

Technology And Growth: The End Of History As We Know It Or Just A New Beginning ?

(The Rise and Fall of American Growth: The US Standard of Living since the Civil War. By Robert J. Gordon, 784 pages, Princeton University Press, 2016)

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The prospective look into the future, be it a literary fantasy (like the novels of Jules Verne) or a scientific approach (like those of Bertrand de Jouvenel who coined the term *futuribles - les futurs possibles* (B. de Jouvenel, 1965) or those of Herman Kahn (H. Kahn, 1967) who wrote in 1967 about year 2000) has always been probabilistic but very often interesting and intriguing and sometimes even amazingly accurate (like the forecast of RAND Corporation made in 1946 (Bilal M. Ayyub, 2001) that estimated the first launch of a space satellite in mid 1957 – prediction validated by the launch of the Soviet Sputnik on October 4, 1957).

The prospective look into the future has always been fascinating to people, but this fascination was even more intense in periods of perceived discontinuity in the representation of the world and in daily life, as well as and when uncertainty about tomorrow or the day after grew beyond a certain point. Particularly after the crisis that started in 2008, and to a large extent not as a direct consequence of it, the world economy entered a period of uncertainty, fuzziness and unexpected developments that may vary (at least and particularly in the developed countries) from uncertainty about the retirement financial stability for a majority of people to insecurity of walking in the streets of Paris, Brussels or Munich and from the implications of the decline of oil and raw materials prices (contrary to the decades long expectations of prohibitive growth) to the instability of long established geopolitical partnerships. In this context, from a very broad perspective, the world of today may be represented as a race between two very different and apparently unconnected processes. The race is not between the two processes per se, but rather in the sense that humankind may look very different function of which of these two process wins the race.

On the one hand, there is the historical process of redefining the balances of power and the spheres of influence. This is the classical process involving states, diplomacy, real politick, negotiations and wars of all sorts. This process seemed to be part of a distant past that apparently ended once with the World War II, but, after all, 71 years (the 1945 – 2016 period) is not such a long time and history proves us time and again that it is not linear but it moves rather in the infinite spirals of dialectics. This process includes (as of mid 2016) many things from the existential issues of European Union to the events in Turkey and from the political implications of globalization and inequality (manifested in Great Britain's result to the EU membership referendum or in the unfolding events of the US elections) to the disputes in the South China Sea. Depending on how the cards will be played by the global actors or depending just on fate or mere probabilities, this historical process may lead to cold or hot conflicts and anyway to a redrawing of the world order.

On the other hand, apparently in a different universe, there is the process of technological change that has been called many names, such as the 4th industrial revolution or the digital revolution, process that seems to bring with it the rise of the robots and of artificial intelligence and also a new architecture of the world economy quite aptly described by Parag Khana as *connectography*, meaning both connected geography or connected reality (Parag Khana, 2016). This process of technological change has been considered important enough to represent the key topic of the Davos meeting of January 2016 when Klaus Schwab, founder and executive chairman of World Economic Forum stated that this 4th industrial revolution will alter all dimensions of human existence, being more comprehensive and complex than anything we have seen before (Schwab, 2016). Under this generous umbrella of the 4th industrial revolution a large number of people, reunited under the denomination of techno-enthusiasts, believe that science and technology will solve in a couple of decades all the issues that are confronting humankind today, including those referring to food, water, a clean and sustainable environment, energy and resources and even the peace that represents the basis for any conceivable future.

Somehow between these two processes comes the massive book of 784 pages written by professor Robert J. Gordon, *“The Rise and Fall of American Growth: The US Standard of Living since the Civil War”*, published in January 2016, that stays away from the first process described above but deals in an original manner with the second one. In a nutshell Robert Gordon claims and to a certain extent demonstrates that the innovations that stayed at the basis of modern life determined a unique moment in the history of humanity (*“one time only changes”*, p. 126) that can not be repeated, at least as long as our professional and personal life remain the way we know today. Also in a nutshell, with reference to the current inventions, Robert Gordon is asking in a very pertinent manner a simple even if disconcerting question: the internet revolution, or the digital revolution or the 4th industrial revolution are they real revolutions? This question can be further reformulated in order to clarify its content: Are these revolutions (which are specific to the last two or three decades) really changing fundamental aspects of the life of the American people and, by extension, the life of the majority of the people on planet Earth? And speculating further: are they able to generate the same type of economic growth and welfare as the innovations of the period 1870–1940?

By its content *“The Rise and Fall of American Growth: The US Standard of Living since the Civil War”* is situated at the cross-roads of history, technology and economics and is structured in three large parts: **the first** deals with the period 1870–1940 and analyzes the innovations that revolutionized the inside and outside of American homes; **the second** refers to the period 1940 – 2015 which is actually divided into two sub-parts: period 1940 – 1970 that concludes what represents in the author’s vision the Golden Age of high growth and progress and the period 1970 – 2015 which marks the transition to slower growth; **the third** part of the book is both an analysis and a synthesis of the first two as it is dedicated to the sources of fast and slower growth. There is also a Postscript where the author presents some possible approaches and policies that may improve and make more sustainable the US economy and society.

Some clarifications are necessary from the very beginning. The book is about the United States economy and the impact of science and technology on the lives of American people since 1870 till present time. But the topics addressed (how science and technology influence the professional and personal life of the majority of people and the consequences on economic growth) are universal and the implications are of interest for all countries and people of the Earth. The message of the book can be interpreted and indeed it has been interpreted by many reviewers (among them Paul Krugman and Tyler Cowen) as pointing to limits in the growth and development potential of science and technology (with a focus on United States and by extension to Western style economies and societies). But quite on the contrary, this is not at all a pessimistic book, a fact the author explains clearly in the Postscript: “... the rise and fall of growth are inevitable when we recognize that progress occurs more rapidly in some time intervals than in others” (p. 665). In order to receive the proper message we just have to take into account that the narrative is mostly from a historical perspective and history has by definition the habit of looking into the very long run.

Anyway, by comparing the glorious and hopeful past with the rather precarious present, the book gives an uneasy feeling that there is a sort of an end of history of progress (as we know it) that suggest a parallel with the end of history envisaged by Francis Fukuyama (Fukuyama, 1992), this time with reference not to socio-political systems but to the growth and development that science and technology can bring to us. Putting things in perspective (an in a more optimistic way) one can say that the main message of the book is that the existing growth and development models applied in the United States and in other developed countries in the past one hundred years have reached their limits and have to be replaced. Otherwise we have to assume low growth a serious social and economic disequilibria.

An explanation is still needed here. As a historian Robert Gordon is focusing on the human beings and the households. One may define its approach as anthropocentric as he speaks and analyzes economic growth but his main references regard the impact of science and technology (with all their economic implications) on human life at all levels. And from this perspective science and technology have already given us all the main benefits of modern life. In his own words, also in the Postscript, the idea mentioned above is clearly presented:” American growth slowed down after 1970 not because inventors had lost their spark or were devoid of new ideas, but because the basic elements of a modern standard of living had by then already been achieved along so many dimensions, including food, clothing, housing, transportation, entertainment, communication, health, and working conditions” (p. 665). These clarifications presented in the Postscript to the book seem to reflect the need of the author to double check how the readers understood his message. And the precaution is justified as many people still believe that the existing growth and development models are definitive, objective and perpetual, while growth (in a quantitative sense) is a natural state of economy and society and may continue for an indefinite length of time.

The implicit idea to be found in the title of the book (“*The Rise and Fall of American Growth*”) and also in its content is that we already have the modern homes (with running water and sewage (defined by Robert Gordon: “*water flows in and flows out: the greatest revolution of all*”, p. 134), electricity, air conditioning, refrigerators, television, and the rest of appliances), we already have modern factories and offices (with machine tools, computers and all sorts of tools and equipment), we already have modern means of transport (automobiles, railways, ships and planes) and modern education and health care, all brought about by the “*great inventions*” of the “*special century*” (pag.17) .

Robert Gordon’s hypothesis is that as long as our way of life is organized according to the present paradigm any new innovations will just bring marginal benefits and marginal effects on economic growth. What he never states clearly in the book is that his predicted long term fall in growth is valid if and only if we as civilization do not change our life and work paradigm. But the terms of the hypothesis are very clear and even incites to ask yourself: in case of a different life and work paradigm, what will happen to growth? And after all, what growth will mean in the new context? The author is not giving an answer regarding new models or paradigms for growth and development, he just points out that high productivity increases and hence high economic growth are not to be expected in the foreseeable future, at least as long as economy and society are organized in the same way. Therefore, in its essence, the book is rather a copiously annotated history about the growth and development paradigm that characterized the Western world for the past almost two centuries, the paradigm that has been defined by the so-called linear growth model in which the future (be it at the time horizon of one year, ten years or one hundred years) is better than the past and better means more, bigger, newer and so on.

By pointing to the end of this model, Robert Gordon is, in fact, asking indirectly what model comes next, taking into account all technological and scientific changes that have accumulated in the past one hundred years. Looking ahead for the next 25 years Robert Gordon is contemplating solutions not for a revolutionary new model of economy and society, maybe not even for an evolutionary one. He proposes some amendments to the existing situation in US, with reference to “greater equality of outcomes” (p. 670), “greater equality of opportunity” (p. 674), “demographic and fiscal headwinds” (p. 678). What he is trying to achieve by his proposals is a more stable and equitable society that generates more wealth but also more welfare for its citizens. A simple enumeration of the measures proposed as a cure for unfavorable trends in economy and society as well as for low growth rates highlights a common denominator – all measures imply the intervention of state in the economy: Tax System Progressivity, Minimum Wage, Public School Financing, Income-Contingent College Loans, Immigration, Tax Reform. His proposals seem feasible but we can only expect they will not be well received by the supporters of full free market mechanisms that militate for the reduction of the size and role of state in economy and society.

In trying to compare the impact of the inventions of the 1870–1940 period with the contemporary inventions Robert Gordon is using a yardstick which can be easily understood by anybody, namely the degree in which whatever technological changes are transforming our lives (presumably for the better). Using this yardstick he makes some very refined economic observations. **One of these observations** is that not all GDP increases are made equal in the sense that although the figures of GDP increase can be the same, the factors that determine them may influence human life in very different ways (Tyler Cowen, 2016). In this context, as an example, the increases of GDP determined by the introduction of automobiles, running water and sewage or antibiotics and vaccines (p. 507) influenced daily lives of millions of people (and even their life expectation) much more than the same increase of GDP determined by the sell of more luxury goods or by the generalization of color television. Another observation is that he refers in his analysis not only to the increase of the purchasing power but also to the decrease (almost to the point of elimination) of the difficult, hard and even dangerous work that most people had to do for earning a living since late 19th century until the end of World War II (Paul Krugman, 2016). By including in his analysis the work conditions both outside and inside the home Robert Gordon is consistent to his anthropocentric approach, he is looking not only at numbers (GDP, purchasing power or salary levels), but also to the quality and easiness of life (p.263). Taking such a perspective his demonstration is rather convincing. Because indeed the life of the majority of people was very different before and after the running water and sewage, combustion engine, cars, electricity, telephone, antibiotics and other discoveries that entered the lives of millions and millions of people after 1870. From daily rhythms of life to the way domestic activities were accomplished, from the meanings of distances and speeds to the ways in which production and trade were carried out, everything changed for the American people and, later on, for the people of other countries on all continents.

These statements are supported by Robert Gordon with compelling evidence. To give just an example: the price of cars declined in United States by 63 % between 1912 and 1930, while in the same time interval the percentage of US households that had access to a car increased from 2 % to 89.8% (p. 172-173). At the same time, the magnitude of these changes taking place in the United States had no parallel in the other developed countries of that time: in 1900 the US had 4 times more phones than Great Britain, 6 times more than Germany and 20 times more than France (p. 196), while in 1930 United States owned 78 % of all world cars.

As Robert Gordon noted, for United States the 1930s represented the most fruitful period in terms of number of innovations compared to the size of economy. This trend was maintained to a certain extent and under different internal and international circumstances during the World War II period and particularly afterwards, during the 1950s and 1960s so that in the after war period all American people with at least high school education had a safe job, a house and a safe perspective on retirement. It is worth mentioning that the chance of person in United States to graduate high school raised from 6 % in 1900 to almost 70 % in 1970. As a synthesis of all this, in one hundred years (defined by the author as “the special century”), from 1870 to 1970 life expectancy increased in the United States from 45 years to 72 years (pag.224).The turning point in this glorious period that started in the last three decades of the 19th century took place, according to Robert Gordon, in the early 1970s, once with (but not necessarily determined by) the oil shocks, the growing competition from the part of other developed countries and especially once with the full maturity of the industrial age and the finalization of the main characteristics of modern professional and personal life.

After the 1990s and especially after 2000 the growing inequality manifested in the American society as well as other dysfunctions have lead to a less optimistic present in which large parts of the population are confronted with unsecure jobs and housing, high and in many cases unaffordable costs for education and health care, an unsecure retirement perspective (from a financial point of view). All these current characteristics of the contemporary American society have determine Robert Gordon to warn its readers on the possibility that the young generation of today can be the first in American history that will not exceed the living standards of their parents. From a different perspective, reading his message in a positive note, we can understand that the solutions to today’s problems can not be found in the extrapolation of the trends and approaches of the 20th century and therefore the new generations should take the responsibility to find new solutions and put them together into a new growth and development paradigm.

While the first part of the book (chapters 2 to 9) presents a well documented interpretation of the way in which science and technology influenced and transformed for the better the life of the US people, the second part (chapters 10 to 15) deals in a rather unequal manner with the scientific and technological inventions after 1970s and especially after 2000 (The Economist, 2016). With reference to the contemporary period Robert Gordon is taking into account the implications of information technology, 3 D printing or internet. But his position is that these developments are not really transforming the life of the majority of people the way other technological breakthroughs did almost a hundred years ago. In this context it is difficult to argue to the fact that the capability to build self-driving cars is less important than the invention of cars in the first place, while the existence of modern housing however expensive and sophisticated is less relevant than the emergence of the “networked home” (p. 216), meaning the house connected to running water, sewage, gas, electricity and telephone.

And particularly Robert Gordon is not at all convinced that the current technological developments may restore the dynamics that made once United States great and provided a safe and fulfilling life for the majority of its citizens. Some critics pointed to the fact that present day technologies and their enormous potential were treated by Robert Gordon in a rather cursorily manner (Greenstein, 2016), not pondering enough about the exponential changes that interconnection of everything (like the Internet of Things) or artificial intelligence may bring to productivity, growth and human life itself.

What is interesting about Robert Gordon’s book is that in an era of heated political debates on various topics he points out to the objective world of science and technology and its impact on economy and society as a whole. At the same time, somehow indirectly and not in an explicit way, he induces to the reader the perception of a choice: we can either continue to perceive and organize the economy and society as we did in the past one hundred years and, as a result, we have to accept low growth rates and a decline of the living standards, or, we can redesign our models and adopt a new paradigm, with new values and new rules of the game.

What Robert Gordon says is that the existing and emerging technologies are amazing and marvelous but by themselves they are not changing our lives the way house plumbing meaning running water and sewage, motor vehicles and air travel, electricity and all sorts of appliances, penicillin and the polio vaccine, telephony

and television did half a century or more ago. At that time science and technology acted as engines of progress almost by themselves. Science and technology made discoveries and inventions and all we had to do in order to improve our lives and achieve economic growth was to apply them. Nowadays, in a very generous and dynamic scientific and technological environment the human factor is much more in charge than before for its destiny. Nowadays, from a scientific and technological point of view, it is more important what we do with what we have than what we have in the first place. We can only hope that better and more knowledge and information may lead to better decisions and to a better (meaning more sustainable and enriching) life for as many people as possible not only in United States but all over the world.

Analyzing the book *“The Rise and Fall of American Growth: The US Standard of Living since the Civil War”* and without diminishing in any way the brilliant historical account of the way in which science and technology influenced and shaped the American and, by extension, the Western economies and societies during the 1870 – 1970 period, one may find anyway some shortcomings of Robert Gordon’s analysis and discourse.

One shortcoming of his approach refers to the overlooking of the second (Satell, 2016) and even third order effects of discoveries and inventions with reference to the contemporary ones. Second and multiple order effects are extremely important, particularly in case of complex systems like economies or societies, not to mention the globalized economy. As each action has one or several consequences, each of these consequences have, in their turn, other consequences (Kaufman, 2012). And these second or third or multiple order effects may generate in time dynamics that were not foreseen initially. To give just an example, the GPS, smartphones, Internet and social networks have had as a first order effect the ability to position oneself wherever on the planet and respectively the ability to communicate, access information and exchange messages on a massive scale. But as a second order effect all these inventions determined the creation of the *sharing economy*, which, in turn, allowed the emergence of *“unicorn”*¹ companies like Uber and Airbnb that exploded from zero in 2009 to over 68 billion US dollars (Uber) and 30 billion US dollars (Airbnb) in July 2016. It is true that up to now the Internet, social networks, big data, 3 D printing, smartphones or the sharing economy have not changed our lives and have not increased economic growth the way the inventions of 1870 – 1940 era did. But, on the one hand the time elapsed since their emergence is not that long and some of them are just coming of age and starting to bear fruits. And, on the other hand, as mentioned above, the second, third and multiple order effects generated by the interactions and trickle down effects of all these innovations can be multiple orders of magnitude larger than what we have seen up to now.

A **second** shortcoming refers to the overlooking of some present day scientific and technological breakthroughs that may change in a fundamental way the human existence. Among them, genomics, nanotechnology and robotics (Satell, 2016). One may argue that these technologies will represent quite soon turning points in humankind history because: **genomics** will allow the editing of DNA and therefore will allow the curing of all diseases and even creating new species while **nanotechnology** will allow the design of entirely new materials (like quantum dots and graphene). As for **robotics**, they can solve the problem of skilled labor in developed countries, including the aging problem, but also the salaries and pension funds problem while they will also create an even bigger problem that will imply the need to rethink the whole economic and social mechanism – how to distribute money to the people so that they will be able to buy the goods and services produced by the robots. And if these aspects are not frightening enough one can add the “Singularity” theory of Ray Kurzweil, now chief scientist at Google, that estimated that around 2045 the artificial intelligence will be infinitely more powerful than human intelligence and humans themselves will transform themselves into different beings by means of genetic alterations, nanotechnology and artificial intelligence (Kurzweil, 2006).

If one remains in the logic of Robert Gordon book and at the same time takes into account these current scientific and technological breakthroughs we may say that the “great inventions” of the “special century” (1870 -1970) liberated humankind from “painful manual labor, household drudgery, darkness, isolation, and early death” (p. 17). But the current innovations may allow humankind to play God by editing DNA and creating new species, curing all diseases, augmenting human senses and extending life (maybe to the point of immortality) as well as designing totally new materials. Such an evolution will not contradict Robert Gordon because he indicated limits within the existing paradigm of social and economic life. An entirely new model will be definitely beyond the framework of analysis of his book.

¹ A “unicorn” is a start-up company, without a previous long term existence that has a market value of more than 1 billion US dollars. Investopedia at page <http://www.investopedia.com/terms/u/unicorn.asp>

For many reasons Robert Gordon's book is fascinating: because it offers a narrative of the birth and maturity of the Western style life, reminding us how life used to be before sewage, running water, electricity and household appliances, automobiles, telephony and antibiotics; because it demonstrates that for now (within the existing paradigm) we can just repair and maintain what have without expecting significant improvements; because opens the door of our imagination, directing our questions to "what next ?" and "what if ...?"

A concise and illustrative opinion on Robert Gordon's book was formulated by Paul Krugman who said: "...this is a book worth reading - a magisterial combination of deep technological history, vivid portraits of daily life over the past six generations and careful economic analysis. ... This book will challenge your views about the future; it will definitely transform how you see the past" (Krugman, 2016).

At the very end, after reading the book "The Rise and Fall of American Growth: The US Standard of Living since the Civil War" the reader may experience several feelings: the feeling of pride and gratitude for the achievements of the human race, achievements that we so often take for granted, but also the feeling of responsibility. Humankind, especially in the Western world has come a long way from a life of hard work and little hope, depending a lot on nature's elements to a life full of possibilities but maybe less clear and less optimistic about the years to come

The book is a great lesson and a remainder that a huge knowledge heritage is available from our predecessors, but the time has come for the new generations to redefine what sustainable growth and development mean. And maybe to also define a new paradigm for the social and economic life of the late first half of the 21st century.

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