Secular Stagnation: History and Reality

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Secular Stagnation:

- Before the Industrial Revolution nobody would have complained about secular stagnation --- stagnation was the norm.

- Growth, such as it was:
  - very slow in the LR
  - reversible and vulnerable
  - based mostly on Smithian effects and not much on technological progress

- The change that occurred after 1800 was a “phase transition” --- growth became the norm. “Hockeystick effect.”

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Why was there no sustained economic growth before the Industrial Revolution?

We can distinguish three types of phenomena

- (1) Demographic negative feedback (Malthusian)
- (2) Institutional negative feedback (predatory behavior, rent-seeking)
- (3) Low level of understanding of why the techniques in use actually worked.

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By the nineteenth century, all three of these obstacles were being overcome, albeit at different rates.

- (1)The Malthusian feedbacks weakened and then disappeared as first Europe and then the rest of the world underwent a fertility transition and birth rates plummeted. [moreover, productivity growth was sufficiently fast to offset diminishing returns to labor]
- (2) In many industrializing countries, rent-seeking declined in the nineteenth century. Predatory behavior was limited within the industrialized world for most of the time, although it was in many cases directed toward non-European nations.
- (3) The most dramatic developments occurred in the area of "useful knowledge" where science was increasingly able to "explain" existing techniques and generate better and new ones.

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So, armed with those three phenomena, can we make sense of our world and venture some --- very tentative and cautious --- predictions about the future?

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Population and Demography

While Malthusianism seems a hardy weed to eradicate, it seems that in our age the problem is *the reverse*: population is growing too slowly, as Alvin Hansen (1939) noted in his famous article introducing secular stagnation.

Moreover, because the slow growth is driven by low fertility (partially offset by rising life expectancy) the world population is ageing rapidly.

Globally, the old-age dependency ratio is expected to rise from 13 percent in 2015 to 38 percent by the end of the twenty-first century. Median population age is projected to rise between 2010 and 2050, in some places quite sharply , such as Germany (from 38 to 51), China (from 35 to 46) and S. Korea (from 38 to 53).

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Is this good or bad news? How bad is ageing?

From a macroeconomic point of view, aggregate demand will rise faster than aggregate supply, if current retirement ages are roughly maintained and dependency rates will rise. This mitigates concerns about secular stagnation driven by inadequate demand as in Summers (2016).

Will slow or zero population growth slow down investment? It seems more likely that it will change the *composition* of investment, toward medical care, tourism, and more home services for the elderly.

Moreover, the inevitable and crushing expenses of medical care and pensions will mean that government spending will have to increase, offsetting any shortfall of aggregate demand.

A serious concern would be that it *reduces the flexibility* of the labor force, because the capacity to re-skill is a negative function of age.

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On predatory behavior, the picture is more mixed

In international relations, it seems as if rich but small states have less to fear from larger but poorer neighbors.

The Kuwait 1991 invasion serves as an example. The international order will (hopefully) not allow this. Luxemburg and Singapore look fairly safe. But there is no guarantee that this will continue, and that western powers will continue to take this stand.

Moreover, we may face a world in which poor predatory nations with nuclear arms will engage in nuclear blackmail.

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Internal rent-seeking is equally ambiguous

It is not easy to assess if the world is getting more or less corrupt.

The world's economies can be seen to fall into three classes:

1. Nations where corruption is very minor (Norway, New Zealand, Singapore).
2. Countries where corruption is pervasive, but where it does not seem to seriously affect the rate of economic growth by much (China, India, Turkey, Illinois)
3. Countries where corruption is so predatory and brazen that it threatens property rights and contract enforcement, and thus weakens entrepreneurship, investment, and innovation (Nigeria, Egypt, Russia).

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What we should hope for is that countries in class (3) will gradually move to class (2). This has happened in Ruanda and Romania, and is hopefully happening elsewhere.

Will globalization reduce corruption? Big question. One hope is that joining transnational organizations and trade agreements will reduce corruption and increase institutional quality. The evidence for that is rather mixed in the EU.

Indeed, in the US there is a marked difference between states in the levels of corruption on the state level.

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What is the outlook for technology?

Techno-pessimism comes in two flavors.

- One is Gordon's technological slow-down hypothesis, that maintains that most of what could be invented has been, and that future innovation will have a much more limited effect on humankind (and will be too weak to forestall the other headwinds he foresees).
- The other is the apocalyptic hypothesis that foresees a world in which people, in some way or another, have been replaced and displaced by machines, mostly some combination of malevolent robots, artificial intelligence run amok, and more sinister ways in which intelligent non-humans of our own creation will create some hazy form of dystopia.

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The good news is that those pessimistic predictions cannot *both* be right.

The even better news is that they can both be wrong.

Leaving aside the more speculative predictions of various machines-eat-men dystopias, I will discuss briefly the concern that future technological progress will be slower and less significant than in the past.

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Here is how to think about it:

Against the concern that in the past century the “low-hanging fruits have been picked” and that innovation is getting increasingly difficult, it can be argued that science provides us with taller and taller ladders.

But that is not the entire story. Technology and science co-evolve in a powerful positive feedback relationship. Science advances when it *has better tools* and more powerful *incentives.*

Seventeenth century science in Europe blossomed in large part because it produced new instruments, most famously the telescope and the vacuum pump. The germ theory was discovered through improved microscopes and lab techniques. Molecular genetics depended crucially on x-ray crystallography.

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So, one way to make reasonable predictions about the future of technological progress is this:

What kind of tools does science have today to work with?

The answer is: the new tools are so vastly more powerful that they make everything before look like toys and some of them boggle the mind.

Just from this point of view, one can predict enormous progress even if it cannot be known what it will look like.

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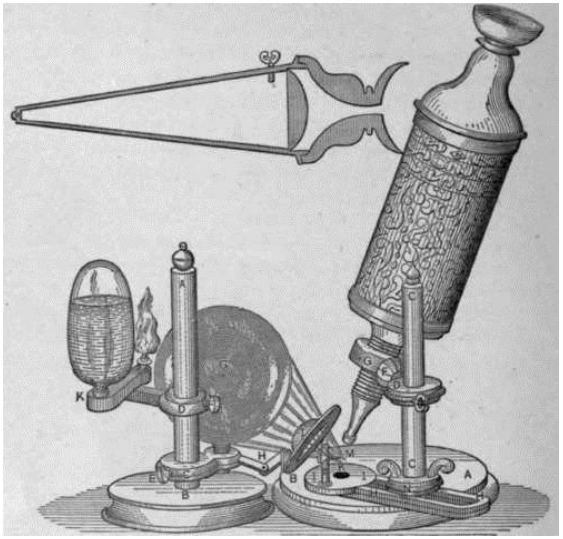
Instruments of the seventeenth century scientific revolution

Galileo's Telescope



Hooke's microscope

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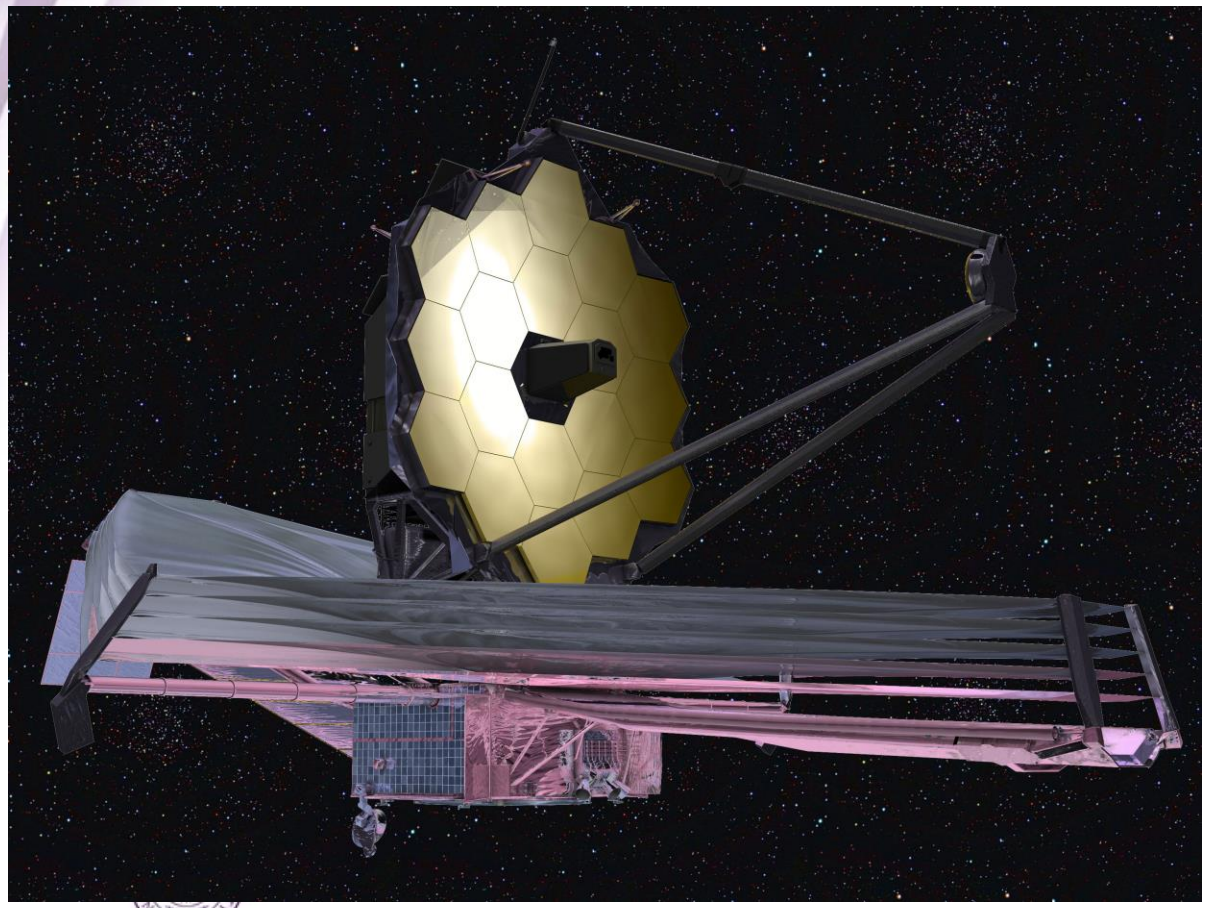
Compare Galileo's telescope with this:



James Webb space telescope, planned for Oct. 2018

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Neither did Louis Pasteur have this:

Betzig-Hell type of stimulated emission depletion (STED) microscope

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But we have so much more:

We have *lasers*, one of the most powerful scientific tools humans have ever designed.

Photograph of a self-contained prototype quantum cascade laser pointer realized at CQD,

Northwestern University Center for Quantum Devices.

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A few examples of the uses of this tool in scientific research

- Laser-induced breakdown spectroscopy (LIBS)
- MALDI: Matrix-assisted laser desorption/ionization (used in mass spectrometry in for instance analytical protein chemistry)
- Particularly useful in biochemistry (e.g. photochemistry) and very high level magnification microscopes..
- Laser ablation (used to study e.g. the neural system by removing specific cells).
- Laser based *lidar* (Light raDAR) technology has application in geology, seismology, remote sensing, and atmospheric physics.
- Laser annealing (in material science, esp. metals).
- Laser interferometers used in trying to detect *gravitational waves*, one of the holy grails of modern physics.
- And, the holiest grail of all: research in controlled *nuclear fusion*. So far, no breakthrough.

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And then, of course, computers

- We have computers that allow us to store, access, and analyze unimaginably large database (forget “big data” --- think “mega-data”). This opens entirely new areas of research in the search for empirical regularities through “deep learning.”

- Computers also allow us to compute and simulate highly complex physical, ecological, and biological relations we never thought we could solve. We have *entirely new scientific disciplines* based on such tools like “computational chemistry” and “computational biology.” These have opened new horizons in material science, the dynamics of turbulence, solid state physics, and more. Quantum computing promises to do this a lot better.

- With all the hype around AI, people rarely mention its potential as a research tool, including literature searches, organizing results, predicting likely dead-ends, and so on. We have developed a new discipline called “Data Science,” vastly augmented by “deep learning techniques” which can be used for many purposes:

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So where do the pessimists go wrong?

- Where Gordon and his fellow doomsters get it wrong when they downplay the future effect of digital technology on the economy: they tend to assess computers' *direct* effects on productivity, but not their *indirect* effects on output via their effect on research and scientific progress.

- They also exaggerate the relative importance of innovation in the digital economy.

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More than digital:

Freeman Dyson feels, with many others, that if the 20th century was "the age of physics," the 21st "may be the age of biology."

We are developing tools that can help us understand, analyze, and manipulate living beings at a level we never thought possible. Molecular and structural biology are providing vast domains for progress, for medicine, agriculture, and hopefully ecology.

The new DNA-editing techniques and so-called "gene drive" (CRISPR-Cas9) will make it possible to design plants and animals to meet our specifications--- including those that will adapt to a changing climate (to say nothing of their potential for medicine).

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New manufacturing techniques may portend a true new Industrial Revolution

Thanks to better science, the exciting frontiers may be in non-digital technologies: material science, and nanoscopic engineering. In fact, these techniques are so revolutionary and innovative that they scare a lot of very smart people about both their intended and unintended consequences --- including their effects on the nature of work.

As a result of these advances, there could be a complete overhaul of manufacturing, known as *additive* manufacturing (sometimes also referred to as 3-D printing). As software improves and materials are become more malleable, this could change industry in a way that would truly merit the term "3rd Industrial Revolution."

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Of course, that raised the question of what happens to manufacturing (and other) jobs

Will the dystopian doomsters turn out to be right and people be reduced to vapid, idle, and useless drones as Kurt Vonnegut predicted in 1974?

This is a conversation worth having, but three brief points are worth making:

1. In past societies there have always existed leisure classes (rich aristocrats, priests,land-owning or slave-owning oligarchies). They never complained about not having to perform back-breaking sweaty work in the fields. Instead, they hunted, wrote poetry, and killed each other.
2. Technological progress in leisure technology has been very rapid in the past century, and those who do not work have plenty to fill their days (Hurst et al., 2017)
3. If work conveys positive utility, people will work without expecting to be paid (more than a quarter of Americans carry out some volunteer work).

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In the limit, we may approach an economy in which the only people who work are the people who *want to* work.

This is already the case to some extent for the US population over 65, where labor force participation rates have gone up (the only age bracket for which it is true).

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Conclusions

- Secular stagnation was a defining feature of most of recorded history, and has turned into sustained growth only in recent centuries.
- An examination of what brought that change about suggests that the likelihood of reverting to a world of stasis in the foreseeable future is not high.
- All the same, there are legitimate concerns about the sustainability of open institutions, free trade and mobility, and effective governance that are favorable to growth, and whether they will keep pace with technological capabilities.
- Keeping up a high level of innovation will depend on ever-improving research tools and equipment, which could radically change the nature of production.

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- Thank you

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