

## REVIEW

# Why Innovation Won't Save Us

For more than a century, the U.S. economy grew robustly thanks to big inventions; those days are gone

BY ROBERT J. GORDON

**NOTHING HAS BEEN** more central to America's self-confidence than the faith that robust economic growth will continue forever. Between 1891 and 2007, the nation achieved a robust 2% annual growth rate of output per person. Unfortunately, the evidence suggests to me that future economic growth will achieve at best half that historic rate. The old rate allowed the American standard of living to double every 35 years; for most people in the future that doubling may take a century or more.

The growth of the past century wasn't built on manna from heaven. It resulted in large part from a remarkable set of inventions between 1875 and 1900. These started with Edison's electric light bulb (1879) and power station (1882), making possible everything from elevator buildings to consumer appliances. Karl Benz invented the first workable internal-combustion engine the same year as Edison's light bulb.

This narrow time frame saw the introduction of running water and indoor plumbing, the greatest event in the history of female liberation, as women were freed from carrying literally tons of water each year. The telephone, phonograph, motion picture and radio also sprang into existence. The period after World War II saw another great spurt of invention, with the development of television, air conditioning, the jet plane and the interstate highway system.

The profound boost that these innovations gave to economic growth would be difficult to repeat. Only once could transport speed be increased from the horse (6 miles per hour) to the Boeing 707 (550 mph). Only once could out-houses be replaced by running water and indoor plumbing. Only once could indoor temperatures, thanks to central heating and air conditioning, be converted from cold in winter and hot in summer to a uniform year-round climate of 68 to 72 degrees Fahrenheit.

As the impact of the late-19th-century inventions faded away around 1970, the computer revolution took over and allowed the economy to remain on our historic path of 2% annual growth. Computers replaced human labor and thus contributed to productivity, but the bulk of these benefits came early in the Electronics Era. In the 1960s, mainframe computers churned out bank statements and telephone bills, reducing clerical labor. In the 1970s, memory typewriters replaced repetitive retyping by armies of legal clerks. In the 1980s, PCs with word-wrap were introduced, as were ATMs that replaced bank tellers and bar-code scanning that replaced retail workers.

The climax was the marriage of communications to the computer as the Internet arose in the 1990s. Amazon.com

was founded in 1994, Google in 1998 and Wikipedia in 2001. Since 2002, though, most computer-related inventions have resulted not in fundamental transformation but in miniaturization, as with hand-held devices like the iPhone, which combines the pre-2002 functions of laptops and early cellphones.

Innovation continues apace today, and many of those developing and funding new technologies recoil with disbelief at my suggestion that we have left behind the era of truly important changes in our standard of living.

The first response from skeptics always involves health care. They believe that medical research, especially on the genome, promises to achieve enormous advances in the treatment of diseases. But the new techniques often fail to de-

liver. One recent study, for instance, demonstrated that high-cost proton-beam treatment for prostate cancer yields no better results than old-fashioned radiation therapy.

Pharmaceutical research appears to be entering a phase of diminishing returns. Developing new drugs is increasingly expensive, and the potential pool of beneficiaries is ever smaller, mainly people with esoteric types of cancer. Few of the medical optimists acknowledge a stark historical fact: The rate of improvement in U.S. life expectancy was three times higher in the first half of the 20th century than in the second.

The fracking revolution and soaring oil and gas production have also excited optimists. But this isn't a source of future economic growth; it merely holds

off future economic decline. Over the past decade, the economy has been burdened by oil prices between \$50 and \$150 per barrel, which have sapped purchasing power available for nonenergy consumption. Holding these prices at bay is progress, to be sure, but it can't compare to the 1960s, when "See the U.S.A. in your Chevrolet" became ever more possible along an expanding interstate highway system when gasoline cost 25 cents a gallon.

Another claim by the growth optimists is that 3-D printing and micro-robots will revolutionize manufacturing. This is an old story, told in one form or another since the first industrial robot was introduced by General Motors in 1961. Manufacturing productivity, driven by robots and other machines

has been healthy throughout the post-war era, even in the past half-decade. But manufacturing's share of the economic pie has inexorably shrunk, from 28% in 1953 to 11% in 2010. That sector of the economy is performing a marvelous ballet, on a shrinking stage.

Can economic growth be saved by Google's driverless car? This is bizarre ground for optimism, but it is promoted not just by Google's Eric Schmidt but by the Massachusetts Institute of Technology's Erik Brynjolfsson. People are in cars to go somewhere, whether from home to work or from home to shop. Once they are inside the car, there is relatively little difference between driving the car on their own or having it drive itself. Greater safety? Auto fatalities per million miles traveled have already declined by a factor of 10 since 1950.

In setting out the case for pessimism, I have been accused by some of a failure of imagination. New inventions always introduce new modes of growth, and history provides many examples of doubters who questioned future benefits. But I am not forecasting an end to innovation, just a decline in the usefulness of future inventions in comparison with the great inventions of the past.

Even if we assume that innovation produces a cornucopia of wonders beyond my expectations, the economy still faces formidable headwinds. The retirement of the baby boomers and the continuing exodus of prime-age males from the labor force, sometimes called the "missing fifth," are reducing hours worked per member of the population. American educational attainment continues to slide ever-downward in the international league tables, due to cost inflation at our universities, \$1 trillion in student loans, abysmal test scores and large numbers of high-school dropouts.

And inequality in America will continue to grow, driven by poor educational outcomes at the bottom and the rewards of globalization at the top, as American CEOs reap the benefits of multinational sales to emerging markets. From 1993 to 2008, income growth among the bottom 99% of earners was 0.5 points slower than the economy's overall growth rate. If future output grows, as I expect, at a rate of just 1% a year, that means the overwhelming majority of Americans will see their incomes grow just 0.5% annually.

The future of American economic growth is dismal, and policy solutions are elusive. Skeptics need to come up with a better rebuttal.

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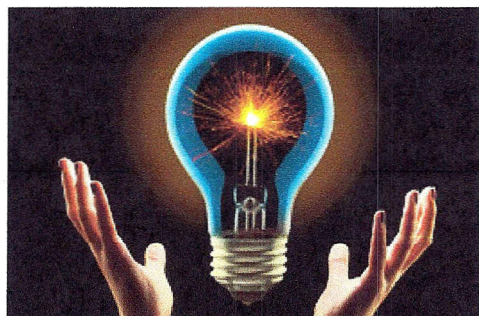
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