

# Two Books for the Price of One: Review Article of *The Rise and Fall of American Growth* by Robert J. Gordon

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## ABSTRACT

Robert Gordon has written a remarkable book; actually two "books," one about the past and one about the future. The first "book" is an account of the dramatic changes in American living standards since 1870. Looking forward, the second "book" makes the case that the miracles that powered the economy upward in the century to 1970 cannot be repeated and that the rate of economic growth has stepped down. Moreover, given headwinds facing the economy, Gordon argues that the typical American family will see only sluggish improvements in living standards. The first "book" is truly extraordinary in its coverage and creativity - it is insightful, compelling, and highly entertaining (and would be for non-economists as well as economists). The second "book" - not so much. It is more speculative and controversial. While Gordon's more pessimistic narrative has gained significant traction, I argue that there is plenty of room for optimism.

Robert J. Gordon's *The Rise and Fall of American Growth: The U.S. Standard of Living since the Civil War* (Princeton University Press, 2016) is a remarkable book; well, actually two "books," one about the past and one about the future. The first "book" is an account of the dramatic changes in American living standards since 1870. Looking forward, the second "book" makes the case that the miracles that powered the economy upward in the century to 1970 cannot be repeated and that the rate of economic growth has permanently stepped down from that heady pace. According to Gordon's rather grim view, the typical American family faces a new normal of sluggish growth in living standards.

I found the first "book" to be truly extraordinary in its coverage and creativity - it is insightful, compelling, and entertaining. The second "book" - not so much. It is more speculative and controversial, and I offer a counter view below.

## Book I: The Past

Gordon first focuses on the dramatic rise in living standards in the United States from 1870 to 1940. To document these changes, he organizes the narrative in terms of key features of daily life. On its surface, the organization appears to track that of household consumption in the national accounts, covering the major categories of goods and services consumed by households, including chapters on food and

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clothing, the character of home life, as well as transportation and communication.

This framework would naturally lead to measuring living standards with real GDP per person. However, Gordon is careful to highlight two shortcomings of real GDP per person as a measure of living standards. First, he argues that properly measured real GDP per person rises faster than in official statistics because price indexes fail to capture some of the welfare benefits of new and improved products, such as antibiotics. Second, Gordon appropriately has a more expansive view of living standards than just what appears in the national accounts. He includes the role of home production, increases in the quality of leisure time, significant declines in the unpleasantness of work, as well as dramatic improvements in health and mortality. Accordingly, he also includes chapters on health; working conditions (both for men mostly working outside the home and for women working mostly inside the home in the earlier decades); as well as the role of risk in everyday life.

This material is magnificent and a terrifically fun read. The major theme for the period from 1870 to 1940 is the revolutionary change in living standards. Each page is chock full of carefully gathered data along with anecdotes and fascinating insights into life in an earlier era. This in-depth analysis reaches far enough back before our time that many of the facts will be startling to all but those who have studied this period. Indeed, one could randomly pick pretty much any page and find an interesting tidbit that reveals just how dramatically life has changed since 1870.

Here is a snapshot of life in 1870: 172 babies out of every 1,000 died in infancy. For Americans who survived childhood, few were in school past age 12. Diets were repetitive and bland, with heavy reliance on salted and smoked pork and corn. Home life was dark, dirty, smelly, and

going to the bathroom meant using a chamber pot or the outhouse. Most jobs required hard physical labour, with 87 per cent characterized as unpleasant. While the quality of life certainly had moved beyond "nasty, brutish, and short," Gordon reminds us that living standards were shockingly primitive by the norms of modern life in America.

Gordon next focuses on the period from 1940 to 2015. This section also is exceptional in its breadth and coverage. It covers the same broad topics, describing the further advances in key areas, including food, clothing, housing, transportation, and entertainment. Gordon highlights the role of air conditioning (making more intensive development of the South and Southwest feasible), the interstate highway system, and commercial air transportation. The main theme in this part of the book is that advances were evolutionary rather than revolutionary, especially after 1970. And, Gordon begins weaving into his narrative the precursors of the period of slower growth from 1970 to 2015.

## **Book II: The Future**

The second "book" makes Gordon's well-known argument that the first and second industrial revolutions that lifted growth through 1970 cannot be repeated. Moreover, the revolution in information and communications technologies (ICT) just does not stack up to earlier innovations in terms of their impact on economic growth. Combined with the economic headwinds that Gordon predicts will slow growth in living standards, he argues that this state of play condemns the United States to a disappointing economic future. Gordon marshals the evidence as well as anyone could to make the downbeat case. That being said, much of his evidence also could be used or reinterpreted to support a more optimistic view.

The first part of his argument is that the current pace of innovation can support a rather pal-

try rate of increase in labour productivity growth relative to the long-run historical average. In particular, he forecasts an average rate of growth in total economy real GDP per hour of 1.2 per cent from 2015 to 2040, compared with 1.6 per cent over 1970 to 2014 and 2.8 per cent over 1920 to 1970.<sup>2</sup> The second part of his argument is that the economy faces a set of headwinds that will restrain increases in real median disposable income per person to just 0.3 per cent a year over this period. While his argument is extensive, counter arguments can challenge his conclusions.

### **The Slow Pace of Innovation?**

Gordon argues that the pace of innovation in the future will look nothing like that prior to 1970 and that the ICT-related boost that occurred during the 1995-2004 period was a one-off event that will not be repeated. In particular, he makes the case that innovation in ICT will be slower than in the past and that productivity gains outside of the ICT sector will be limited. Regarding modest increases outside of ICT, Gordon indicates that this outcome should be expected both because innovations in these areas will continue to be more incremental and because gains in ICT will have a smaller impact outside of ICT than in the past.

To support this argument that progress in ICT will be more modest, he makes the case that especially rapid advances in semiconductor technology - a key driver of the ICT revolution - are behind us. He colourfully labels this argument the "Death of Moore's Law." (Moore's Law is the idea, put forward by Intel founder Gordon Moore in 1965, that the density of transistors on semiconductors will double every two years.<sup>3</sup>)

A key exhibit in this argument is a figure (Gordon, 2016: Figure: 13-1) that plots the number of transistors on microprocessors over time; this line fluctuates around a steadily rising trend line that embodies Moore's Law. The series for the actual semiconductor count flattens out in recent years and dips slightly below the trend line. This flattening of the actual count could, of course, represent the end of Moore's Law; however, it occurs following an extended period in which the actual count was well above the trend line. As a matter of simple data analysis, it seems somewhat of an over-reach to suggest that the uptrend in a time series largely has come to an end because that series has slowed to slightly below its rapid upward trend. That would be like announcing the "Death of real GDP growth" when real GDP flattens out and dips in a recession.

More importantly, a recent paper on semiconductor prices by Byrne, Oliner, and Sichel (2015) provides evidence of continuing rapid advances in semiconductor technology. First, Intel's pace of advance in chip density (the number of transistors on a given area of silicon) remained just as rapid on average over the 2004-2014 period as over the 1994-2004 period. Looking ahead, Intel - the largest producer of microprocessors - recently stated that it remains on a path to double chip density every two and a half years, slower than in recent years but still quite rapid (Clark, 2015).

Second, and not surprising given the advances in chip density, measures of actual microprocessor performance - gauged in terms of how quickly microprocessors complete a suite of applications that users actually undertake - have increased around 30 per cent a year since the mid-2000s. Taken together, this evidence suggests ongoing rapid gains; accordingly, I dis-

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2 Gordon's projection of a 1.2 per cent average increase in total economy real GDP per hour corresponds to roughly a 1.4 per cent rate of advance in output per hour in the business sector.

3 Moore's original formulation (Moore, 1965) pegged the doubling time at only one year, but in 1975 he revised the period to two years based on actual experience to that point.

agree with Gordon's assessment that the pace of innovation in ICT has recently slowed.

Regarding productivity gains outside of the ICT sector, the economic historian Joel Mokyr (2014) describes remarkable progress that is occurring in genetic engineering, materials science, 3-D printing and associated mass customization, and the gradual lessening of the importance of location and distance in the organization of work. He suggests that these and other new technologies have the potential to be highly transformative. I agree. As a blue sky example, if 3-D printing develops sufficiently, the structure of manufacturing could change dramatically with goods produced on demand and on location.

As for whether advances in ICT will boost the broader economy, Gordon states that technological progress in PCs largely has stopped (or at least slowed) because no one needs a more powerful PC, implying that users of PCs will not create additional productivity advances. The comment about PCs may be correct, but it completely misses the point. The locus of innovation has shifted far beyond the personal computer and the pace at which PC performance is improving tells us very little about the future impact of ICT. The locus of ICT innovation has shifted to software, mobile devices, robotics, artificial intelligence, virtualization and cloud computing, and a host of other areas.<sup>4</sup> And, access to computing power is becoming ubiquitous and available on demand with the rise of cloud computing and simpler interfaces. These changes seem likely to engender many hard-to-anticipate changes with the potential to boost productivity.

More generally, how should Gordon's productivity forecast for 2015 to 2040 be evaluated? I offer a few observations. First, as Branstetter and Sichel (2016) highlight, economists have a terrible record when it comes to forecasting productivity growth. During the 1930s and then again in the late 1980s and early 1990s, stretches of poor economic performance led to pessimistic narratives about the economic future. In the 1930s, Alvin Hansen (1939) projected an extended period of "secular stagnation" for the economy.<sup>5</sup> In the late 1980s and early 1990s, many economists expected continued weak productivity growth, and Paul Krugman (1990) penned the book *Age of Diminished Expectations*, arguing that slow growth would be with us for a long time. In both cases, the economy improved dramatically not so long after these gloomy prognostications. The lesson Branstetter and Sichel take from this record is that recent trends in productivity provide very little information about its future path.

Second, I would quibble with Gordon's reliance on past forecasts of technology as supportive evidence for his projection. While Gordon cites a fascinating array of past forecasts of technology that turned out to be more or less right, there are many examples of past forecasts of technology that turned out to be spectacularly wrong (Information Week, 2011; Telegraph, 2016). In 1876, Western Union concluded in an internal memo "This 'telephone' has too many shortcomings to be seriously considered as a means of communication." In 1943, the president of IBM suggested that, "I think there is a world market for maybe five computers." Lastly, in 1977 the founder of Digital Equipment Corporation (a leading maker of mini

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4 Byrne, Oliner, and Sichel (2016) shows that the rate of quality-adjusted price decline for PCs slowed significantly after 2010. But, for tablets, quality-adjusted prices have fallen rapidly since Apple introduced the iPad in 2010.

5 Hansen (1939) described secular stagnation as "sick recoveries, which die in their infancy and depressions which feed on themselves and leave a hard and seemingly immovable core of unemployment." Larry Summers (2014) resurrected the term "secular stagnation," providing another gloomy take on U.S. economic prospects.

computers) argued that, "There is no reason for any individual to have a computer in his home."

These examples illustrate that predicting the future is hard. A more subtle point is that each of these incorrect predictions was made through the lens of then-current technologies. In 1876, telegrams were a far more effective communication tool than early telephones and their limited network. Our unfortunate forecaster at Western Union could not see how quickly telephones would advance, how rapidly their price would fall, nor how extensive the network would become. Not surprisingly, the same type of shortcoming afflicted the other prognosticators. I suspect that observers today suffer from the same inability to anticipate technologies that have not yet been thought of.

Finally, I have one other serious concern about Gordon's argument that the ICT revolution provided a one-time, one-decade boost to productivity growth. The economic effects of innovation rarely occur in a linear pattern, but rather come with a lag and in waves. Paul David (1990) makes a powerful case that the economic benefits of electricity occurred about a quarter of a century after the key inventions occurred, once electricity became more widespread and businesses had made the necessary adjustments to exploit electricity. Chad Syverson (2013) suggests that the gains from electricity occurred in waves. One wave started about 1915 and lasted about a decade. Then, an extended productivity lull occurred, followed by another upward surge. Productivity gains from ICT may or may not follow the pattern of those related to electricity, but the electricity experience certainly raises the possibility that the economy is undergoing a transition period prior to a second wave of productivity advance from ICT.

### **The Role of Headwinds?**

While an increase in real GDP per hour of 1.2 per cent a year over the next quarter century would be disappointing, Gordon argues that the typical (median) American will see an even smaller rate of increase in real disposable income - just 0.3 per cent a year - as gains are restrained by a series of headwinds. These restraints on growth include rising inequality, slowing increases in educational attainment, demographic shifts that will restrain hours worked per person, and the fiscal challenges facing the United States.

I agree with Gordon on the restraining role of demographic shifts. On the other headwinds he cites, I think it is a tougher call. The year 2040 is a long way off; much could and will happen that is unexpected. Moreover, as Mokyr (2014) points out, the U.S. economy has faced enormous headwinds in the past and still has prospered. In the 20th century, the United States faced two World Wars, a drawn out Cold War, a major Depression, huge demographic shifts, and dramatic social changes. Still, the economy powered ahead. Each of the restraints that Gordon identifies outside of demographic changes - inequality, education, and fiscal challenges - could be overcome by good policy choices. Indeed, in the book's postscript Gordon provides a comprehensive summary of policies that have the potential to support and boost growth. Of course, in the current political climate in the United States, the easy call is to say that such policies will never happen. Yet, the United States has overcome major challenges in the past. Indeed, the year 1870 was just a few years after the Civil War, a period when political divisions and polarization likely were even greater than they seem now. Yet, 1870 was the beginning of an amazing century of growth.

## Is a Brighter Future Possible?

What might a brighter productivity future look like? Branstetter and Sichel (2016) sketch out some possibilities outside of the ICT sector, quantifying possible effects related to advances in robotics, education, and health care. Branstetter and Sichel also highlight the importance of a widening pool of researchers around the world whose work can benefit people in all countries. They suggest that these and other changes could boost productivity growth well above its average pace during the past decade. That position is also supported by a simulation relying on a multi-sector Solow growth model, which suggests that the current disappointing pace of productivity growth is well below the steady-state growth rate implied by the model.<sup>6</sup> Indeed, a plausible alternative simulation points to steady-state labour productivity growth of 2¼ per cent a year in the business sector. While such a growth rate is far above productivity's recent pace, it is just about equal to the average growth rate of business sector labour productivity since 1889.

Should one believe this brighter scenario given Gordon's case that growth has permanently slowed? The pessimistic narrative has gained considerable traction recently, aided by the very weak performance of actual productivity. However, the reasons for that poor performance are not well understood by economists, and, at key times in the past the emergence of a consensus around a downbeat view of the future occurred shortly before a productivity revival. Will the United States experience such a revival in coming decades? We will not know the answer until the future unfolds, but I believe that a brighter scenario is highly plausible and that that possibility has been too readily dismissed. In short, there is plenty of room for optimism.

## References

- Branstetter, Lee and Daniel E. Sichel (2016) "Seven Reasons to be Optimistic about Productivity," working paper.
- Byrne, David M., Stephen D. Oliner, and Daniel E. Sichel (2013) "Is the Information Technology Revolution Over?" *International Productivity Monitor*, No. 25, pp. 20-36, <http://www.csls.ca/ipm/25/IPM-25-Byrne-Oliner-Sichel.pdf>.
- Byrne, David M., Stephen D. Oliner, and Daniel E. Sichel (2015) "How Fast Are Semiconductor Prices Falling?" NBER working paper #21074, April.
- Byrne, David M., Stephen D. Oliner, and Daniel E. Sichel (2016) "A New Look at Prices of Personal Computers, Tablets, and Cell Phones," presented at NBER Summer Institute, July.
- Clark, Don (2015) "Intel Rechecks the Tablet on Moore's Law," *The Wall Street Journal*, July 16.
- David, Paul A. (1990) "The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox," *American Economic Review*, May, pp. 355-361.
- Gordon, Robert J. (2016) *The Rise and Fall of American Growth: The U.S. Standard of Living since the Civil War* (Princeton, N.J.: Princeton University Press).
- Hansen, Alvin (1939) "Economic Progress and Declining Population Growth," *American Economic Review*, Vol. 29, March, pp. 1-15.
- Information Week* (2011) "12 Worst Tech Predictions of All Time," February 17.
- Krugman, Paul (1990) *Age of Diminished Expectations* (Cambridge: MIT Press).
- Mokyr, Joel (2014) "The Next Age of Invention," *City Journal*, Winter, <http://www.city-journal.org/html/next-age-invention-13618.html>.
- Moore, Gordon E. (1965) "Cramming More Components onto Integrated Circuits," *Electronics*, Vol. 38, No. 8, April 19.
- Summers, Lawrence H. (2014) "U.S. Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound," *Business Economics*, Vol. 49, No. 2, pp. 65-73.
- Syverson, Chad (2013) "Will History Repeat Itself? Comments on 'Is the Information Technology Revolution Over?'" *International Productivity Monitor*, No. 25, pp. 37-40, <http://www.csls.ca/ipm/25/IPM-25-Syverson.pdf>.
- Telegraph* (2016) "Worst tech predictions of all times," June 29.

<sup>6</sup> The simulation is based on an update of the steady-state analysis in Byrne, Oliner, and Sichel (2013).