International Institute for Applied Systems Analysis
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Probing into the nexus of medical progress, ageing, and health expenditure

Michael Kuhn

Economic Frontiers Program

International Institute for Applied Systems Analysis

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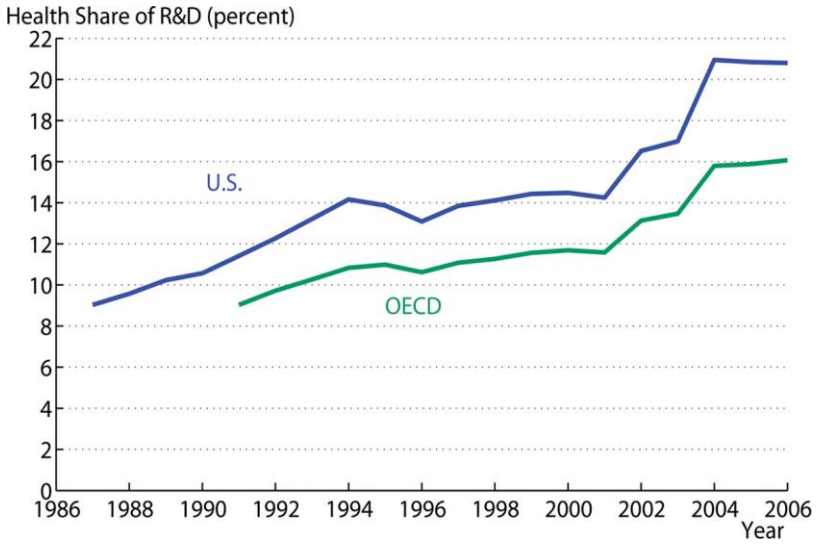
The nexus



Charles I. Jones, *Life and Growth*. *Journal of Political Economy* 2016 124:539-578.
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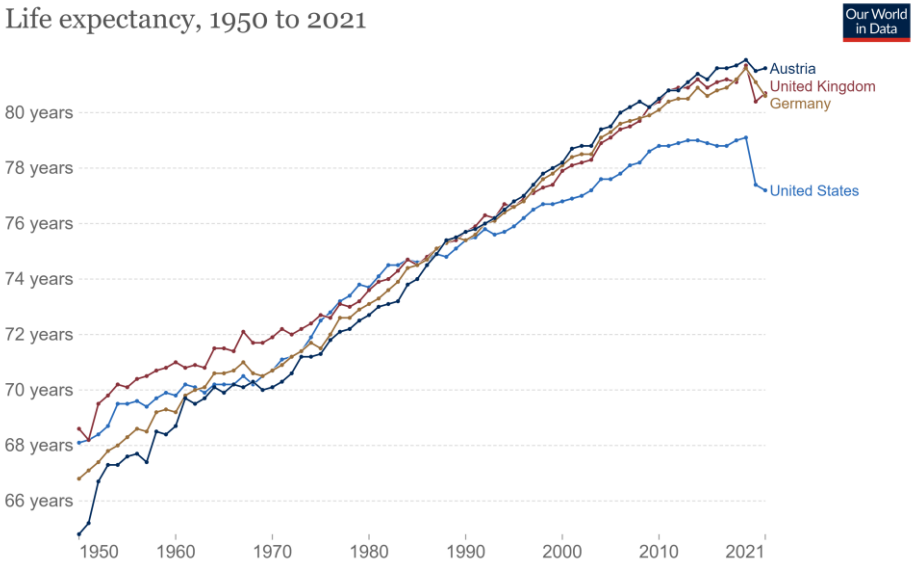

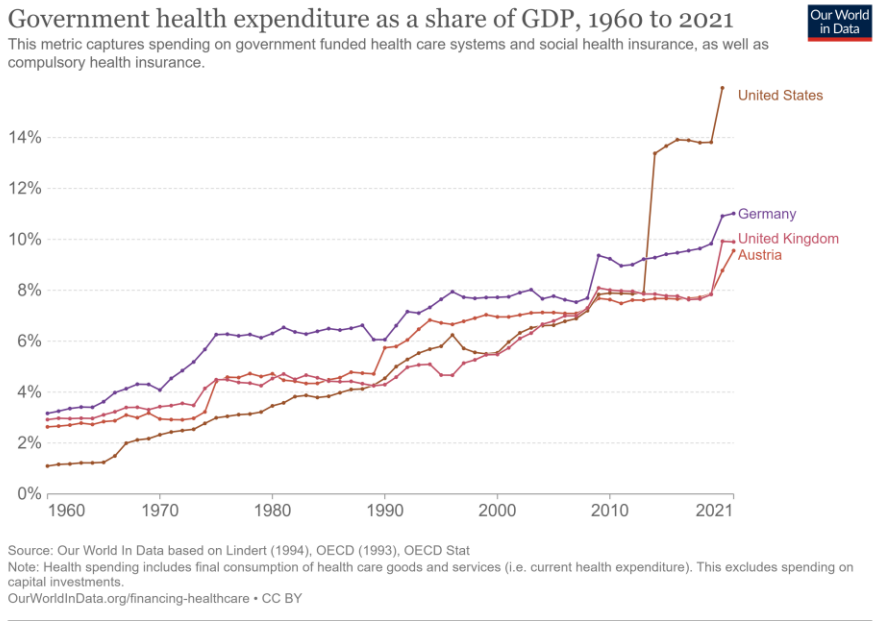

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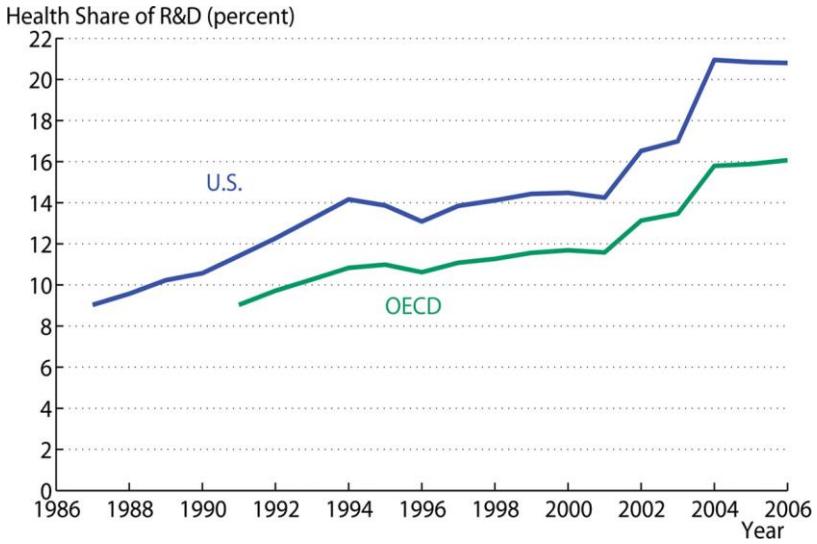

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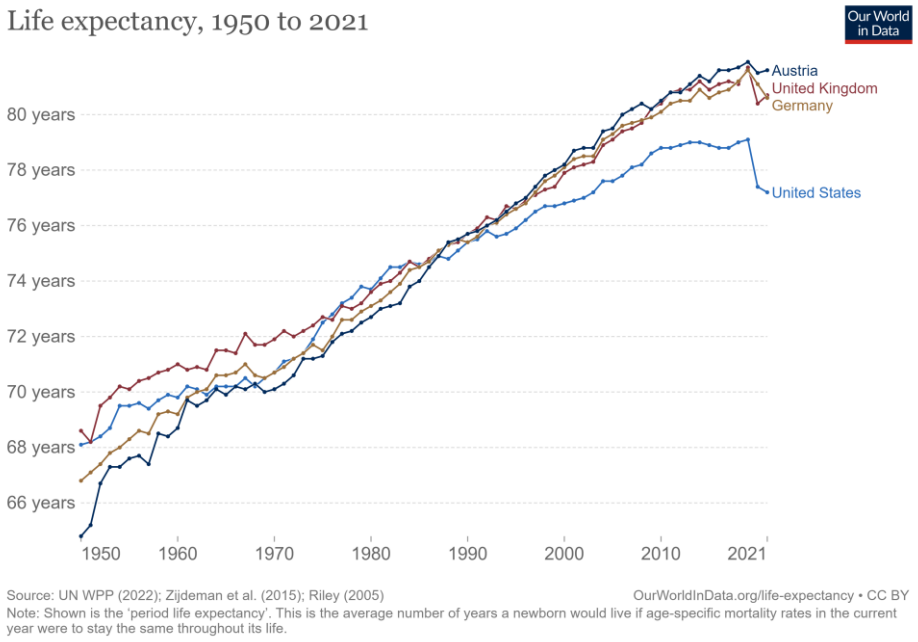

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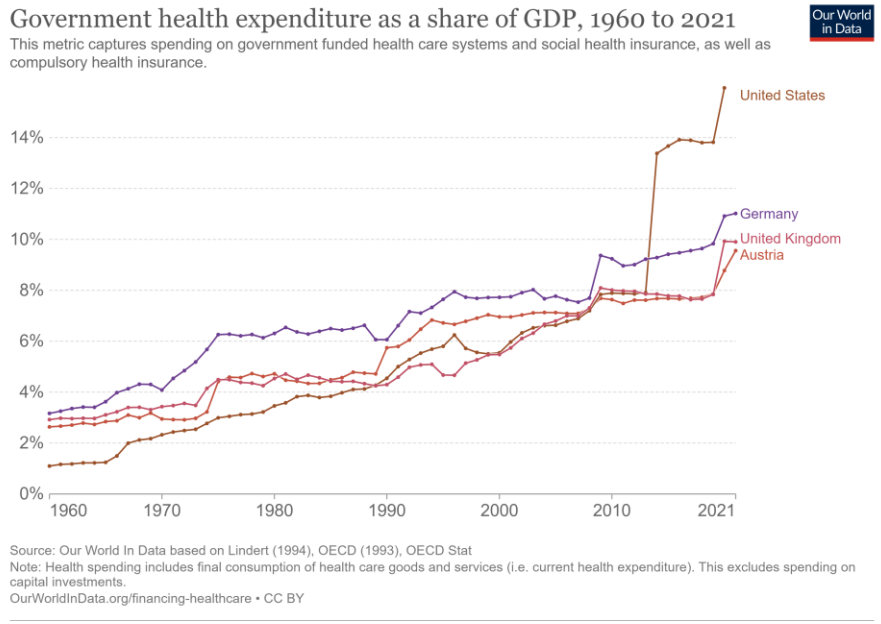

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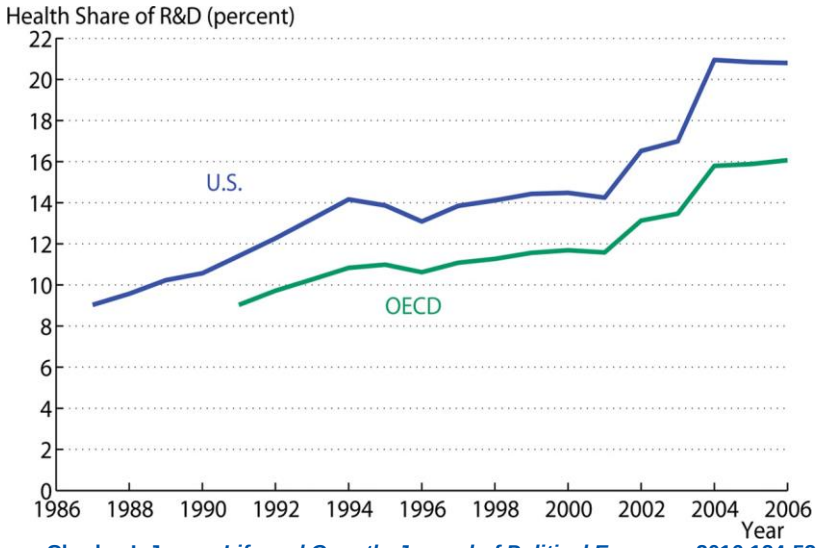

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Acemoglu & Linn (2004)
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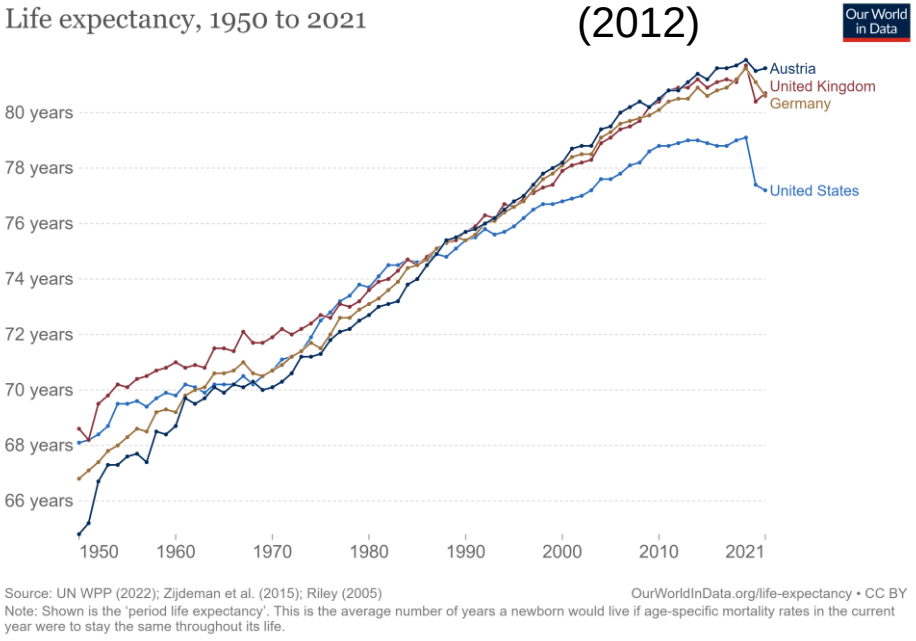

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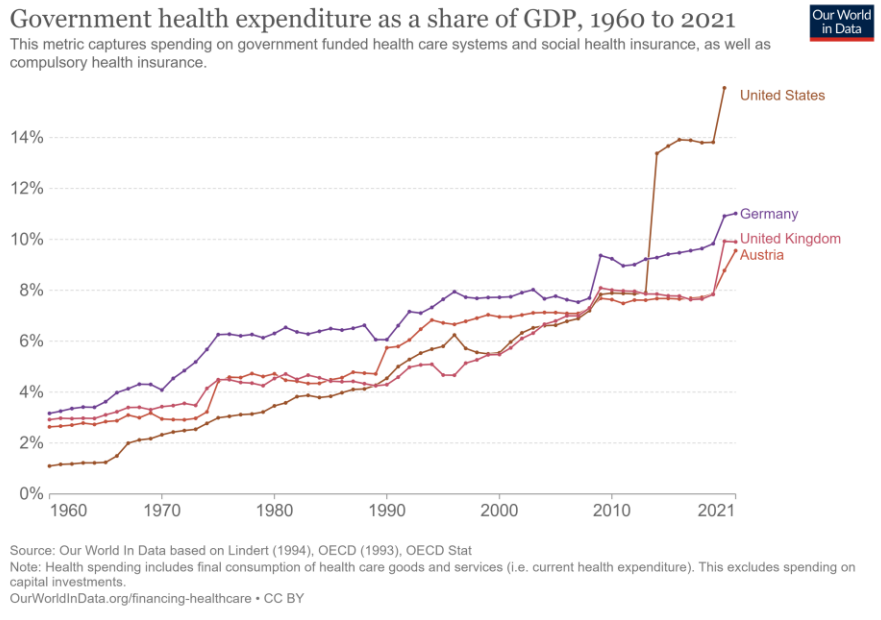

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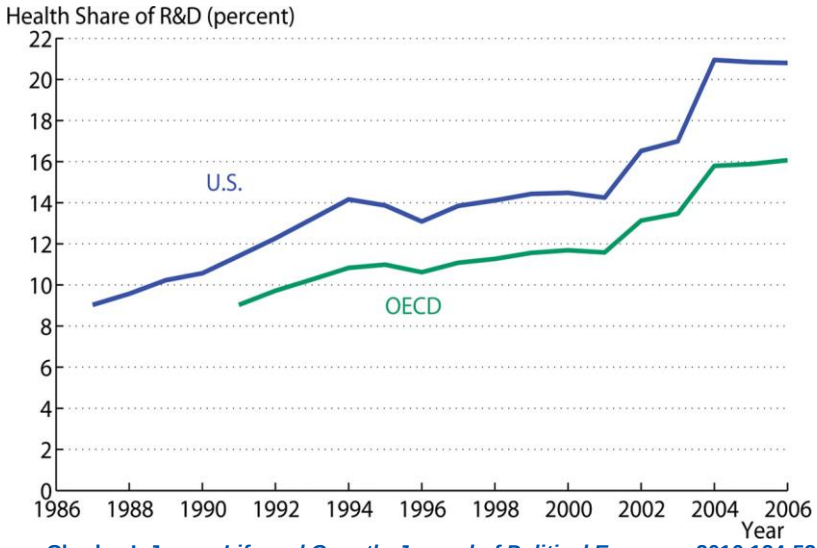

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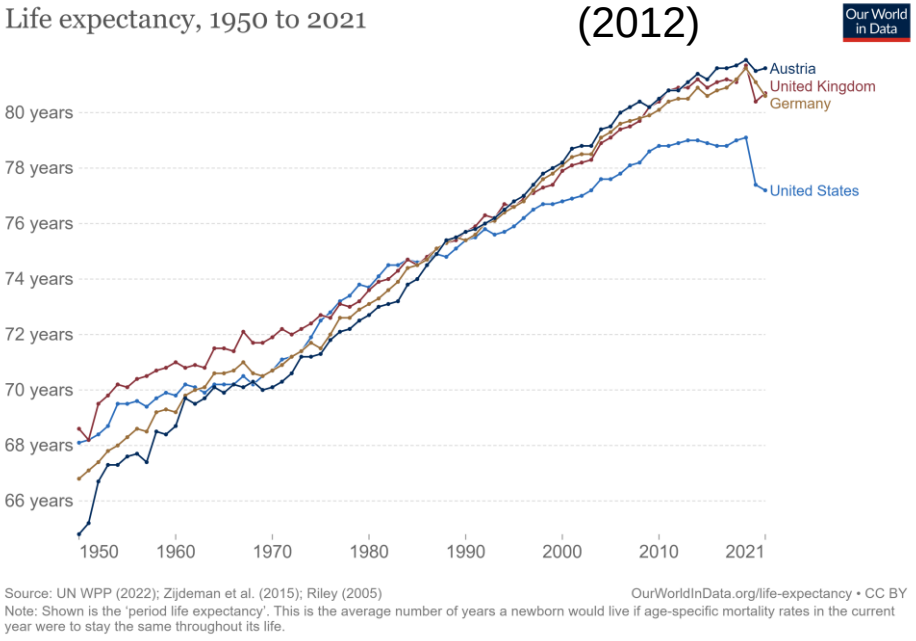

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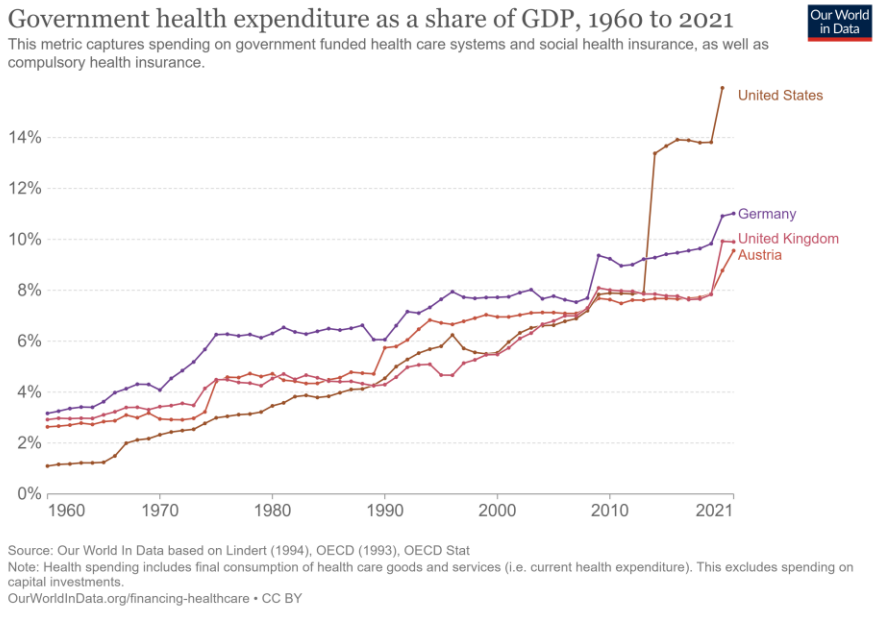


Cutting the nexus: The MEDPRO project

- Accept **mutual causality (complementarity) along the nexus** but apply theoretical yet calibrated models to **understand** some of the **linkages** and employ counterfactual analysis to trace out…

- … (a) the **mechanisms and incentives** behind medical progress and their role as **policy** levers
  (b) the **impact on** longevity, health spending, economic performance but **ultimately welfare**!

- Settings:

  Impact of **cardiac revolution** and role of **medical diffusion**
  (Frankovic et al., J Macro Econ, 2020)

  Impact of **health insurance expansion** on medical progress and outcomes
  (Frankovic and Kuhn, JHE, 2023)

  Medical progress and the **longevity gap**
  (Frankovic and Kuhn, J Econ Ageing, 2019)

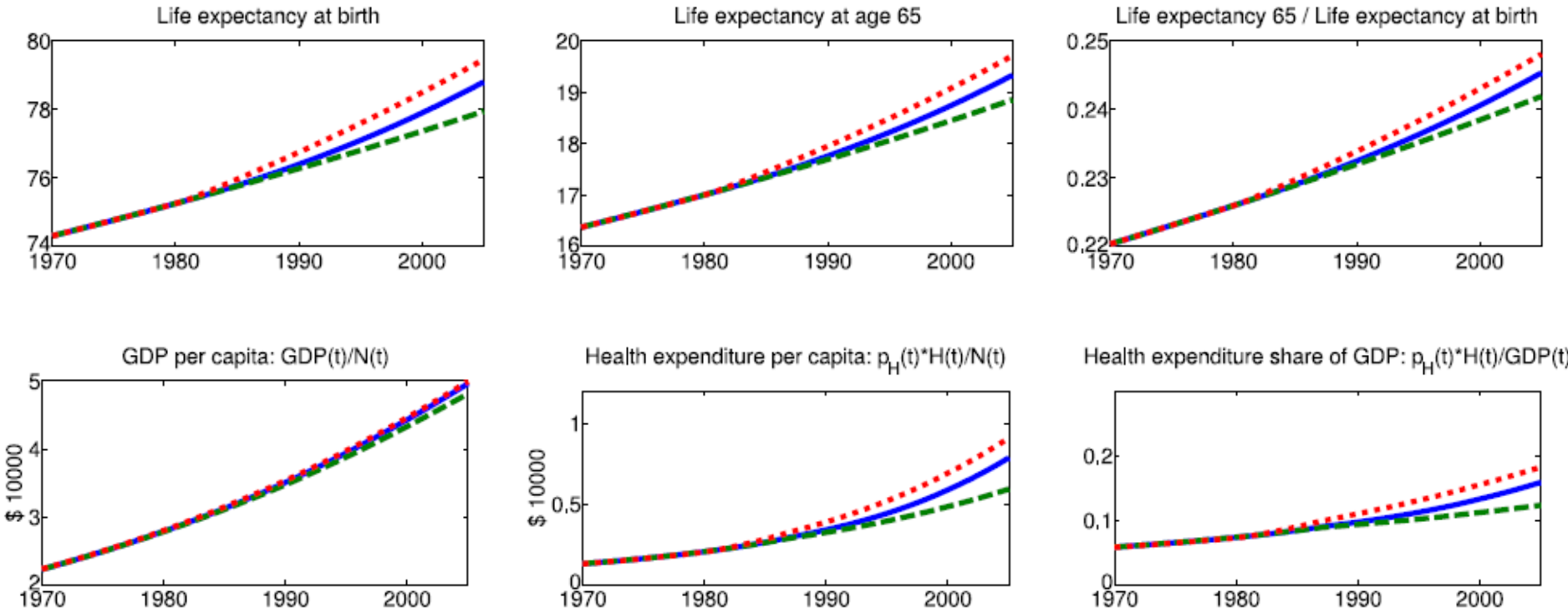
  Impact of medical progress in a **public health care** system with **congestion**
  (Kelly and Kuhn, J Macro Econ, 2022)

Model features

- General equilibrium model of **overlapping generations** of households with **realistic demography** (i.e. survival rates and, thus, age structure).
- Individuals consume, save and **utilize health care** over their life-cycle.
- **Health care lowers mortality** subject to decreasing returns but enhanced by **medical progress**. Contribution of health care to mortality change calibrated to 30%-50% (following e.g. Ford et al. 2006, NEJM).
- Final goods and **health care sector** produce with capital and labour (calibrated to realistic factor shares and labour productivity growth).
- Models calibrated to **US economy and health care** (data!) broadly **1960-2010.**
- Medical progress raises impact of health care on mortality (**product rather than process innovation**) which is in line with **increasing nominal prices** of treatments but **declining quality-adjusted prices**!

Impact of cardiac revolution 1980-2005

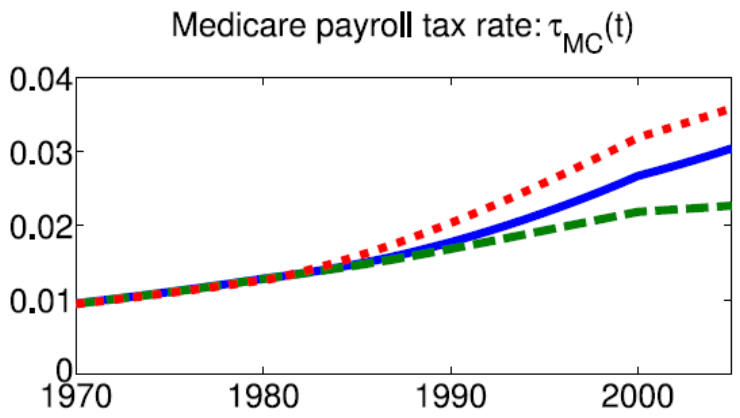
- Calibrated to **cardiac revolution between 1980-2005**; 32.5% of life expectancy to be explained by medical progress & health care utilization
- **Diffusion lag 8.9 years** (Skinner & Staiger, 2015: 5-10 years)

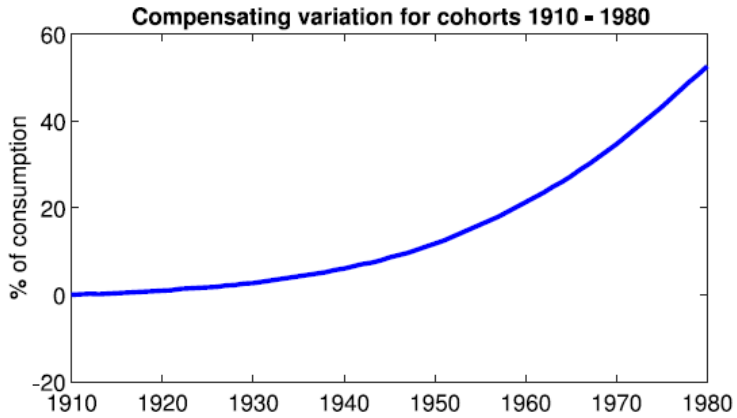


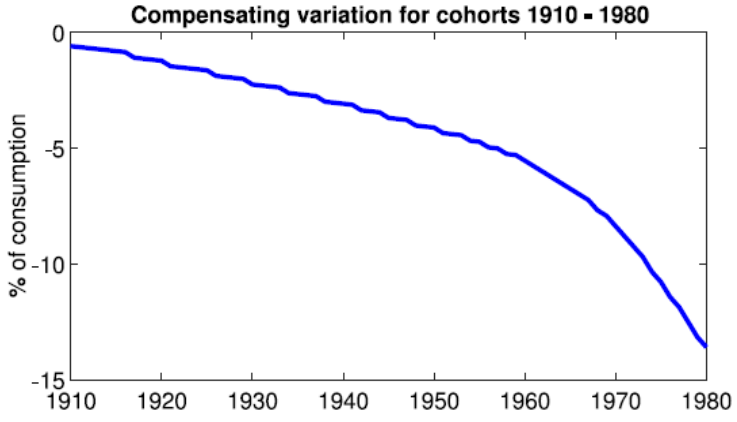
- Calibrated benchmark
- No medical progress
- Instantaneous diffusion

Impact of cardiac revolution: welfare

- **Compensating variation for medical progress:** % life cycle consumption that individuals in a world without medical progress would need to receive to attain same utility as in the benchmark
- **Compensating variation for perfect diffusion:** % life cycle consumption that individuals in a world with perfect diffusion would need to give up to receive same utility as in the benchmark.

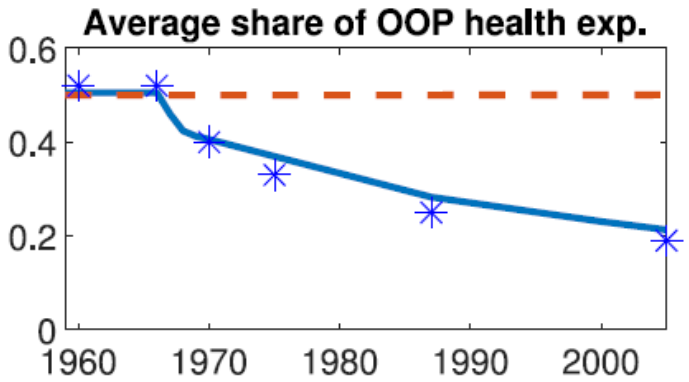


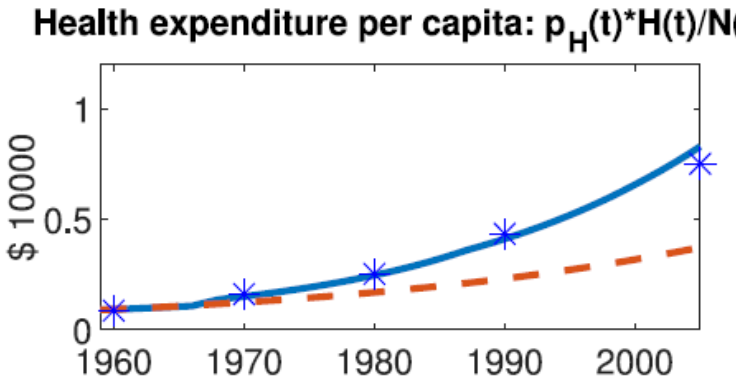


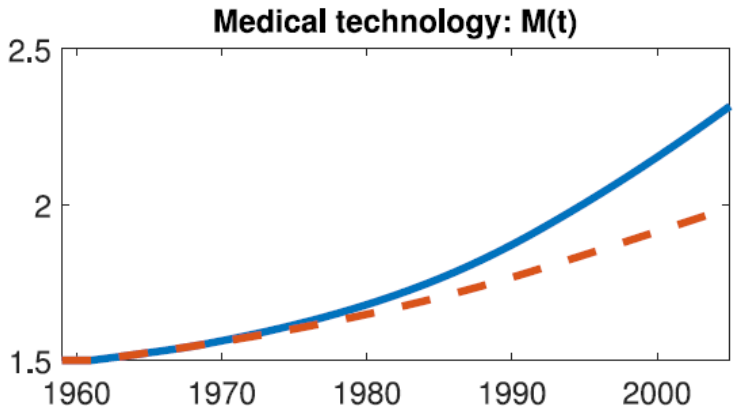


Impact of health insurance expansion 1965-2005

- **Health insurance** modelled as **pure subsidy** (no value to insurance per se)
- **3rd sector: Medical R&D produced with capital and labour.** Quality competition in health care sector => producer surplus converted into purchases of medical technology.
-



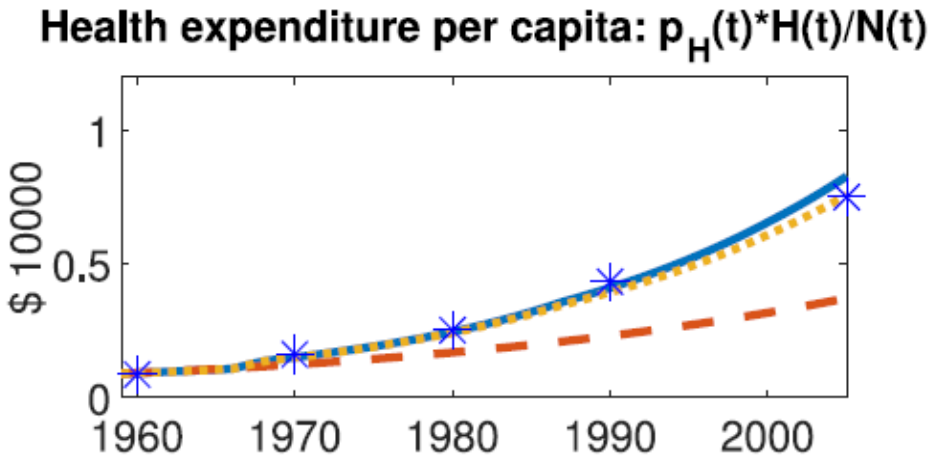


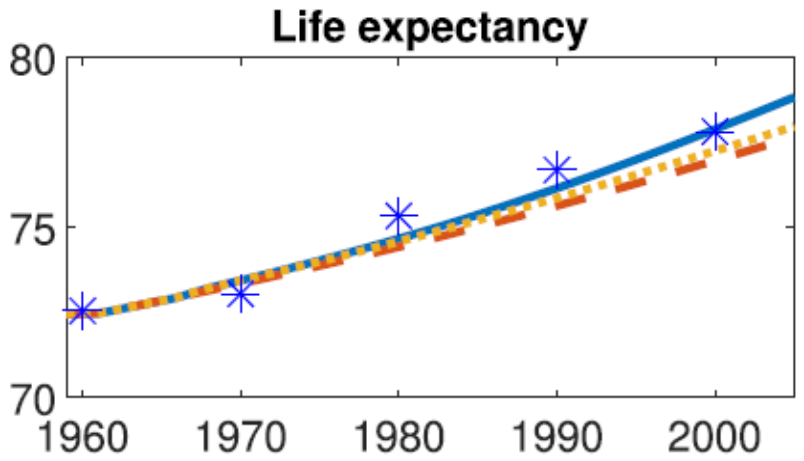


- Calibrated benchmark
- No insurance expansion

Health insurance expansion: moral hazard

- Insurance moral hazard: pure subsidy => excessive consumption
- Health **expenditure growth without sizeable increase in life expectancy** (flat-of-the-curve medicine)



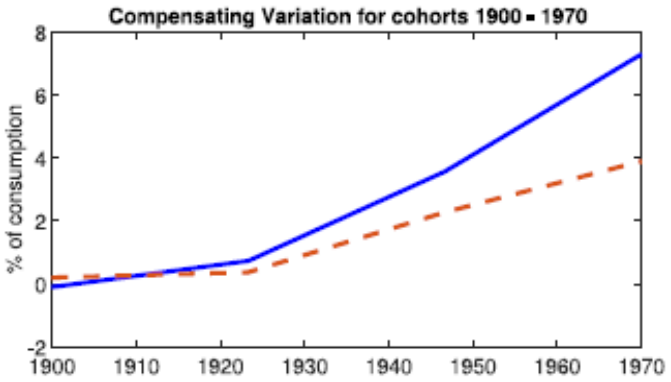


- Calibrated benchmark
- No insurance expansion
- Insurance expansion without medical progress (moral hazard)

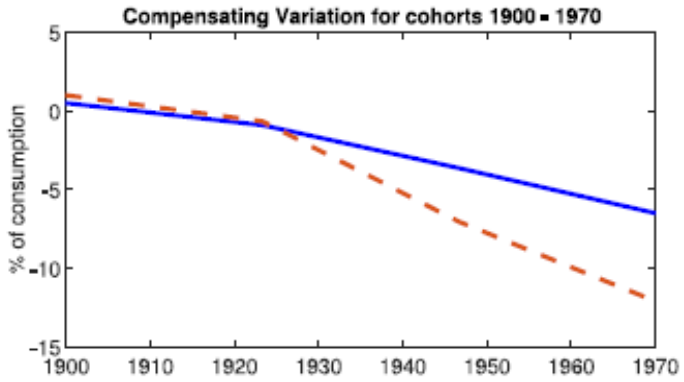
Health insurance expansion: Welfare impacts

- Benchmark scenario
- Scenario without productivity growth

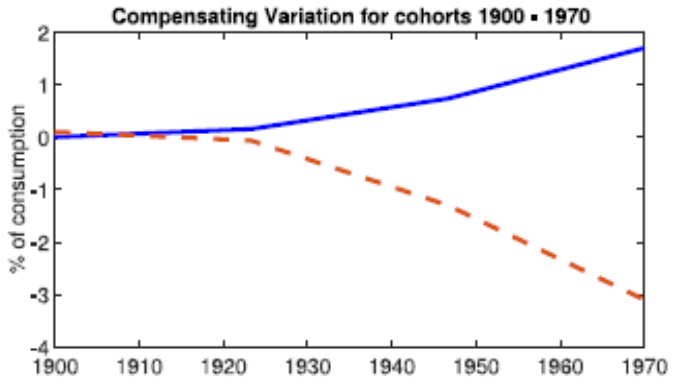
Induced medical progress only



Insurance expansion only



Net effect

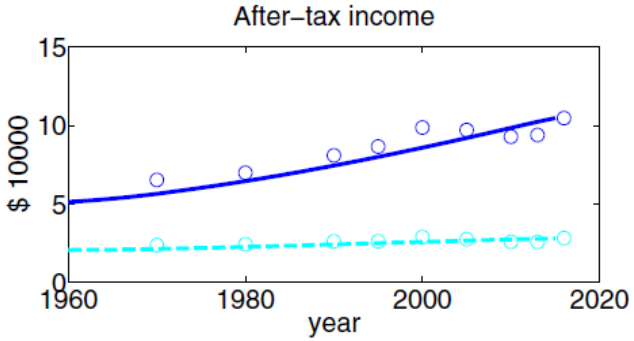


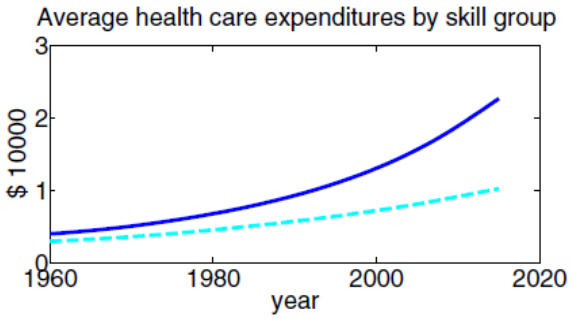
- Gains from **medical progress overcompensate losses from moral hazard** for all cohorts
- Early cohorts stand to gain little from medical progress (too late) but actually gain from moral hazard (access to health care in old age)
- **Trading two intergenerational externalities:** Excessive consumption by old imposes moral hazard burden on young but advances medical progress that is benefitting the young!
- Net welfare gains **contingent on sufficient income growth** (a la Hall and Jones, 2007; Jones 2016).

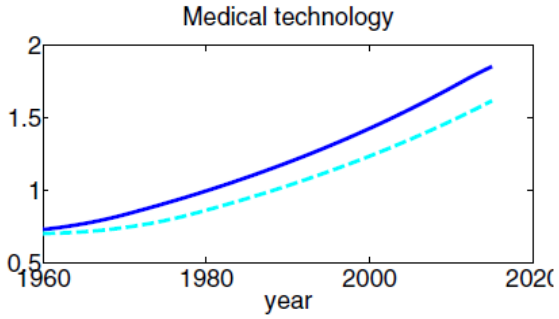
Medical progress and the SES mortality gap

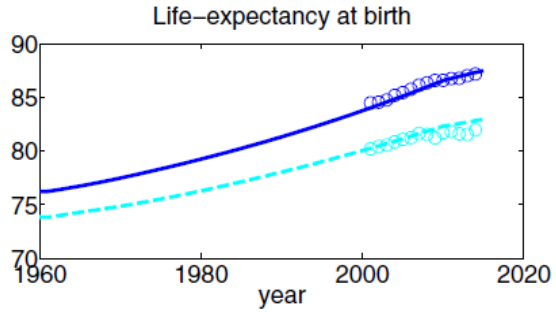
- Chetty et al. (JAMA, 2016) and many others: **Large (and growing) longevity gap by income** (and other SES indicators)
- Introduce **two skill/income groups** into our model to study role of medical progress. The skilled…

  …earn **higher income** (in 1960) and increasingly so due to **skill-biased technical progress**
  …have an **advantage** in the timely **access to (**and effective use of) **state-of-the art health care**
  …have **lower co-insurance**
  …may be **less vulnerable to medical price inflation**









Top-50% earners Bottom-50% earners

Medical progress: Channels

- Decomposition: Compare **benchmark** with all channels against **counterfactuals in which individual channels are turned off**: compare resulting changes in longevity gap
- Benchmark = all disadvantages active
- Counterfactuals I-III = eliminate one of the disadvantages each (note: medical price inflation does not create disadvantage for the unskilled)

Comparing Benchmark and Counterfactuals (CFs) to identify contribution of biases.

Longevity gap	in 2015	Increase 1960–2015	due to bias	share of benchmark incease explained
Benchmark	4.5 years	2.1 years	–	–
CF I: no skill-bias in earnings	4.1 years	1.7 years	0.4 years	19%
CF II: no skill-bias in med. eff.	3.3 years	0.9 years	1.2 years	57%
CF III: no skill-bias in insurance	4.4 years	2.0 years	0.1 years	5 %
Sum CF I-III:	–	–	1.7 years	81%
CF V: CF I-III combined	2.9 years	0.5 years	–	24%

- Counterfactual V: **Initial income inequality** translates into **differences in the demand for health care**. These are **leveraged** in their impact on longevity **by medical progress**!

Summary and Outlook

- Despite greater health care spending, there are **sizeable welfare gains to medical progress** – assuming concomitant productivity/income growth! Specific dynamics (e.g. diffusion) matter
- Health insurance: benefits from **induced medical progress overcompensate moral hazard**
- Starting from a situation in which direct subsidization of medical R&D (with future gains!) may be not politically favoured by current generations, **health insurance** (favouring the current old) may provide a **second-best**.
- Medical progress has strong potential to **boost the longevity gap**
- **Results carry over to a public health care system with congestion** (e.g. waiting): potential gains from medical progress cannot fully materialize if demand increase translates into congestion/waiting. To make medical progress effective, capacity would need to be increased.

Outlook

- Micro-processes and new types of medical R&D
- Medical innovation impacts in the very long-run (empirical study)
- Further work on the impact of medical progress in heterogeneous populations
- Role of medical progress and health care spending within declining economies (climate change!)

Thank you!

Happy Birthday DHE!!!

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