we will assess the likelihood that the U.S. economy has entered into a phase of substantially faster long-term growth.

What Determines the Pace of Long-Term Economic Growth?

Economic growth must, by definition, result from either or both of two general economic events. First, increased inputs, specifically more capital applied or more labor employed, allows a nation to increase its level of economic output. Such accumulation has most often been through the augmenting of the stocks of capital (i.e., plant and equipment) and human capital (i.e., education and training) relative to the labor input (i.e., the number of available workers). This process is often called *capital deepening.* The second path to increased output is through an improvement in the *efficiency* with which productive inputs are used, that is, finding better ways to use a given stock of resources so as to raise the output per unit of input. Efficiency improvement allows output to rise without any change in the quantity of inputs. And certainly, capital deepening and efficiency improvement can work together to raise the level of output.

Economic analysis and evidence indicates, however, that the accumulation of inputs alone through capital deepening cannot generate a sustained rate of economic growth. The limiting factor is *diminishing returns*. A process of steadily raising the level of the capital

input will, for an intermediate time period, raise the level of output and boost the economy's growth rate. But, the inevitable onset of diminishing returns dictates that each successive increase in the level of input generates a proportionately smaller increase in the level of output, until at some point no further increase in output occurs, and the growth rate falls to zero. Capital deepening can generate economic growth over the medium-term, but not the long-term.

Mainstream theories of economic growth indicate that the *engine of long-term growth* for mature economies is the steady improvement in the efficiency with which productive inputs are used. Better ideas, more advanced techniques, new products – all the things we lump under the heading of *technological change* – in effect, push off the onset of diminishing returns to the process of capital deepening and maintain a positive long-term growth rate. A sustained rate of efficiency improvement assures a sustained rate of long-term growth. A faster rate of efficiency improvement allows a faster rate of long-term growth.

The great importance of efficiency improvement to the process of economic growth has been well established by so-called growth accounting studies. Such studies endeavor to sort out the relative contribution of the inputs used in the productive process, including efficiency improvement, to the generation of the level of output. Depending on the time period examined, efficiency improvement accounted for 75% to 90% of the increase in per capita output in the U.S. and other advanced economies.[1]

A question that arises is: what determines the rate of efficiency improvement? This has been a subject of much interest in recent research into the process of economic growth. In the framework of the mainstream model of economic growth the development of technological change and the generation of efficiency improvement are taken as an external force operating outside the economic system, moving more or less as a random process over time, falling on the economic system like "manna from heaven." Recent theoretical research on determinants of economic growth has tried to connect the accumulation of productive knowledge to purposeful economic behavior. In this framework productive knowledge is modeled as an *endogenous force*, itself the result of economic decisions and actions of individuals responding to market forces. New productive "ideas" arise because it is profitable to create them. A better mouse trap does not fall from heaven but gets invented because people will pay a premium for a more efficient way to catch mice.[2]

New thinking about the process of economic growth has improved our conception of the form and dimensions of an *infrastructure* for the production of efficiency improvement. This infrastructure includes such things as population size, commitment of resources to education and R&D, and institutions governing enforcement of property rights (e.g., patent laws). In its most plausible form, however, this model presents idea creation as a production process also subject to diminishing returns, which leads to an

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[1] See Denison, Edward. 'The Interruption of Economic Growth'. *Economic Journal*, March 1993; and Jones. *Op cit*, p. 42 .

[2] For a full development of these ideas see: Jones, Charles I. *Introduction to Economic Growth.* New York. W.W. Norton, 1997, pp. 71-113; and Romer, Paul. "Endogenous Technological Change." *Journal of Political Economy 98*. October 1992, 71-102.

invariant pace for an economy's rate of long-run growth. In this framework, it is possible to *temporarily* accelerate the rate of efficiency improvement and the near-term rate of growth of an economy. This acceleration, however, is toward a technological frontier, the expansion of which is at an exogenously determined pace. Once at the frontier, an economy's long-run growth rate will, as in the mainstream model, settle back to the exogenously determined pace. The U.S., with a large and well established growth infrastructure is very likely on that frontier. New ideas will periodically emerge that raise efficiency, but many observers believe it unlikely that there will be permanent accelerations of the long-term growth rate.

The salient message of current accepted theories of economic growth is that the long-term rate of growth will largely be determined by the rate of improvement in productive efficiency. Further, for mature industrial economies such as the U.S., such efficiency improvement are believed to emerge at a relatively constant rate, that is substantially unrelated to economic forces. This does not preclude some modest degree of fluctuation in the rate of efficiency improvement and the rate of economic growth over the medium-term. Temporary accelerations and decelerations are possible.

History of U.S. Long-Term Growth and Efficiency Improvement

In this section we will examine what have been the historical realities of growth for the U.S. over the long-run. Table 1 presents data on long-term economic growth rates dating from 1870 through 1994, measured by annual average rates of change for real (inflation adjusted) GDP per capita. (Per capita GDP is a more telling gauge of improvement in economic welfare than a simple rate of change in real GDP.) This period reaches far enough back in time so as to encompass some of the early decades of industrial development and vigorous economic expansion. These data are also expressed for sub-intervals to help reveal any degree of medium-term variability in the U.S. growth rate.

Table 1. Growth Rate of U.S. Real Per-Capita GDP, 1870-1994

1870-1994	1948-1994	1948-1973	1973-1994
1.8	2.1	2.5	1.8

Source: Jones[3] and U.S. Department of Commerce

Table 1 shows that U.S. real GDP per capita advanced at an average annual rate of 1.8% between 1870 and 1994. What cannot be gleaned from the table is that this growth rate has shown substantial constancy over this 124-year period, with most deviations – up and down– explained by the swings of the business cycle. Some deviation, beyond business cycle effects, has occurred, however. Table 1 also presents growth rates for

[3] Jones, Charles I. *Introduction to Economic Growth*. New York. W.W. Norton, 1997, p. 13. Provides estimate of growth rate over 1870– 1994 interval.

recent shorter time periods. In the post-WWII era, 1948-1994, the growth rate of per-capita GDP does accelerate to an average annual rate of about 2.1%. This 46-year sub period itself seems to be divided into two very distinct periods. For the 25-years from 1948 to 1973, the growth rate jumped significantly to a 2.5% average annual pace. But for the 21 years from 1973 to 1994, the economy's average annual growth rate fell back to a 1.8% average annual pace.

Clearly, based on the experience of the early post-war period, the economy's growth rate can rise above its long-run trend for a substantial period of time. The 1948 to 1973 experience would suggest a medium-term acceleration of as much as 0.7 percentage points above the 1.8% long-term trend rate.

A critical question raised by these data is whether the exuberant growth performance of the early post-war years established a new norm against which to measure subsequent lackluster growth performance, or at least the degree of medium-term acceleration of growth that is periodically possible. On the other hand, it is also credible to see the rapid growth of the early post-war period as an aberration and the slower longer term trends as a more realistic benchmark against which to assess the prospects for long term growth in the U.S. economy.

Evidence from Changes in Efficiency Improvement. The discussion above was about growth rates for per capita GDP. While this is a very telling measure of a nation's ability to advance its material well-being , it is not an exact correspondent to "improved efficiency," the force that economic theory says is the dominant and enduring wellspring for long-term growth. Efficiency improvement is difficult to gauge, however. Total factor productivity (TFP) is the measure used to approximate the rate of improvement in economy-wide efficiency. TFP is measured by first accounting for the separate contributions to increased output of increases in the input of capital and labor. Any increase in output over and above what is attributable to increased factor input is called TFP, and can be used, particularly over long periods of time, as a proxy measure of improved efficiency.

Table 2 presents estimates of TFP for the U.S. over selected time intervals from 1860 through 1999. One sees there a pattern of moderate paced improvement subject to some variation. A significant acceleration of the rate of TFP growth occurred during the 60 year period between 1913 to 1972. This, of course, was the era when a remarkable abundance of major inventions were fully integrated into the U.S. economy. These inventions included electric lights, electric motors, the internal combustion engine, the airplane, the telephone, the superhighway, and a variety of home appliances. It is not surprising that the confluence of so many major innovations induced a sizable and long lived increase in the rate of growth of TFP in the United States. It is also plausible that the deceleration of TFP growth in the 1972-1995 period is a winding down from this unique period of fast paced inventiveness, to a more normal cadence. We can also see in Table 2 that the re-acceleration of TFP growth in the short 1995 to 1999 period has been large, exceeding the fast pace of the 1913-1972 period.

Table 2. Growth Rates of U.S. Total Factor Productivity, 1870-1999			
1870-1913	1913-1972	1972-1995	1995-1999
0.77	1.60	0.62	1.79
Source: Gordon[4]			

The open question is whether the experience of these recent 4 years is the harbinger of a new era of rapid efficiency growth and accelerated growth of per capita GDP. Professor Robert Gordon of Northwestern University views this prospect with considerable skepticism.[5] His analysis of the productivity data for the 1995-1999 period shows that the productivity growth is very localized, and very likely lacking in the propelling effect of the more pervasive productivity impacts of the 1913-1972 period. Gordon observes that recent productivity increases are heavily concentrated in the production of computer hardware and telecommunications equipment, with significant spillovers into other parts of the durable manufacturing sector. This impact affects only about 12% of the economy; the remaining 88% shows no increase in the pace of TFP growth. Other recent studies have found a somewhat broader spread of recent productivity growth to other industries beyond the durable manufacturing sector.[6] However, because these studies did not adjust for the effects of the business cycle, it seems likely that some or all of the effects they found are transitory. Even in these more optimistic studies the results still do not show the degree of economy-wide productivity impact that was true for the invention rich 1913-1972 period. Particularly telling is the lack of TFP improvement in the services sector, where computer and telecommunications equipment investments have been the most intensive.

Conclusion

A substantial amount of capital deepening occurred in the U.S. economy during the 1990's and this has no doubt induced at least a *temporary* acceleration of economic growth. Whether the economy has entered into an extended era of faster long-term economic growth induced by a sustained increase in the pace of efficiency improvement is more problematic. It is difficult to glean a trend from only 4 years of data. It is certainly possible that the long-term rate of growth may rise above the pace of the seemingly slow 1973-1995 period. But, there remains considerable reason to doubt that the pace of growth will exceed or even rival the fast growth of the 1913-1972 period.

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[4] Gordon, Robert, J. "Does the New Economy Measure up to the Great Inventions of the Past." *Journal of Economic Perspectives.* May 1, 2000, Table 2. forthcoming.

[5] Gordon, *op cit.*

[6] See Jorgenson, Dale and Kevin Stiroh. *Raising the Speed limit: U.S. Economic Growth in the Information Age*. Manuscript. May 1, 2000. And Oliner, Stephen and Daniel Sichel, *The Resurgence of Growth in the Late 1990s*. The Federal Reserve Board. May, 2000.