

# Technology, Societal Well-being and Inequality

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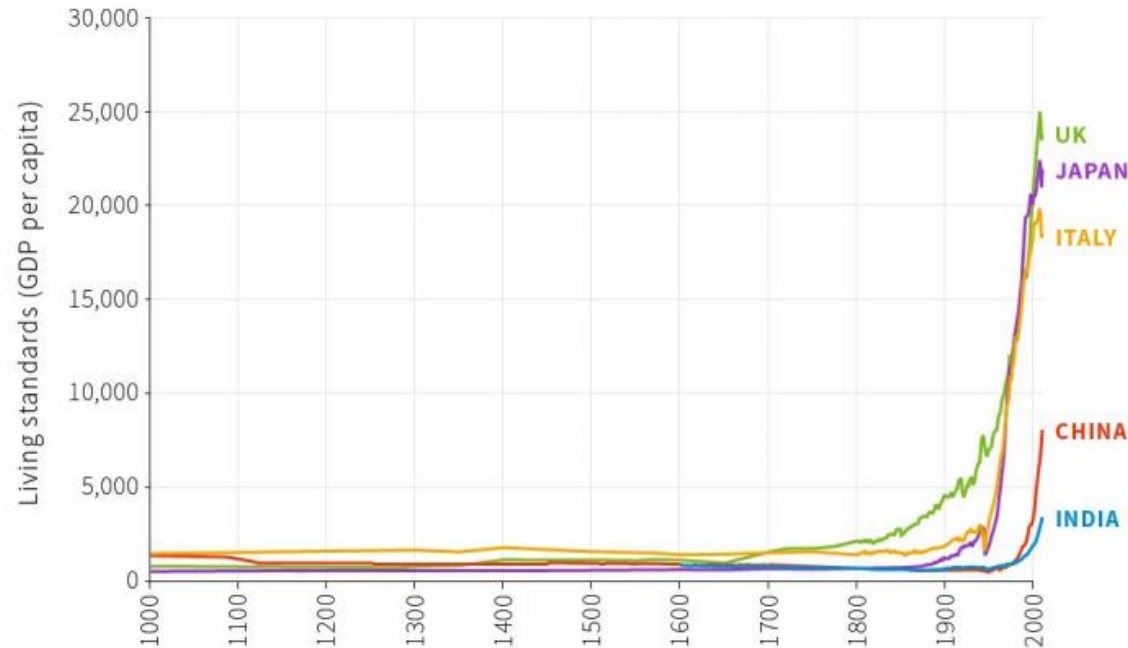
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# I. On the importance of creating a learning society

- The transformation to “learning societies” that occurred around 1800 for Western economies, and more recently for those in Asia, appears to have had a far, far greater impact on human well-being than improvements in allocative efficiency or resource accumulation.
  - For hundreds of years, standards of living had remained essentially unchanged

# Historical living standards



Source: INET

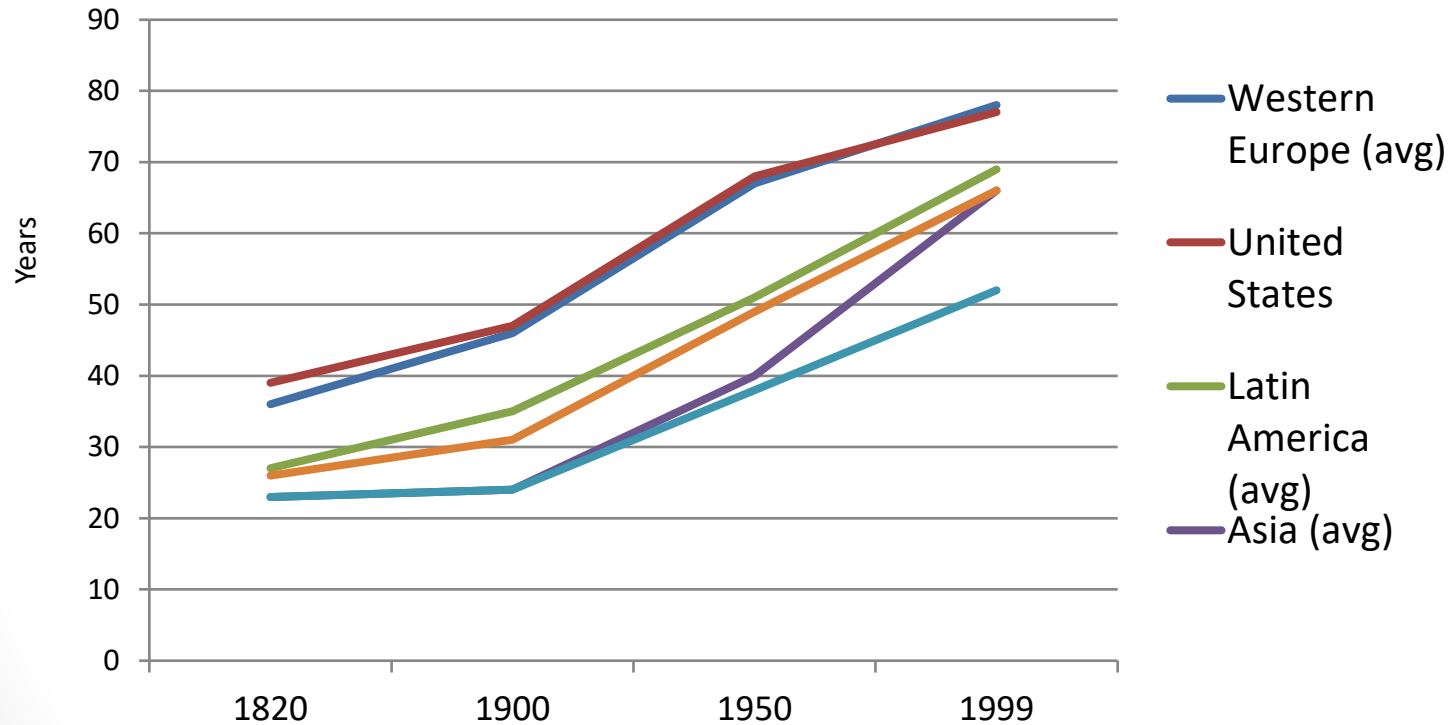
# Real wages of London craftsmen, 1200-2000



Figure 3. Real wages over seven centuries: craftsman (skilled worker) in London (1264-2001).

Source: INET

# Improvements in life expectancy since 1820



Data are estimates from A. Maddison, 2001, "The World Economy: A Millennial Perspective," OECD.

# What caused this seemingly sudden change?

- The enlightenment—A CHANGE IN MINDSET
  - Questioning authority
  - Recognizing change was possible
  - Requiring reassessment of how we know “truth” and of how we organize society
- The scientific method provided a systemic way of figuring out how to improve productivity
  - Getting more outputs from given input
- Social organization (rule of law, new institutions) allowed cooperation among larger numbers of people—increasing the extent of the market
- Key role for our research and educational institutions

# Welfare economics of innovation

- **Standard theory about efficiency of markets has nothing to say about the efficiency of markets in innovation**
- **There is no general theory asserting that markets are in fact efficient in the allocation of resources to innovation**
  - The level of investment in R & D
  - The direction of investment (kind of research)
  - The choice of research strategies
  - Of course, if there are other market failures (environmental prices are wrong), then the direction of innovation will reflect these other market failures
    - Insufficient incentives to economize on resources, protect the environment

# Implication: a key role for government

- Quite the contrary: presumption that the market is inefficient
  - Disparity between private and social returns
    - Positive externalities—learning spillovers
  - Public good nature of knowledge
  - Impossibility of appropriating full social returns
  - But some of private benefits represent “rents” (like monopoly profits)
- Strong presumption that the market will not allocate enough resources to innovation and learning, and what resources are allocated are often allocated in the wrong direction
  - Underinvestment in basic research
  - Government financial support is necessary



# The big concern

- **Growth of labor-replacing robots will lead to even more inequality and unemployment**
  - Machines have long been stronger than humans, better able to do many physical jobs
  - Computers are better at processing large amounts of information
  - AI means that robots may even be better at learning
  - Extent to which they can replace or outperform humans in immediate future uncertain—large variance in estimates
  - But if they do, demand for labor will be reduced, and real wages of workers (especially unskilled workers) will fall

# Further problems

- Problems exacerbated by growth of monopoly power of technology companies
  - And their ability to avoid paying taxes
  - Overall share of labor is decreasing
- Firms choose wrong direction of technology
  - Should be resource (carbon) saving
  - Instead is unskilled-labor saving
    - Contributing to unemployment and increasing inequality

# Socially unproductive innovations

- Some innovations are directed at increasing exploitation (increasing market power, extending its reach and duration) or increasing “rents” in other ways
  - Examples: high-frequency trading; markets focusing on unskilled labor replacing innovation, even when shadow price of labor is low, ignoring importance of carbon innovation
  - Innovation in contracts that allow airline reservation companies and credit card companies to earn excessive profits
  - Innovation in drug companies that allow them to “evergreen” patents—extending their market power
  - Using AI to exploit consumers
    - Undermining the basis of the efficiency of the market economy
- All of these innovations increase inequality

# But this is not inevitable

Alternative perspective: with appropriate government actions, there can be more productive innovations and we can ensure that innovation results in greater equality

- We could *redirect* innovation
  - Innovation could be labor-augmenting (IA: intelligence assisting), increasing productivities of large proportion of population, raising wages
  - Innovation could be more directed at addressing major problems—like climate change
    - Better climate regulations, pricing carbon
  - “Rent-seeking” innovation could be discouraged
    - Regulations and taxes that discourage rent-seeking, exploitation, encourage competition
    - Strong competition laws, strongly enforced
    - Schumpeter argued that one need not worry about monopoly power—competition to be the innovator-monopolist sufficed; monopoly would be temporary
    - Economic theory has explained why Schumpeter was wrong: monopolies can persist, limit and distort the innovation process

# Ensuring that everyone benefits from innovation

- Innovation makes society more productive
  - So **everyone could be made better off**, with appropriate redistributions and rules
    - Progressive taxation
      - Ensuring that technology companies pay tax, rich individuals don't avoid or evade taxes
    - Intellectual property rights that ensure the better sharing of the benefits of innovation
      - Underlying most advances is basic research, financed by the government
  - Much of the increase in inequality associated with innovation is rents, and taxing these rents is non-distortionary
    - The increase in the “effective labor supply” by human-replacing robots not only lowers wages, but increases the return to capital
    - An increase in returns to capital that was not “earned”

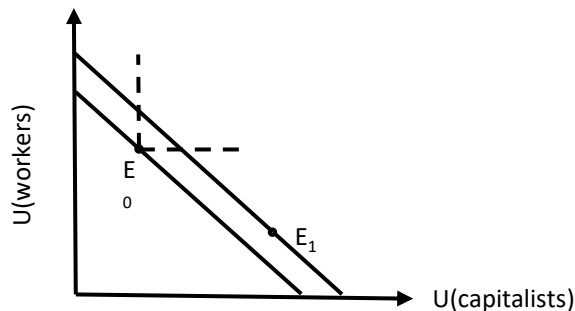
# Key role of education

- We can supply more individuals with the skills needed by modern technology
  - Taking advantage of modern technology to reach more individuals and to provide them with more tailored education experience
  - Design of education system crucial
    - In US and some other countries, education system is “regressive” and becoming increasingly so
    - Key part of the intergenerational transfer of advantage and disadvantage

# Technological possibilities and utility

Consider arrival of a new technology that replaces workers.  
Would their standard of living *necessarily* collapse?

1) If (i) the world is 1<sup>st</sup>-best and (ii) redistribution is *costless*,  
the utility possibilities frontier (UPF) moves out (even if competitive  
equilibrium wage decreases):

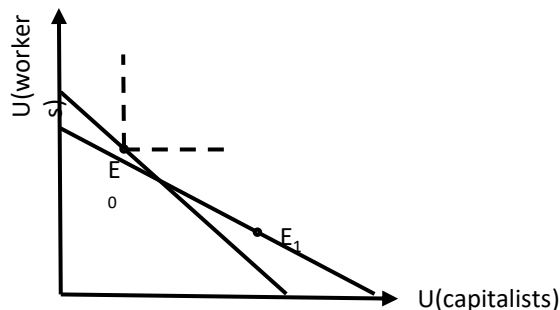


→ Redistribution can ensure that everyone is better off

# Technological possibilities and utility

Consider arrival of a new technology that replaces workers.  
Would their standard of living *necessarily* collapse?

2) If (i) the world is 1<sup>st</sup>-best but (ii) redistribution is *limited*, the *constrained* utility possibilities frontier (UPF) may not lie outside the original schedule:



→ Limiting technological change may be desirable for workers



# Technological possibilities and utility

More generally: the 1<sup>st</sup>-best UPF is the outer envelope of all possible constrained UPFs, which reflect all possible institutional regimes, e.g.:

- explicit redistribution systems
- intellectual property regimes
- market arrangements (e.g. market power)
- social norms (e.g. about charity or social equity)

→ changing any of these institutions may improve workers' welfare

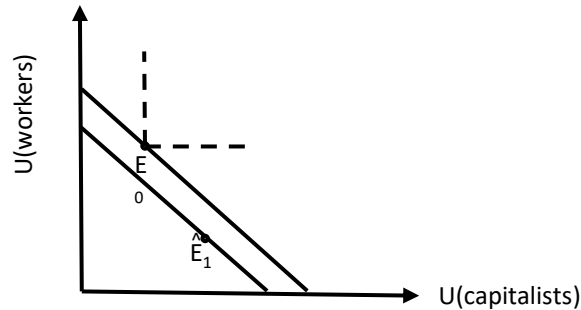
→ If redistributions limited, may have to rely more on other institutional changes

→ Limits on IP limit rents that accrue to innovators; may also limit pace of innovation

# Technological possibilities and utility

Consider arrival of a new technology that replaces workers.  
Would their standard of living *necessarily* collapse?

3) If the world is *not 1<sup>st</sup>-best*, the utility possibilities frontier may move inwards (even with costless distribution):



→ Limiting technological change may again be desirable

# How to help ensure evolution of technology is likely to be welfare-increasing

- Economy will be evolving towards service sector economy
- Among key service sectors are education, health, and other public services
- Value of those services is largely socially determined—not “just” a market process
- If we value those services highly—pay good wages, provide good working conditions, and create sufficient number of jobs—that will limit growth in market income inequality
  - Including jobs with limited skill requirements
  - Higher pay will result in such jobs having higher “respect”
  - Private sector wages will follow public sector wages
  - May need also to provide wage subsidy for low-wage jobs, to encourage demand for such jobs and increase wages

# Theory of induced innovation

- Relative costs of different factors affect incentives for direction of innovation
- **Markets on their own engage in excessive investment in labor-saving innovations**
  - **Resulting in too high a level of unemployment, too low wages**
- **Example of macroeconomic externality**
  - Resulting in lower wages and higher unemployment
- **Policies can affect relative costs of different factors**
  - Low interest rates/cost of capital makes labor relatively expensive
  - Recent monetary policies may thus have encouraged labor-saving innovation
  - Leading to more inequality
  - And in the medium term, making the problem of achieving full employment even more difficult
    - May be trade-off between unemployment today and unemployment later

# Innovation, employment policy, and inequality

- **Wages affect evolution of productivity**
  - Wage compression policies of Scandinavia lead to increased productivity of unskilled workers (unskilled bias t.c.)
  - Minimum wages may have similar effects
  - Puts additional burden of fiscal and monetary policy to maintain full employment
- **Increasing carbon price may shift innovation towards those which save the planet**
- **May be desirable to have a tax on robots** (more generally, on labor-saving innovations) to help internalize externality

# Adjustment costs

- Some of inequality that results from innovation is related to adjustment
- Workers who have been replaced by machines often cannot easily find jobs elsewhere
  - Example of structural transformation
  - Markets on their own don't manage structural transformations well
    - One interpretation of the Great Depression was that it was the result of the market failure in transitioning from agriculture to manufacturing
    - The result of rapid innovation in agriculture, which greatly reduced the need for agricultural workers
  - Those who have lost their jobs don't have resources to make investments to change jobs
    - Problem exacerbated if they have to move
    - Helps explain geographical pattern of suffering from innovation
    - Which in turn has political consequence

# Three critical responses

- General education: those with good general education are more able to switch jobs
- Active labor market policies: governments have to help with retraining and reeducation
  - In some countries, such policies have proven effective
- Industrial policies
  - To create jobs using the skills of the available labor force
  - Place-based policies—recognizing that geography matters, individuals are not perfectly mobile, and that the social capital that has been created in particular communities is an important asset that should not be wasted

# The need for a reinvigorated 21<sup>st</sup> century welfare state

- All of these policies are part of a reinvigorated 21<sup>st</sup> century welfare state
- Which goes beyond social protection
- And includes making investments in people and places when they don't have the resources to make those investments themselves
- Recognizes importance of imperfections of capital markets
- Together, these policies are critical in ensuring that innovation results in shared prosperity



# Concluding remarks

- Advances in technology can (and have) lead to an increase in inequality
- But this is not inevitable: it represents a failure of policy
- Advances in science and technology represent the reason that living standards today are so much higher than they were two centuries ago
- The increased productivity means that everyone can be made better off
- But markets—left to themselves—may mean that many, even a majority, can be worse off
- There are policies that can ensure that advances in science and technology are the blessing that they should be
- The problem is one of politics: can we, and will we, adopt the policies that ensure that we can achieve shared prosperity?