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Economic Prospects for the Long Run

Remarks by

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at

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Let me start by congratulating the graduates and their parents. The word "graduate" comes from the Latin word for "step." Graduation from college is only one step on a journey, but it is an important one and well worth celebrating.

I think everyone here appreciates what a special privilege each of you has enjoyed in attending a unique institution like Simon's Rock. It is, to my knowledge, the only "early college" in the United States; many of you came here after the 10th or 11th grade in search of a different educational experience. And with only about 400 students on campus, I am sure each of you has felt yourself to be part of a close-knit community. Most important, though, you have completed a curriculum that emphasizes creativity and independent critical thinking, habits of mind that I am sure will stay with you.

What's so important about creativity and critical thinking? There are many answers. I am an economist, so I will answer by talking first about our economic future--or your economic future, I should say, because each of you will have many years, I hope, to contribute to and benefit from an increasingly sophisticated, complex, and globalized economy. My emphasis today will be on prospects for the long run. In particular, I will be looking beyond the very real challenges of economic recovery that we face today--challenges that I have every confidence we will overcome--to speak, for a change, about economic growth as measured in decades, not months or quarters.

Many factors affect the development of the economy, notably among them a nation's economic and political institutions, but over long periods probably the most important factor is the pace of scientific and technological progress. Between the days of the Roman Empire and when the Industrial Revolution took hold in Europe, the standard of living of the average person throughout most of the world changed little from

generation to generation. For centuries, many, if not most, people produced much of what they and their families consumed and never traveled far from where they were born. By the mid-1700s, however, growing scientific and technical knowledge was beginning to find commercial uses. Since then, according to standard accounts, the world has experienced at least three major waves of technological innovation and its application. The first wave drove the growth of the early industrial era, which lasted from the mid-1700s to the mid-1800s. This period saw the invention of steam engines, cotton-spinning machines, and railroads. These innovations, by introducing mechanization, specialization, and mass production, fundamentally changed how and where goods were produced and, in the process, greatly increased the productivity of workers and reduced the cost of basic consumer goods. The second extended wave of invention coincided with the modern industrial era, which lasted from the mid-1800s well into the years after World War II. This era featured multiple innovations that radically changed everyday life, such as indoor plumbing, the harnessing of electricity for use in homes and factories, the internal combustion engine, antibiotics, powered flight, telephones, radio, television, and many more. The third era, whose roots go back at least to the 1940s but which began to enter the popular consciousness in the 1970s and 1980s, is defined by the information technology (IT) revolution, as well as fields like biotechnology that improvements in computing helped make possible. Of course, the IT revolution is still going on and shaping our world today.

Now here's a question--in fact, a key question, I imagine, from your perspective. What does the future hold for the working lives of today's graduates? The economic implications of the first two waves of innovation, from the steam engine to the Boeing

747, were enormous. These waves vastly expanded the range of available products and the efficiency with which they could be produced. Indeed, according to the best available data, output per person in the United States increased by approximately 30 times between 1700 and 1970 or so, growth that has resulted in multiple transformations of our economy and society.[1] History suggests that economic prospects during the coming decades depend on whether the most recent revolution, the IT revolution, has economic effects of similar scale and scope as the previous two. But will it?

I must report that not everyone thinks so. Indeed, some knowledgeable observers have recently made the case that the IT revolution, as important as it surely is, likely will not generate the transformative economic effects that flowed from the earlier technological revolutions.[2] As a result, these observers argue, economic growth and change in coming decades likely will be noticeably slower than the pace to which Americans have become accustomed. Such an outcome would have important social and political--as well as economic--consequences for our country and the world.

This provocative assessment of our economic future has attracted plenty of attention among economists and others as well. Does it make sense? Here's one way to think more concretely about the argument that the pessimists are making: Fifty years ago, in 1963, I was a nine-year-old growing up in a middle-class home in a small town in South Carolina. As a way of getting a handle on the recent pace of economic change, it's

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[1] See Angus Maddison (2007), *Contours of the World Economy, 1-2030 AD: Essays in Macro-Economic History* (New York: Oxford University Press), table A.7, p. 382.

[2] Two important examples are Tyler Cowen (2011) and Robert J. Gordon (2010, 2012); the latter reference, in particular, also contains a discussion of headwinds to growth beyond the prospects for innovation. See Tyler Cowen (2011), *The Great Stagnation: How America Ate All the Low-Hanging Fruit of Modern History, Got Sick, and Will (Eventually) Feel Better* (New York: Dutton); Robert J. Gordon (2010), "Revisiting U.S. Productivity Growth over the Past Century with a View of the Future," NBER Working Paper Series 15834 (Cambridge, Mass.: National Bureau of Economic Research, March); and Robert J. Gordon (2012), "Is U.S. Economic Growth Over? Faltering Innovation Confronts the Six Headwinds," NBER Working Paper Series 18315 (Cambridge, Mass.: National Bureau of Economic Research, August).

interesting to ask how my family's everyday life back then differed from that of a typical family today. Well, if I think about it, I could quickly come up with the Internet, cellphones, and microwave ovens as important conveniences that most of your families have today that my family lacked 50 years ago. Health care has improved some since I was young; indeed, life expectancy at birth in the United States has risen from 70 years in 1963 to 78 years today, although some of this improvement is probably due to better nutrition and generally higher levels of income rather than advances in medicine alone. Nevertheless, though my memory may be selective, it doesn't seem to me that the differences in daily life between then and now are all that large. Heating, air conditioning, cooking, and sanitation in my childhood were not all that different from today. We had a dishwasher, a washing machine, and a dryer. My family owned a comfortable car with air conditioning and a radio, and the experience of commercial flight was much like today but without the long security lines. For entertainment, we did not have the Internet or video games, as I mentioned, but we had plenty of books, radio, musical recordings, and a color TV (although, I must acknowledge, the colors were garish and there were many fewer channels to choose from).

The comparison of the world of 1963 with that of today suggests quite substantial but perhaps not transformative economic change since then. But now let's run this thought experiment back another 50 years, to 1913 (the year the Federal Reserve was created by the Congress, by the way), and compare how my grandparents and your great-grandparents lived with how my family lived in 1963. Life in 1913 was simply much harder for most Americans than it would be later in the century. Many people worked long hours at dangerous, dirty, and exhausting jobs--up to 60 hours per week in

manufacturing, for example, and even more in agriculture. Housework involved a great deal of drudgery; refrigerators, freezers, vacuum cleaners, electric stoves, and washing machines were not in general use, which should not be terribly surprising since most urban households, and virtually all rural households, were not yet wired for electricity. In the entertainment sphere, Americans did not yet have access to commercial radio broadcasts and movies would be silent for another decade and a half. Some people had telephones, but no long-distance service was available. In transportation, in 1913 Henry Ford was just beginning the mass production of the Model T automobile, railroads were powered by steam, and regular commercial air travel was quite a few years away. Importantly, life expectancy at birth in 1913 was only 53 years, reflecting not only the state of medical science at the time--infection-fighting antibiotics and vaccines for many deadly diseases would not be developed for several more decades--but also deficiencies in sanitation and nutrition. This was quite a different world than the one in which I grew up in 1963 or in which we live today.

The purpose of these comparisons is to make concrete the argument made by some economists, that the economic and technological transformation of the past 50 years, while significant, does not match the changes of the 50 years--or, for that matter, the 100 years--before that. Extrapolating to the future, the conclusion some have drawn is that the sustainable pace of economic growth and change and the associated improvement in living standards will likely slow further, as our most recent technological revolution, in computers and IT, will not transform our lives as dramatically as previous revolutions have.

Well, that's sort of depressing. Is it true, then, as baseball player Yogi Berra said, that the future ain't what it used to be? Nobody really knows; as Berra also astutely observed, it's tough to make predictions, especially about the future. But there are some good arguments on the other side of this debate.

First, innovation, almost by definition, involves ideas that no one has yet had, which means that forecasts of future technological change can be, and often are, wildly wrong. A safe prediction, I think, is that human innovation and creativity will continue; it is part of our very nature. Another prediction, just as safe, is that people will nevertheless continue to forecast the end of innovation. The famous British economist John Maynard Keynes observed as much in the midst of the Great Depression more than 80 years ago. He wrote then, "We are suffering just now from a bad attack of economic pessimism. It is common to hear people say that the epoch of enormous economic progress which characterised the 19th century is over; that the rapid improvement in the standard of life is now going to slow down."[3] Sound familiar? By the way, Keynes argued at that time that such a view was shortsighted and, in characterizing what he called "the economic possibilities for our grandchildren," he predicted that income per person, adjusted for inflation, could rise as much as four to eight times by 2030. His guess looks pretty good; income per person in the United States today is roughly six times what it was in 1930.

Second, not only are scientific and technical innovation themselves inherently hard to predict, so are the long-run practical consequences of innovation for our economy and our daily lives. Indeed, some would say that we are still in the early days of the IT

[3] John M. Keynes (1931), "Economic Possibilities for Our Grandchildren (1930)," in *Essays in Persuasion* (London: Macmillan), p. 358.

revolution; after all, computing speeds and memory have increased many times over in the 30-plus years since the first personal computers came on the market, and fields like biotechnology are also advancing rapidly. Moreover, even as the basic technologies improve, the commercial applications of these technologies have arguably thus far only scratched the surface. Consider, for example, the potential for IT and biotechnology to improve health care, one of the largest and most important sectors of our economy. A strong case can be made that the modernization of health-care IT systems would lead to better-coordinated, more effective, and less costly patient care than we have today, including greater responsiveness of medical practice to the latest research findings.[4] Robots, lasers, and other advanced technologies are improving surgical outcomes, and artificial intelligence systems are being used to improve diagnoses and chart courses of treatment. Perhaps even more revolutionary is the trend toward so-called personalized medicine, which would tailor medical treatments for each patient based on information drawn from that individual's genetic code. Taken together, such advances could lead to another jump in life expectancy and improved health at older ages.

Other promising areas for the application of new technologies include the development of cleaner energy--for example, the harnessing of wind, wave, and solar power and the development of electric and hybrid vehicles--as well as potential further advances in communications and robotics. I'm sure that I can't imagine all of the possibilities, but historians of science have commented on our collective tendency to

[4] See Martin Neil Baily, James M. Manyika, and Shalabh Gupta (2013), "U.S. Productivity Growth: An Optimistic Perspective," *International Productivity Monitor*, Spring, pp. 3-12.

overestimate the short-term effects of new technologies while underestimating their longer-term potential.[5]

Finally, pessimists may be paying too little attention to the strength of the underlying economic and social forces that generate innovation in the modern world. Invention was once the province of the isolated scientist or tinkerer. The transmission of new ideas and the adaptation of the best new insights to commercial uses were slow and erratic. But all of that is changing radically. We live on a planet that is becoming richer and more populous, and in which not only the most advanced economies but also large emerging market nations like China and India increasingly see their economic futures as tied to technological innovation. In that context, the number of trained scientists and engineers is increasing rapidly, as are the resources for research being provided by universities, governments, and the private sector. Moreover, because of the Internet and other advances in communications, collaboration and the exchange of ideas take place at high speed and with little regard for geographic distance. For example, research papers are now disseminated and critiqued almost instantaneously rather than after publication in a journal several years after they are written. And, importantly, as trade and globalization increase the size of the potential market for new products, the possible economic rewards for being first with an innovative product or process are growing rapidly.[6] In short, both humanity's capacity to innovate and the incentives to innovate are greater today than at any other time in history.

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[5] This tendency has been referred to as the first law of technology. On the potential impact of genome sequencing, see Francis Collins (2010), "Has the Revolution Arrived?" *Nature*, vol. 464 (April), pp. 674-75. For an accessible discussion of the possibilities for life expectancy, see Stephen S. Hall (2013), "On beyond 100," *National Geographic*, May, http://ngm.nationalgeographic.com/2013/05/longevity/hall-text.

[6] For a discussion of the economic models of growth that build in cumulative forces of knowledge generation and the effects of expansion in the size of the market, see Charles I. Jones and Paul M. Romer (2010), "The New Kaldor Facts: Ideas, Institutions, Population, and Human Capital," *American Economic Journal: Macroeconomics*, vol. 2 (January), pp. 224-45.

Well, what does all this have to do with creativity and critical thinking, which is where I started? The history of technological innovation and economic development teaches us that change is the only constant. During your working lives, you will have to reinvent yourselves many times. Success and satisfaction will not come from mastering a fixed body of knowledge but from constant adaptation and creativity in a rapidly changing world. Engaging with and applying new technologies will be a crucial part of that adaptation. Your work here at Simon's Rock, and the intellectual skills, creativity, and imagination that that work has fostered, are the best possible preparation for these challenges. And while I have emphasized technological and scientific advances today, it is important to remember that the arts and humanities facilitate new and creative thinking as well, while helping us to draw meaning that goes beyond the purely material aspects of our lives. I wish you the best in facing the difficult but exciting challenges that lie ahead. Congratulations.