



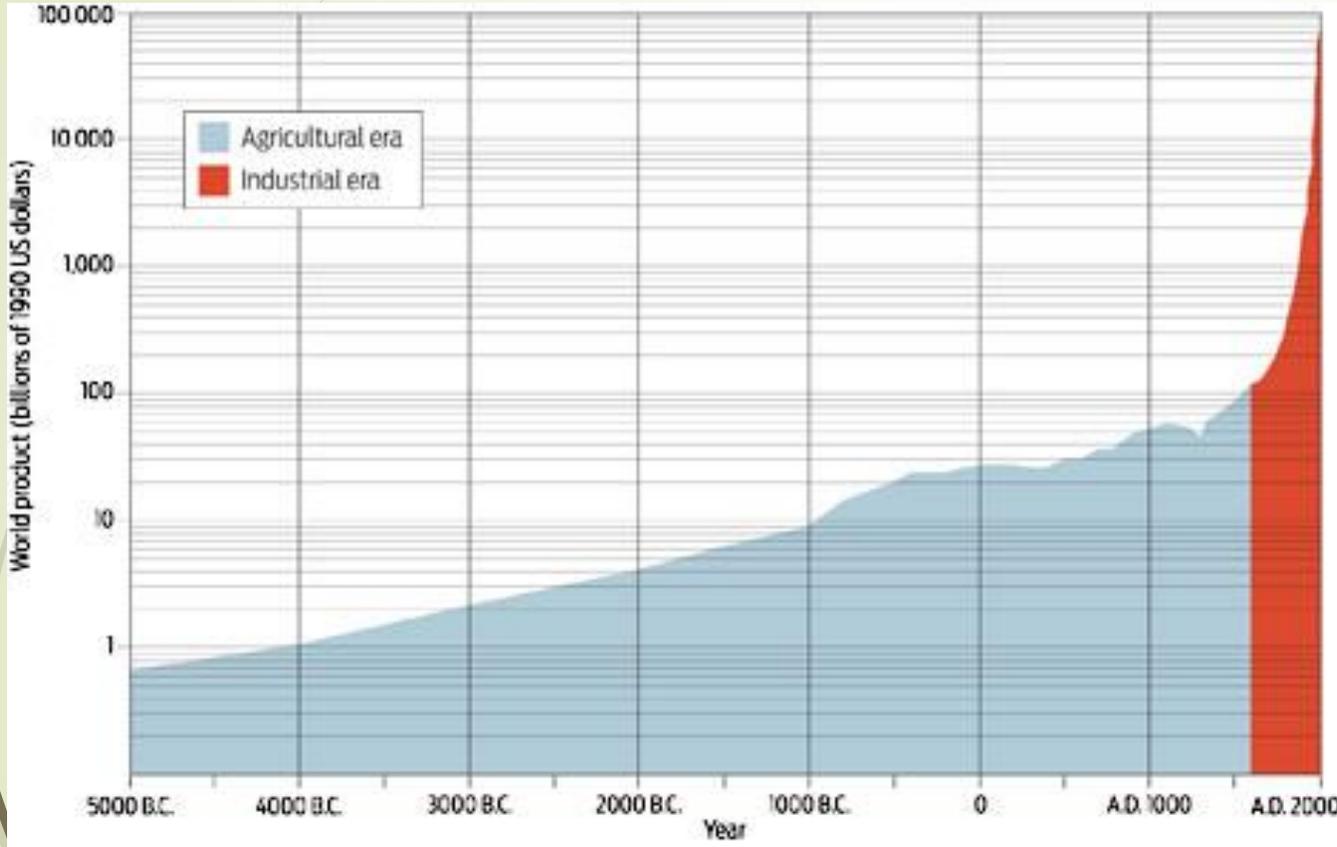
Artificial Intelligence and the Economy

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World GDP: 5000BC – 2000AD



Source: J.B. De Long

The transition between agriculture and industrialization was a singular event

The doubling time for world output changed from every 900 years to every 15 years

Could a new singularity be imminent?

Singularitans claim it could occur any time between 2045 - 2140



Artificial Intelligence and the Singularity

- What could cause a singularity?
- It must be something that affects most of the economy
 - Biotechnology?
 - Telecommunications?
 - Nanotechnology?
- The only candidate is **artificial intelligence**, because it could drastically affect the productivity of the entire labor force.



Artificial Intelligence and the Singularity

- What is intelligence? Ability to learn, reason, solve problems, perceive, comprehend language, and adapt behavior to fit new circumstances
 - Self enhancing Artificial Intelligence can improve these capabilities on its own.
 - The capability of biological intelligence is fixed, but that of artificial intelligence is growing exponentially
 - Consider a scenario in which AI technology advances quickly
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What are the obstacles to new advances in AI?

- ▶ Knowledge burden/ information overload
 - ▶ Human resistance to/ fear of change
 - ▶ Motivation to innovate may decrease
 - ▶ Challenges of coordination
 - ▶ Economic incentives to slow down innovation
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- ▶ Nonetheless, let us imagine a future in which innovations in AI advance and diffuse into the economy



Specific Technologies that can be expected

- ▶ Intelligent computers
- ▶ Human augmentation with nanobots and Brain-Computer-Interface
- ▶ Robots
- ▶ Whole brain emulation/ mind uploading

- ▶ Enabling precursor technologies:
 - ▶ Biotechnology
 - ▶ Nanotechnology
 - ▶ Robotics



Implications



- **ROBO-SAPIENS:** No clear distinction between human and machine/ a human-machine civilization
- **METHUSELARITY:** great increases in lifespan
- Higher productivity/ lower costs of production
- Robot labor throughout the economy
- New ethical issues:
 - Threatening/friendly AI
 - Machine rights



Economic Analysis

- ▶ Spectrum of tasks that can be ranked by how good humans (possibly augmented ones) perform compared to robots.
- ▶ No matter how productive robots become, human labor would still be used.
 - ▶ **Luddite fallacy:** The belief that labor saving technologies would reduce the demand for labor
- ▶ **Moravec's paradox:** high level reasoning is easy for computers, sensorimotor skills are hard.
 - ▶ Steven Pinker writes "... it will be the stock market analysts and petrochemical engineers that are in danger of being replaced by machines. The gardeners, receptionists and cooks are secure in their jobs for decades to come".



What about prices and wages?

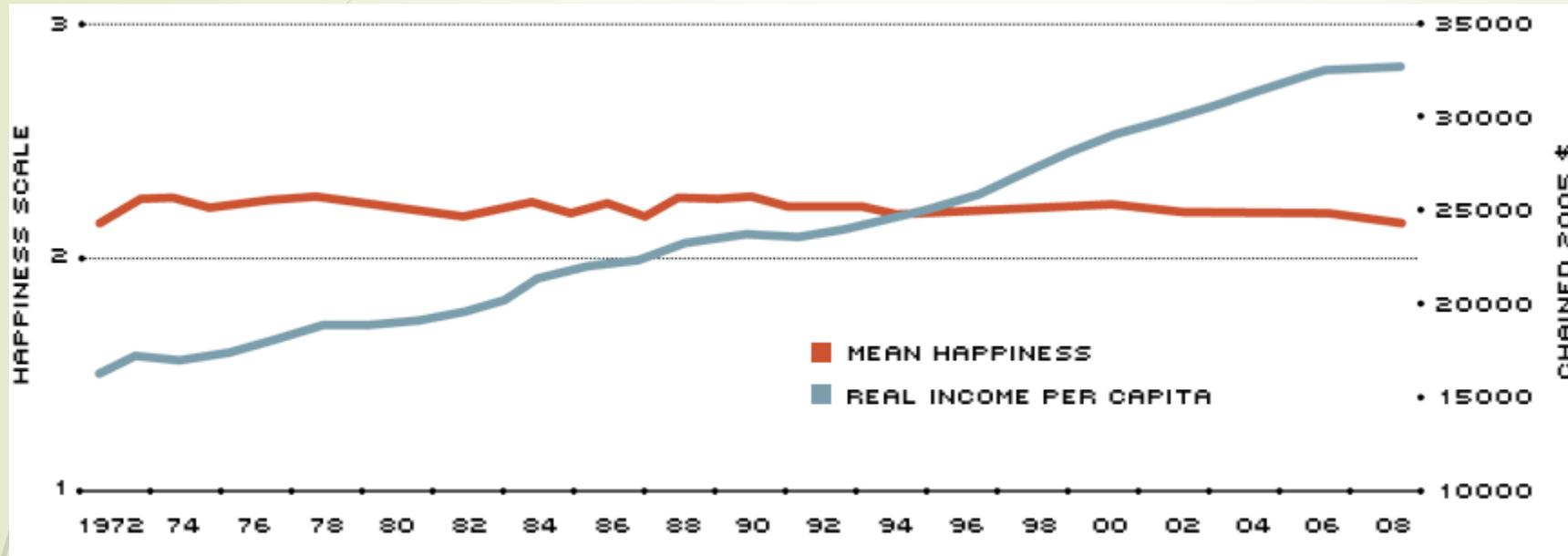
- ▶ Prices will be much lower because of greater efficiency and the average person will be able to consume more
- ▶ **Iron Law of Wages:** If new labor can always be supplied, wages will eventually equal the cost of subsistence of the labor
 - ▶ Robot wages will equal the cost of keeping the robots running
- ▶ Human wages will depend on whether AI makes you more or less valuable in a world with robot labor
- ▶ It also depends on how strong preferences are for human labor
 - ▶ Rich people may prefer to be served by natural humans
 - ▶ Clients may prefer human sales people and service personnel



Economics of Methuselararity

- ▶ Currently, life expectancy is increasing by .3 years every year.
- ▶ If this factor reaches 1, **longevity escape velocity (LEV)** will be reached. The longer you have lived, the longer you will live
- ▶ Only modest increases in medical technology are required to achieve increases
 - ▶ Smart toilets, databases with your DNA, Organ growth and replacement
- ▶ Aubrey de Grey claims that the first 1000 year old will be only 20 years (!) younger than the first 150 year old
- ▶ Most deaths will be caused by accidents or catastrophic events
- ▶ Percentage of adults working will increase and improve the dependency ratio
- ▶ No retirement, but rather multiple careers
- ▶ Increases in life expectancy have greatly increased income historically

Will AI increase happiness?



Historically, improvement in income over time has not improved average happiness (this assertion is disputed)

If AI increases income inequality, it may actually reduce average happiness

Artificial happiness, created pharmacologically, or cosmetically, has had mixed success.



Thank you

