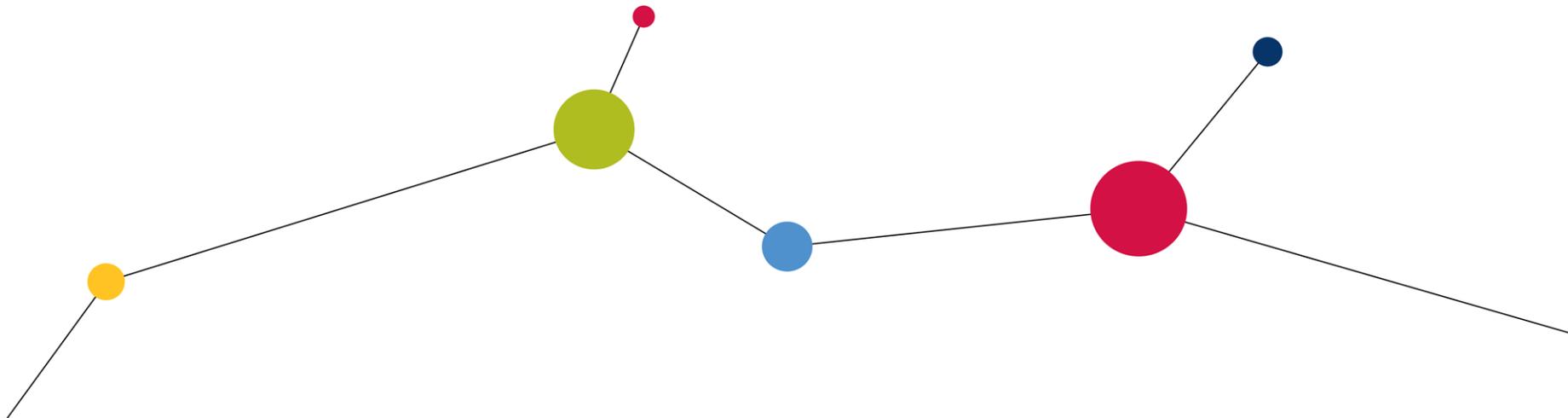


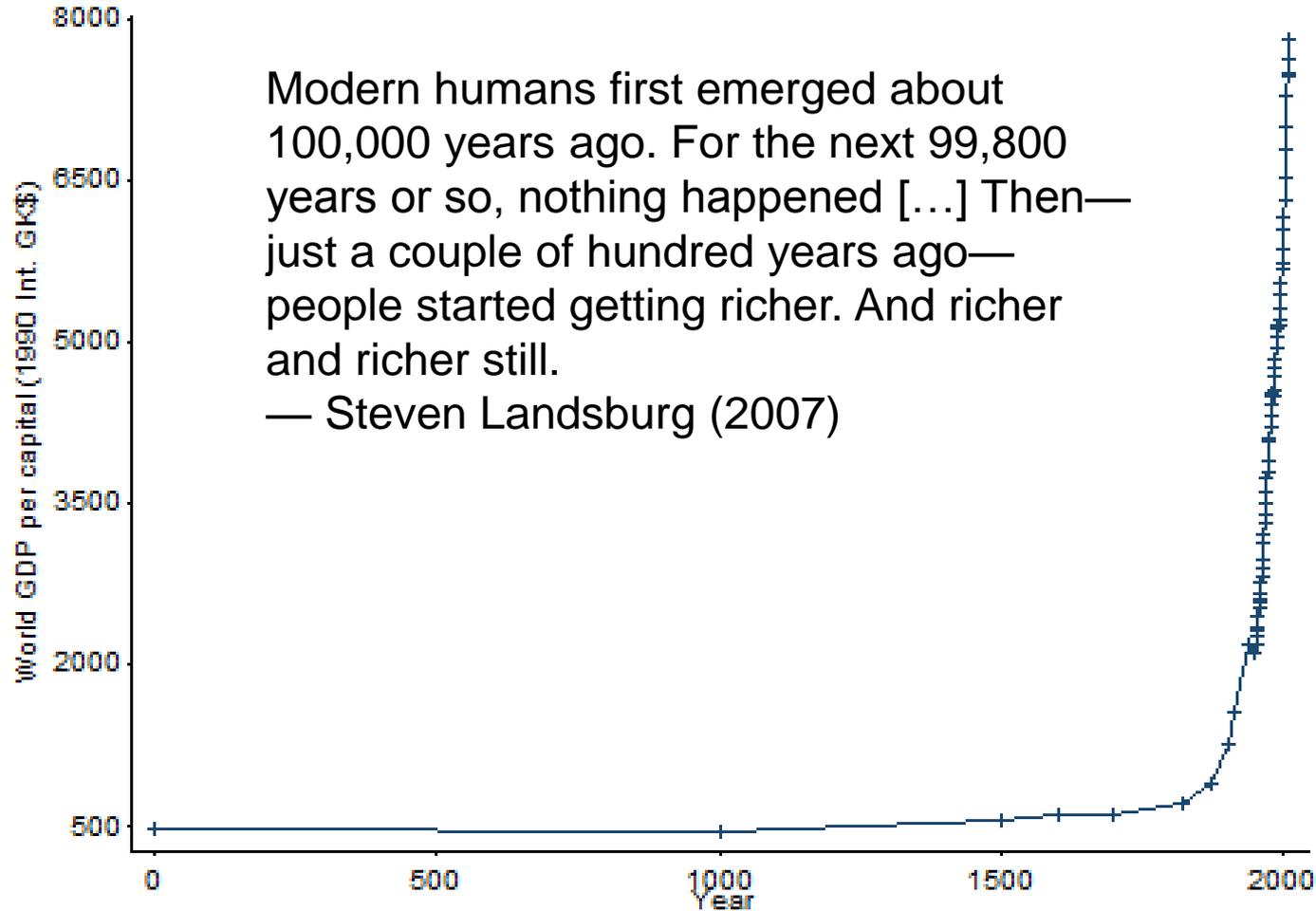
# The Fourth Industrial Revolution

Is This Time Different?

Carl Benedikt Frey



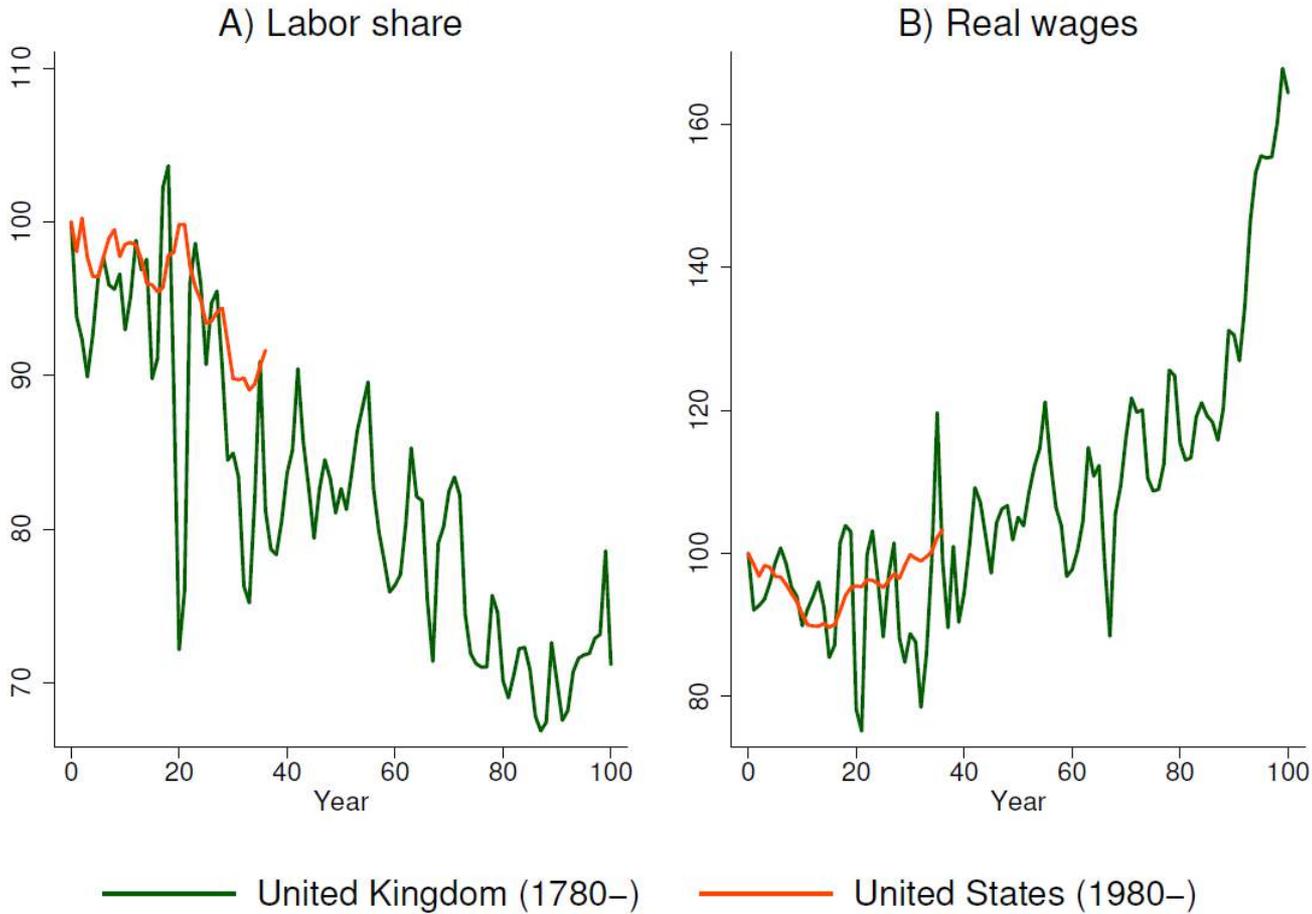
# A Brief History of Progress



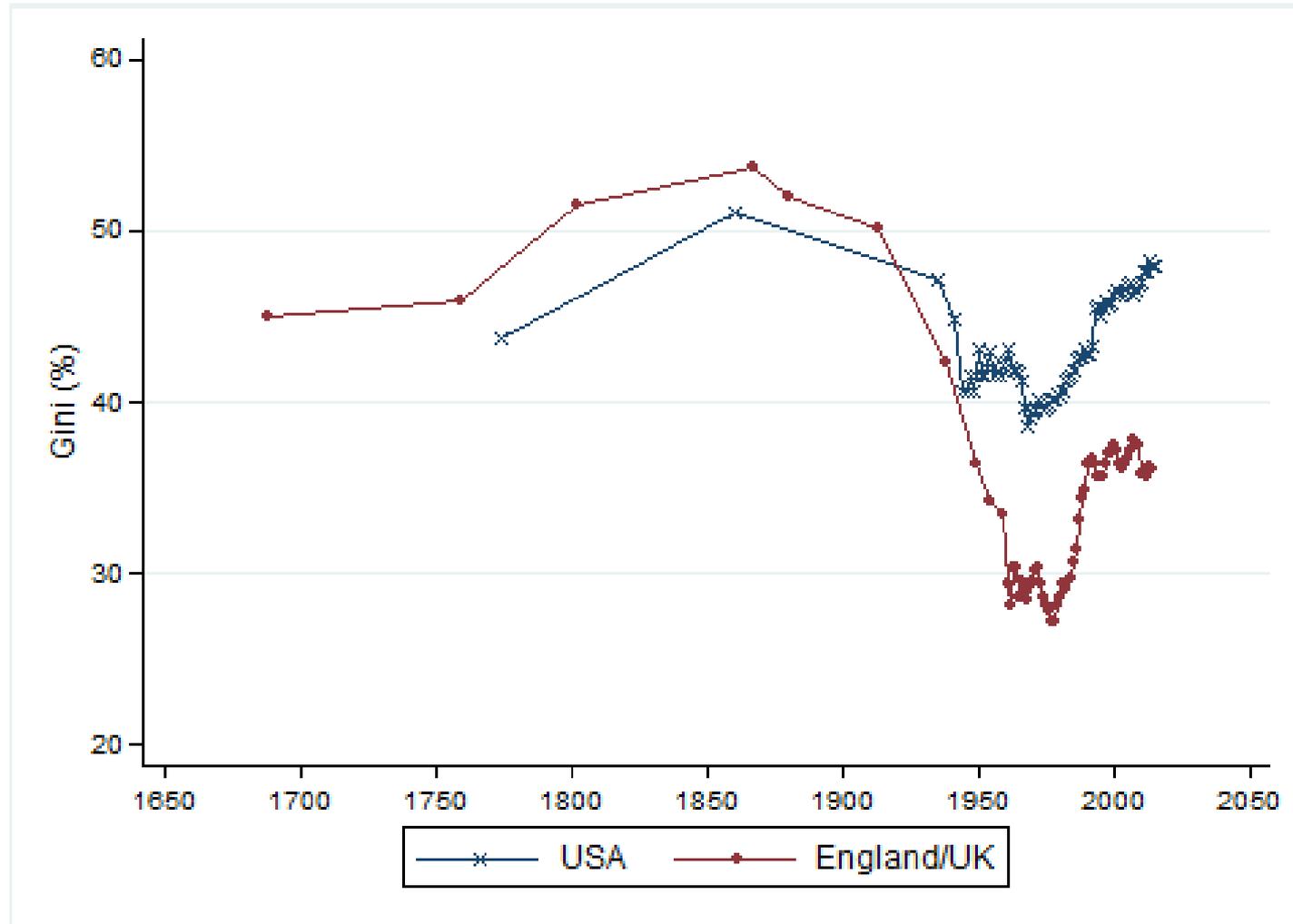
Modern humans first emerged about 100,000 years ago. For the next 99,800 years or so, nothing happened [...] Then—just a couple of hundred years ago—people started getting richer. And richer and richer still.

— Steven Landsburg (2007)

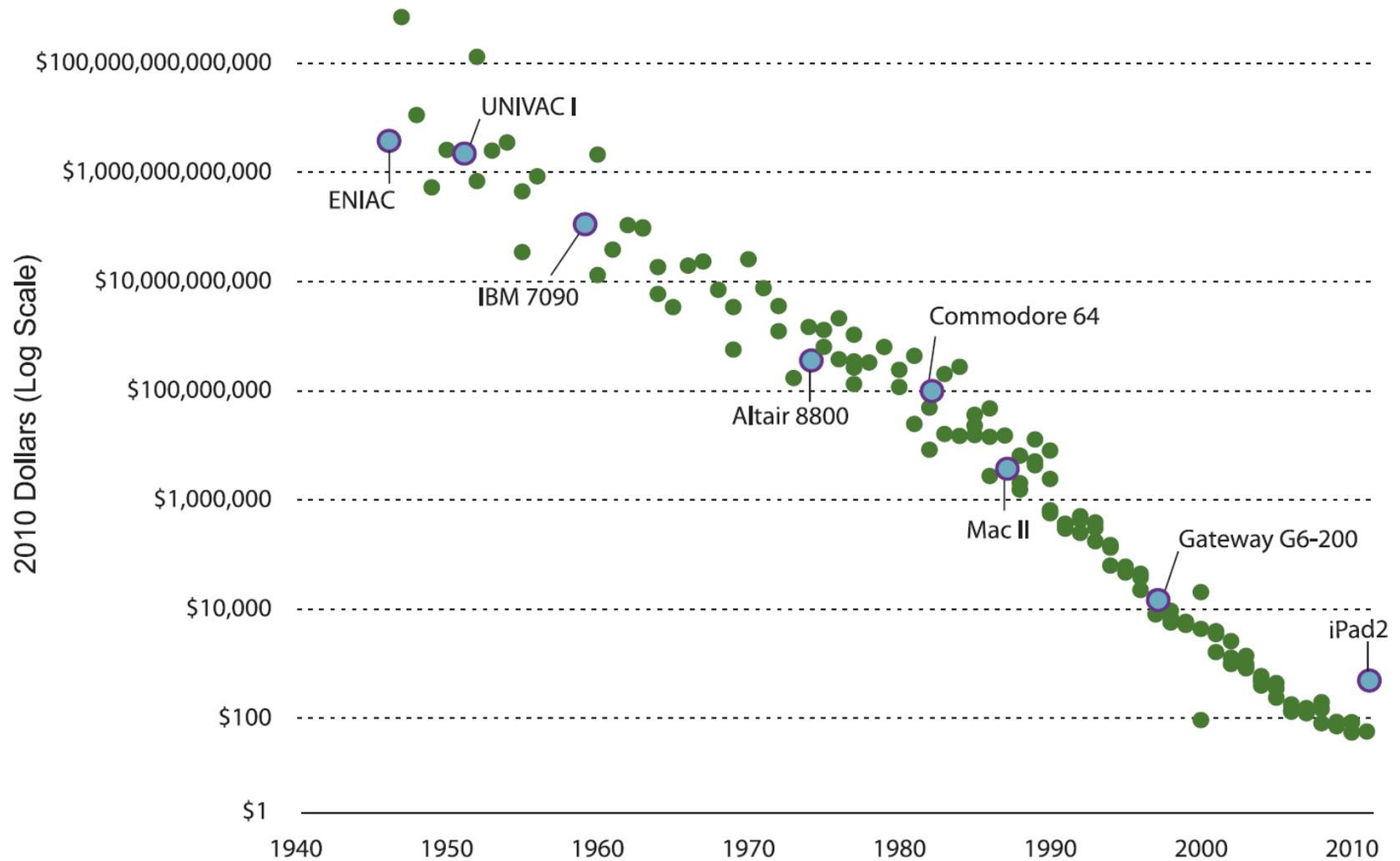
# A Tale of Two Industrial Revolutions



# A Tale of Two Industrial Revolutions



# Is This Time Different?



# We Have Seen Nothing Yet

## Human computers

performing mathematical calculations

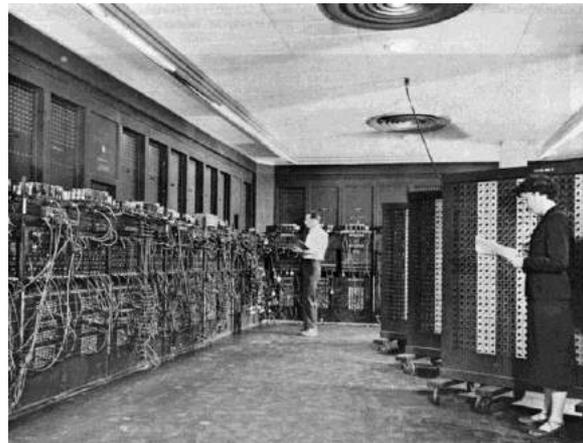
"The human computer is supposed to be following fixed rules; he has no authority to deviate from them in any detail."  
(Turing, 1950)



## Electronic computers

performing routine tasks:

- Calculation
- Repetitive customer service
- Picking or sorting
- Repetitive assembly



## Machine learning algorithms

performing **non-routine** tasks:

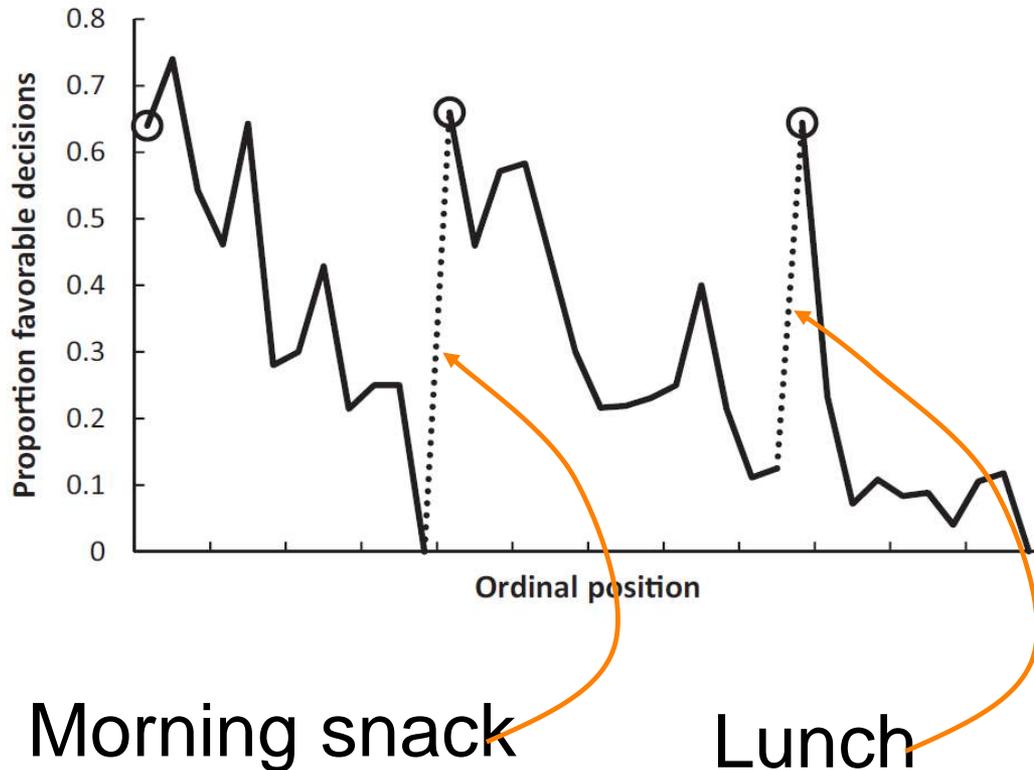
- Medical diagnostics
- Document review
- Translation
- Driving



Google  
Translate

Break through language barriers.

# Comparative Disadvantage



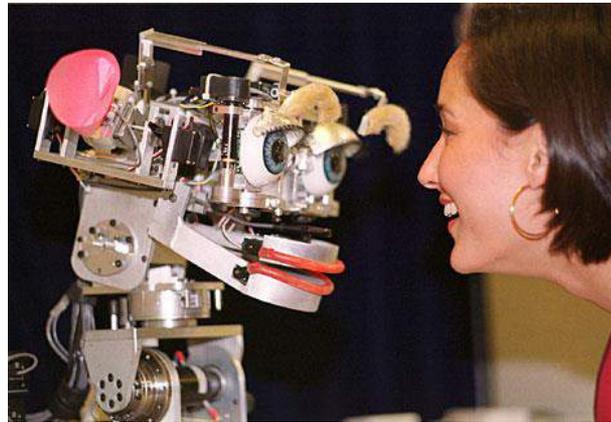
Israeli judges are significantly more lenient after a food break (Danziger et al 2011).

# The Human Advantage

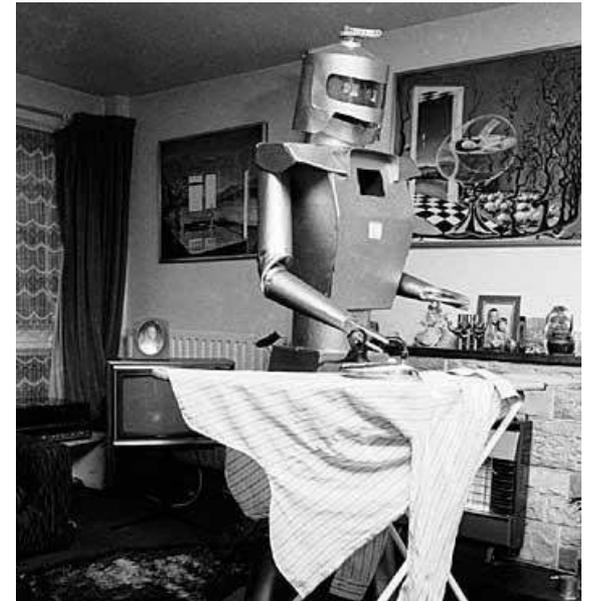
## Creativity



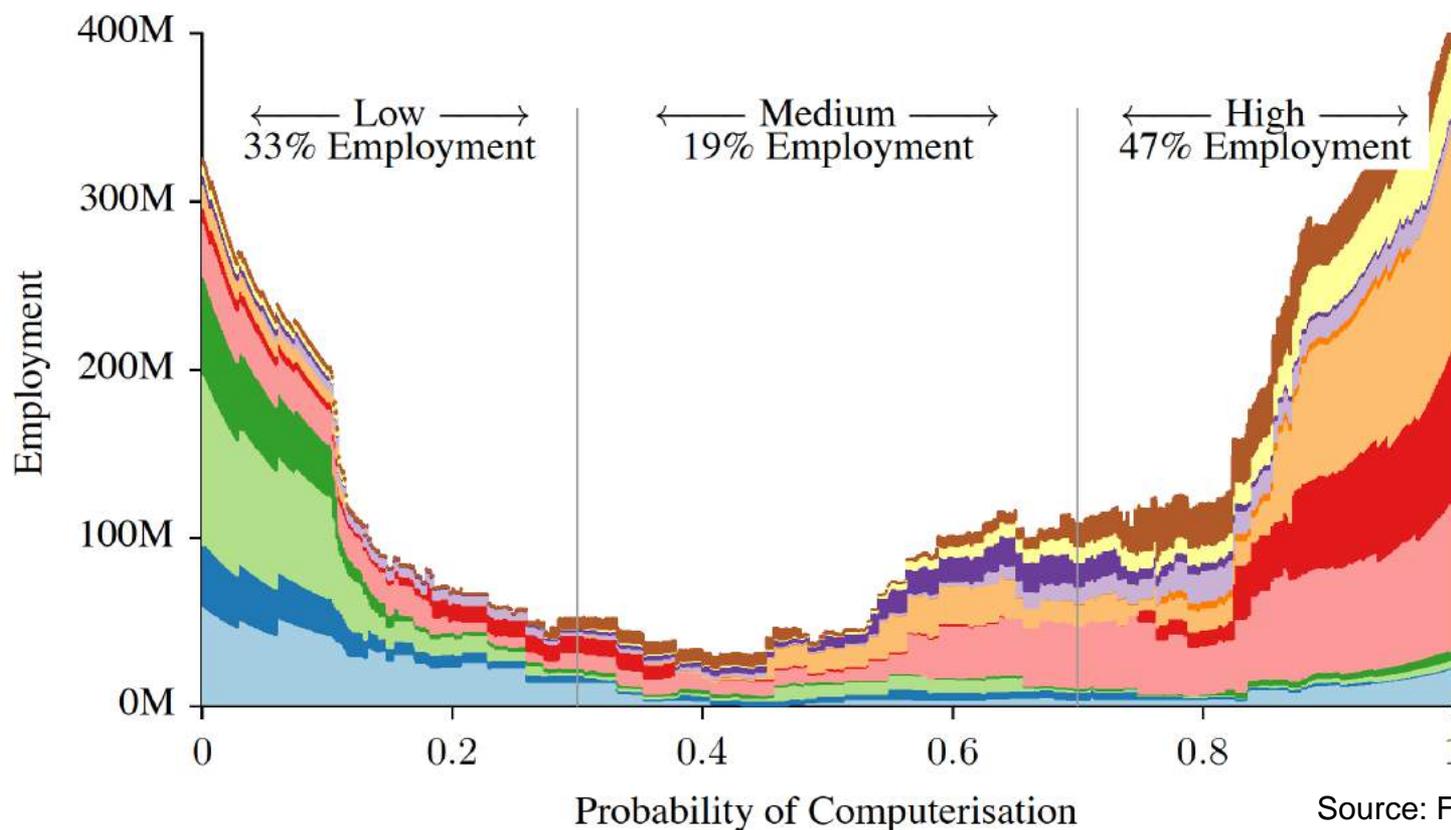
## Social intelligence



## Perception and manipulation



- Management, Business, and Financial
- Computer, Engineering, and Science
- Education, Legal, Community Service, Arts, and Media
- Healthcare Practitioners and Technical
- Service
- Sales and Related
- Office and Administrative Support
- Farming, Fishing, and Forestry
- Construction and Extraction
- Installation, Maintenance, and Repair
- Production
- Transportation and Material Moving



# Industries at Risk

	Low Risk (%)	Medium Risk (%)	High Risk (%)
Accommodation & Food Services	2.8%	10.5%	86.7%
Administrative & Support Services	1.6%	36.2%	62.2%
Agriculture, Forestry, Fishing & Hunting	75.6%	12.0%	12.3%
Arts, Entertainment & Recreation	47.9%	12.5%	39.6%
Construction	21.6%	19.8%	58.6%
Educational Services	63.1%	19.7%	17.2%
Finance & Insurance	28.9%	17.3%	53.7%
Government	46.2%	30.6%	23.2%
Health Care & Social Assistance	39.4%	25.0%	35.6%
Information	51.6%	38.3%	10.1%
Management of Companies & Enterprises	82.8%	6.2%	11.0%
Manufacturing	19.9%	18.4%	61.7%
Mining, Quarrying and Oil & Gas Extraction	7.8%	46.3%	45.9%
Other Services (ex Public Admin)	44.9%	24.7%	30.4%
Professional, Scientific & Technical Services	54.0%	10.9%	35.1%
Real Estate and Rental & Leasing	0.7%	32.0%	67.2%
Retail Trade	14.5%	18.9%	66.6%
Self-Employed	60.4%	8.9%	30.7%
Transportation & Warehousing	5.5%	19.4%	75.0%
Utilities	40.3%	27.8%	31.9%
Wholesale Trade	15.9%	18.4%	65.7%

# Jobs at Risk

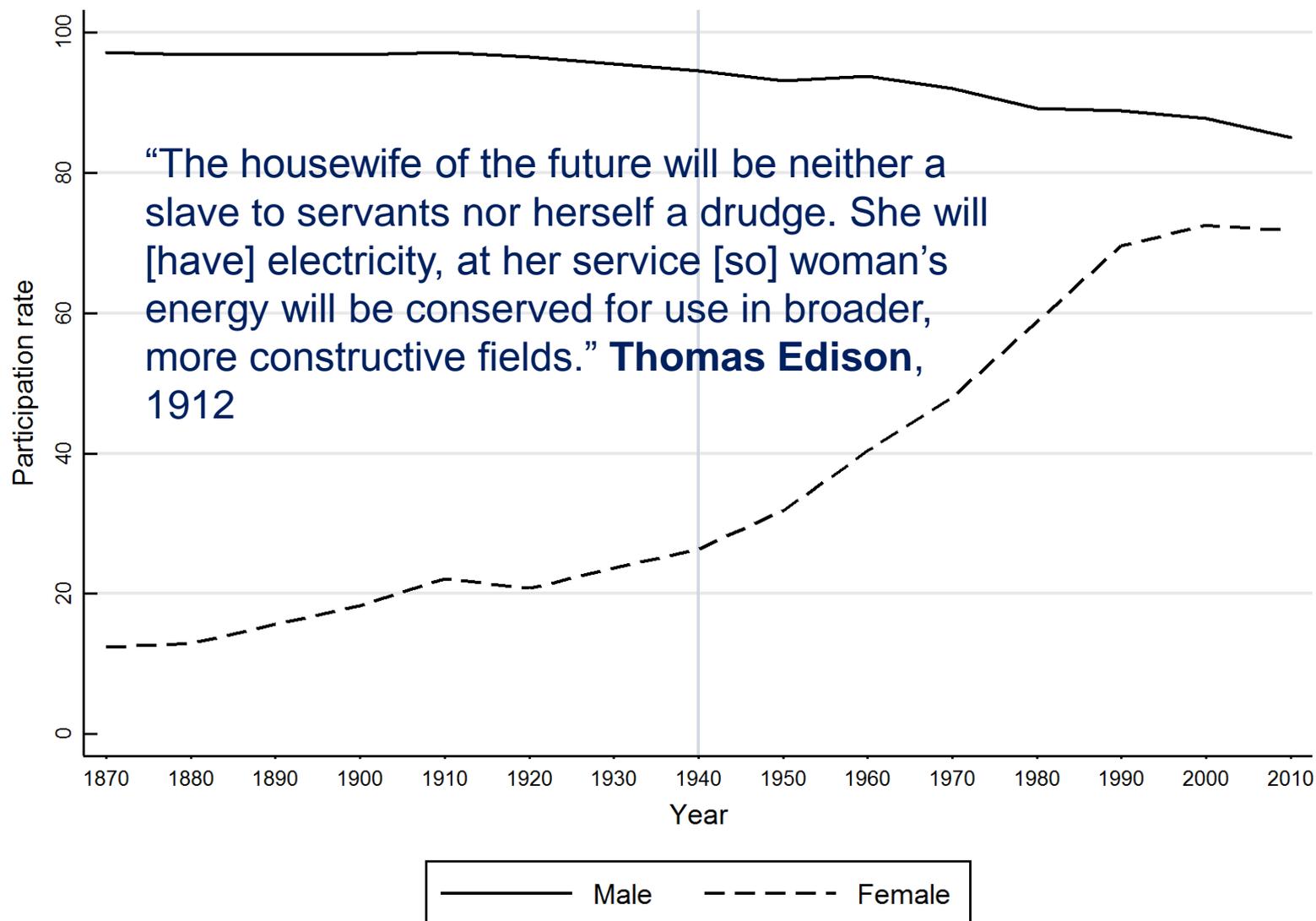


588.	0.93	1	53-7051	Industrial Truck and Tractor Operators
589.	0.94	1	13-2011	Accountants and Auditors
592.	0.94	0	35-3031	Waiters and Waitresses
671.	0.98		43-3031	Bookkeeping, Accounting, and Auditing Clerks
672.	0.98		43-6012	Legal Secretaries
673.	0.98		27-4013	Radio Operators
674.	0.98		53-3031	Driver/Sales Workers
675.	0.98	1	13-1031	Claims Adjusters, Examiners, and Investigators
676.	0.98		41-2022	Parts Salespersons
677.	0.98	1	13-2041	Credit Analysts

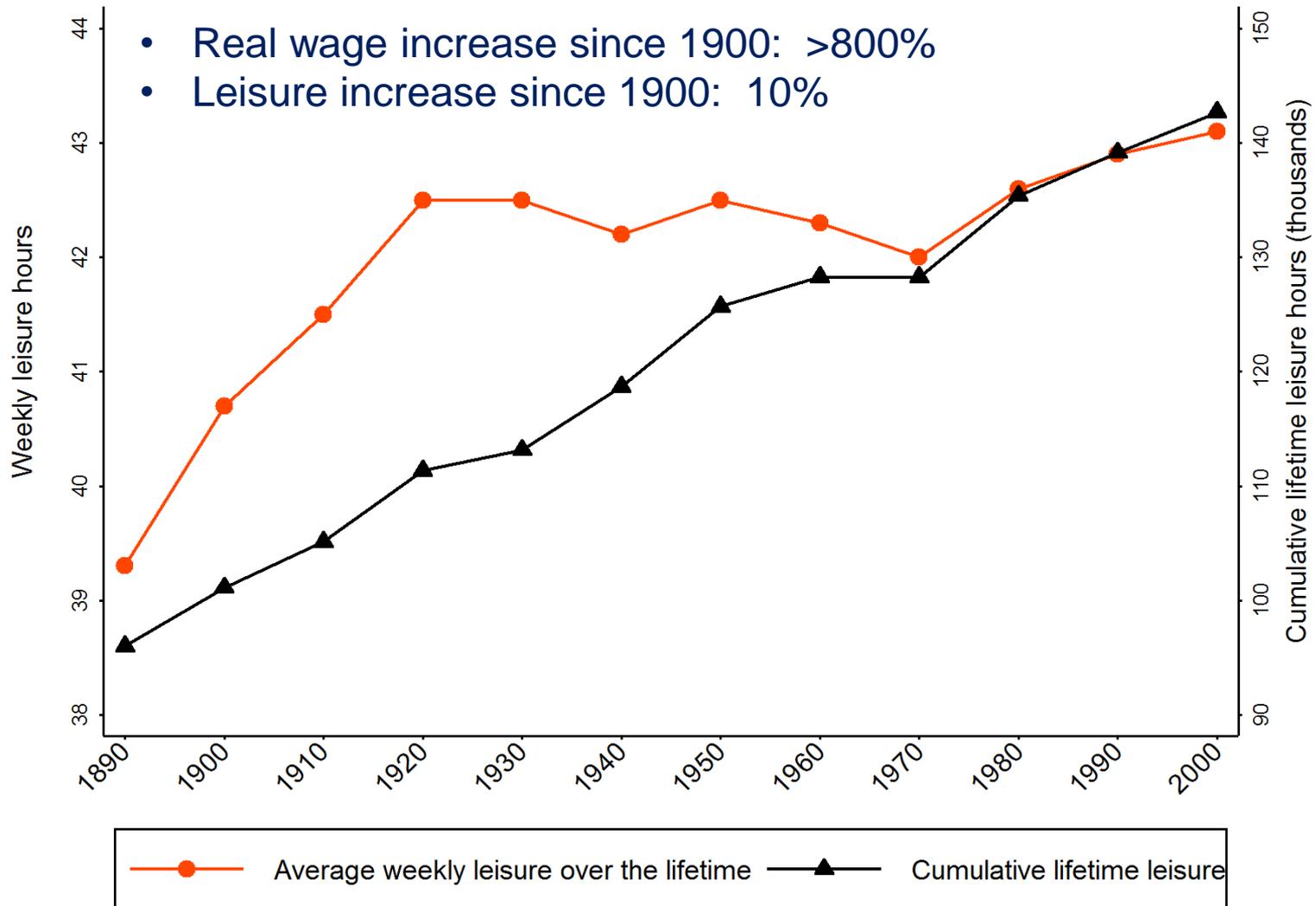
# Occupations that disappeared – a few examples



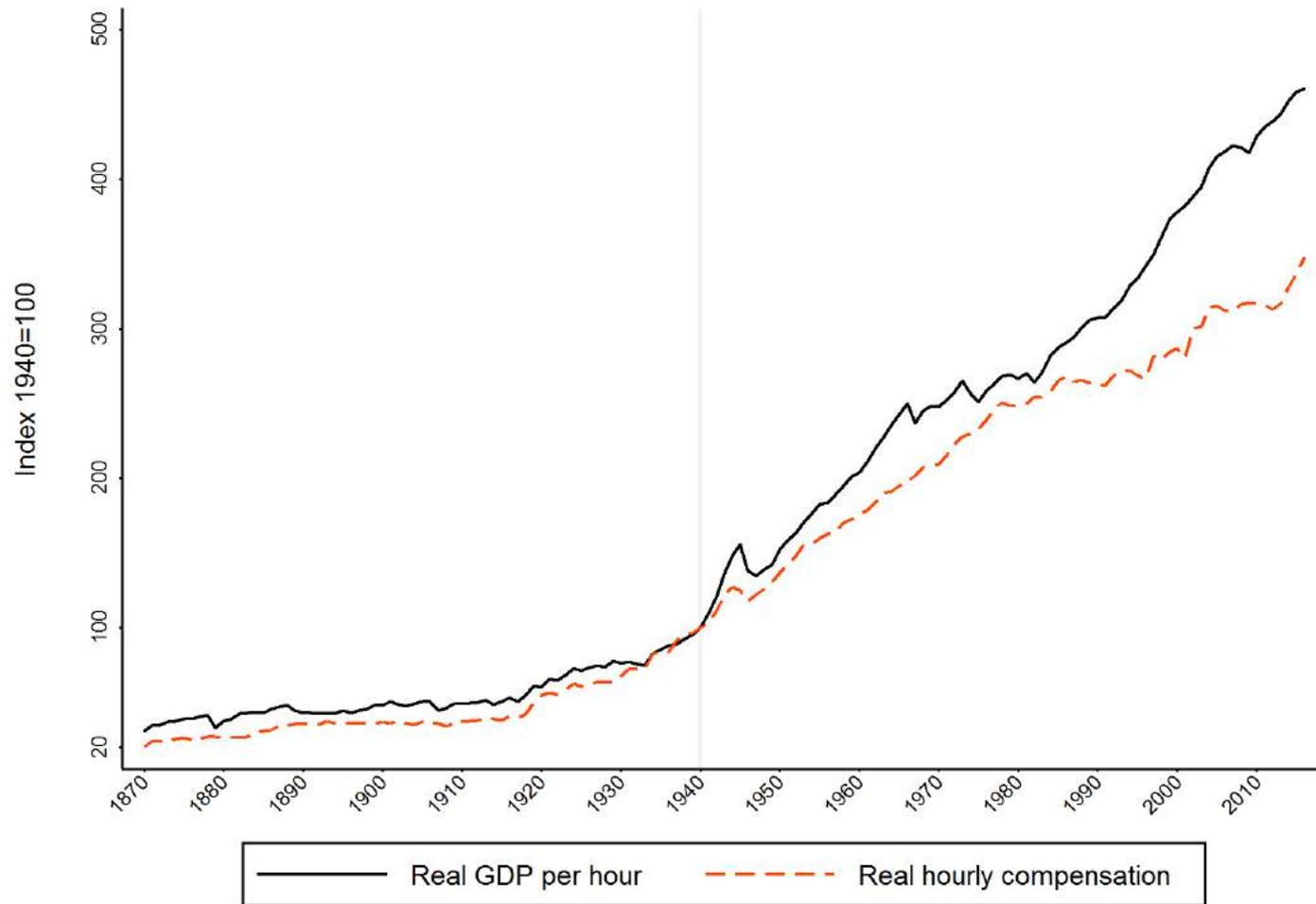
# More jobs than ever – labour force participation



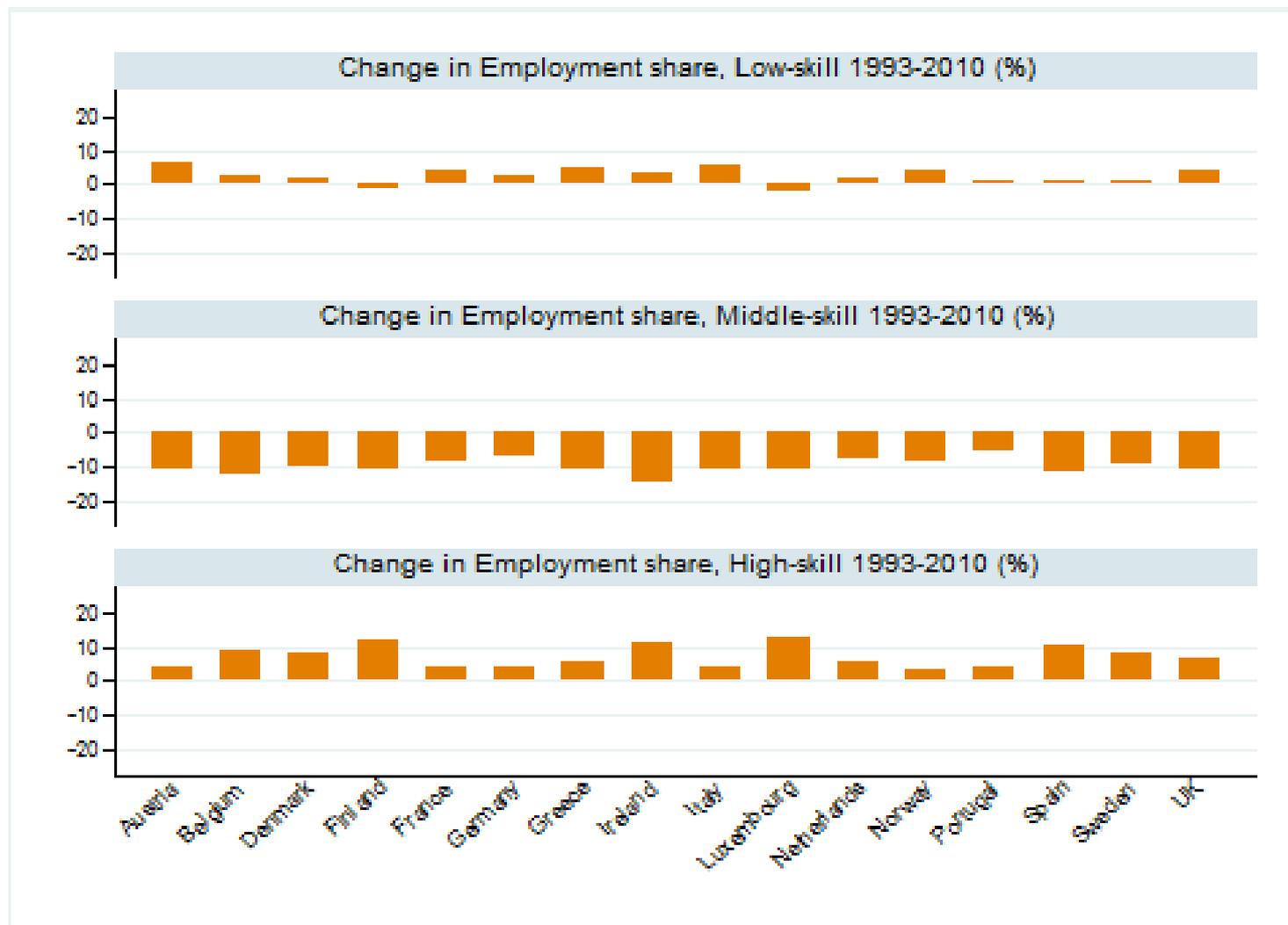
# Preparing for a life of leisure?



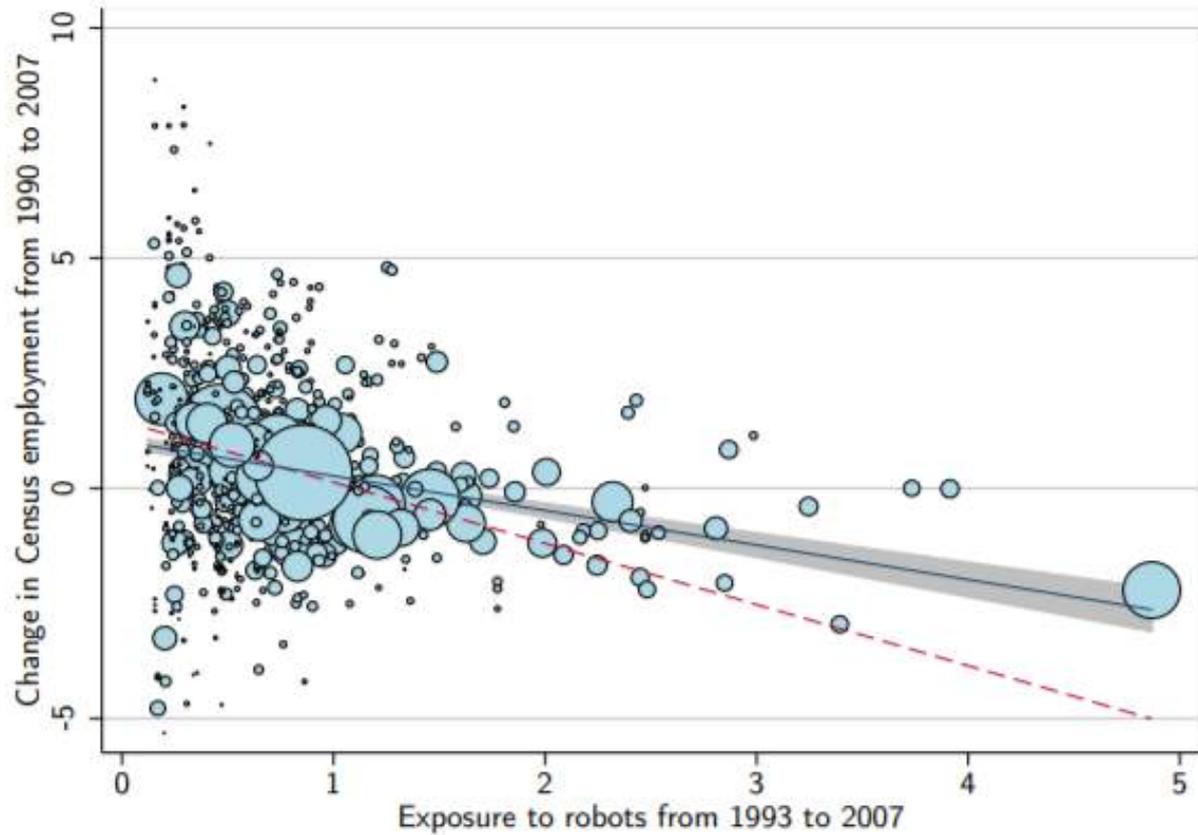
# Who gains from progress?



# The Disappearing Middle

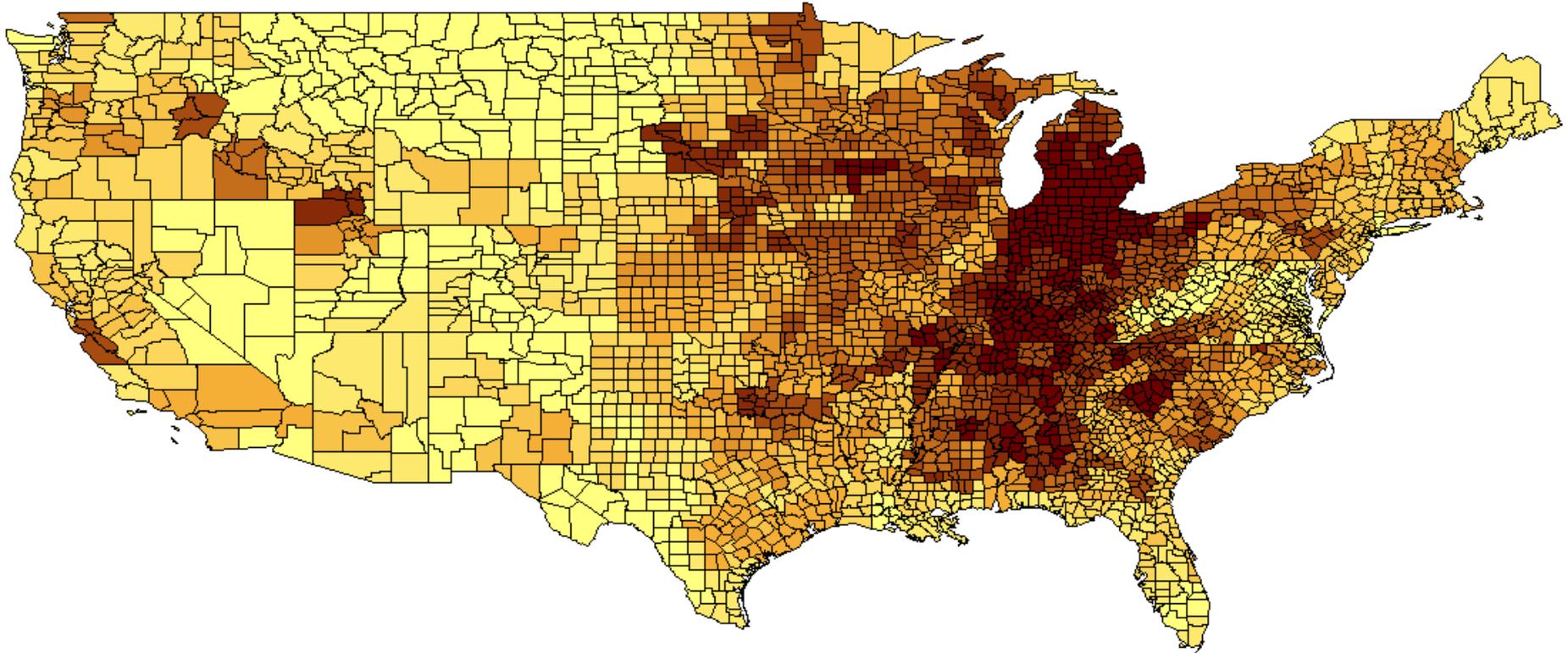


# Robocopalypse?

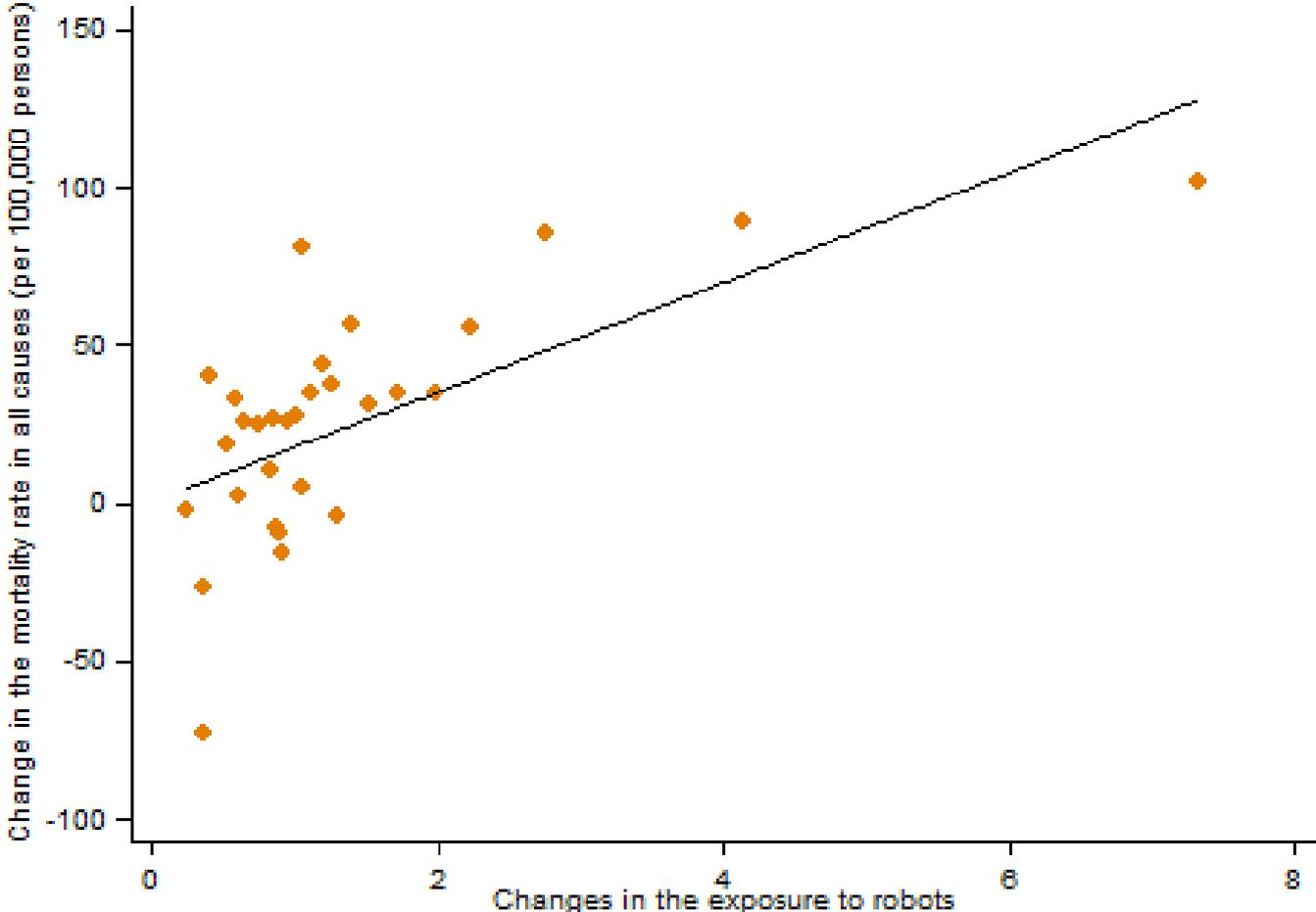


Source: Acemoglu & Restrepo (2017)

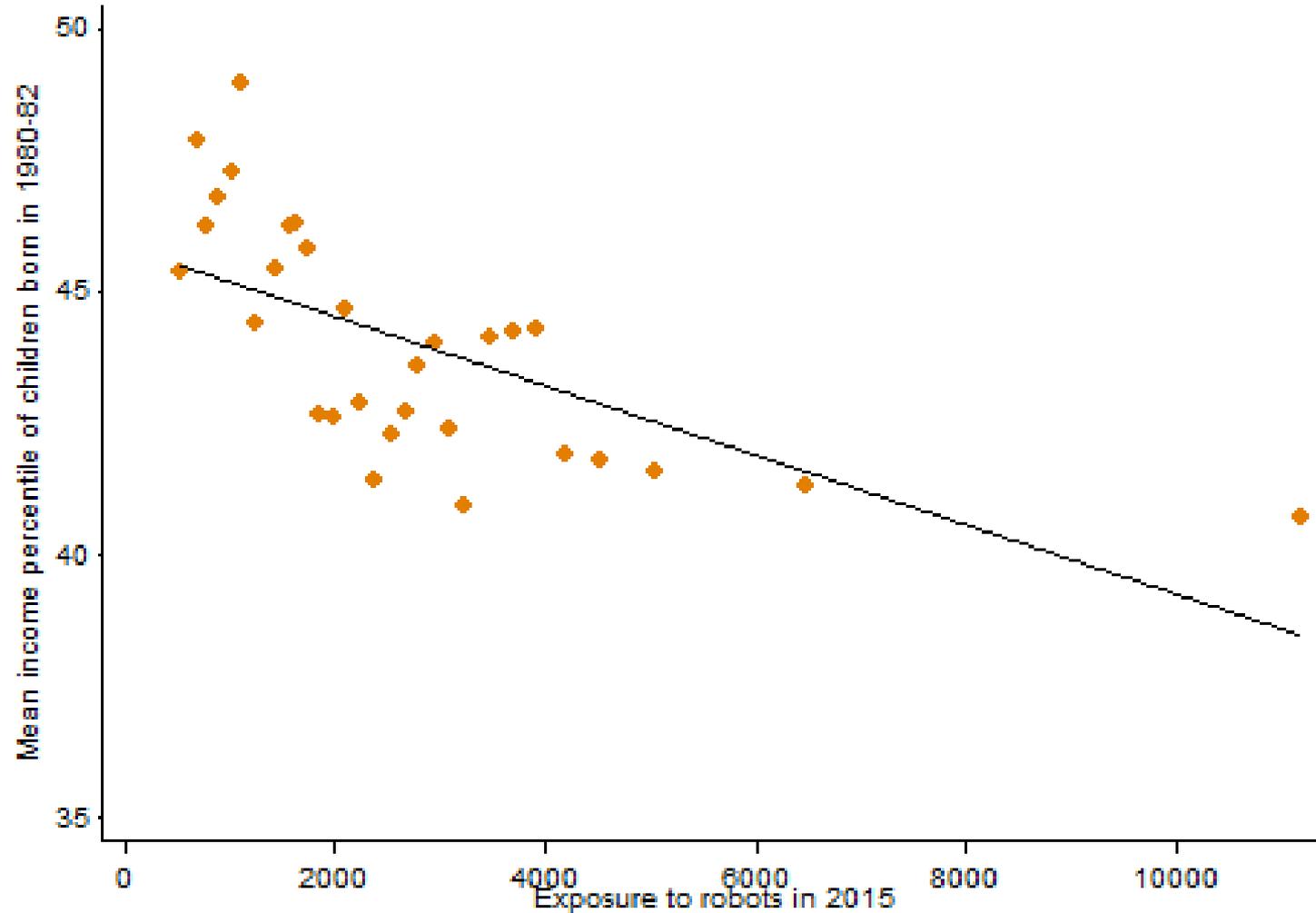
# Mapping the Robot Revolution



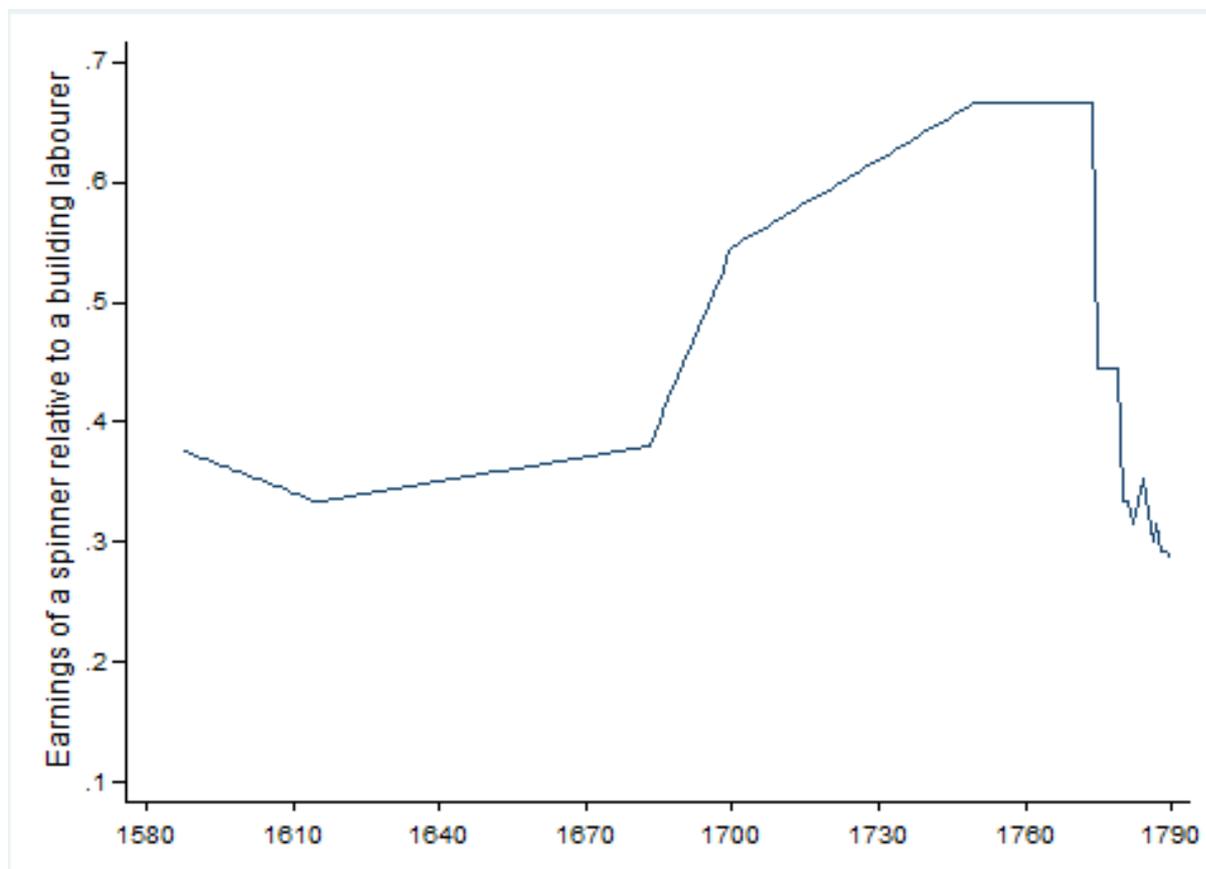
# Deaths of Despair



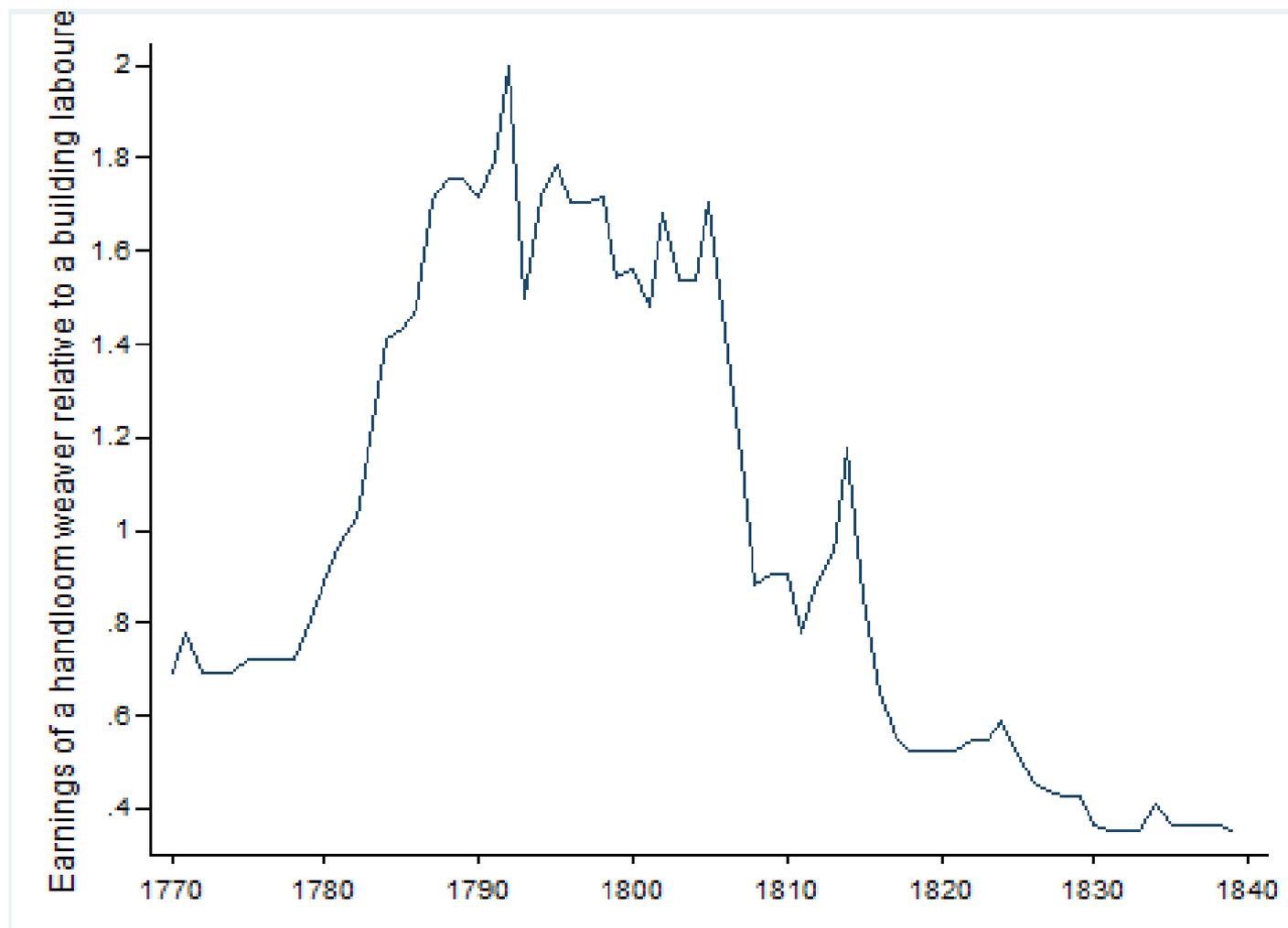
# Faltering Opportunity



# The Victims of the Factory



# The Victims of the Factory



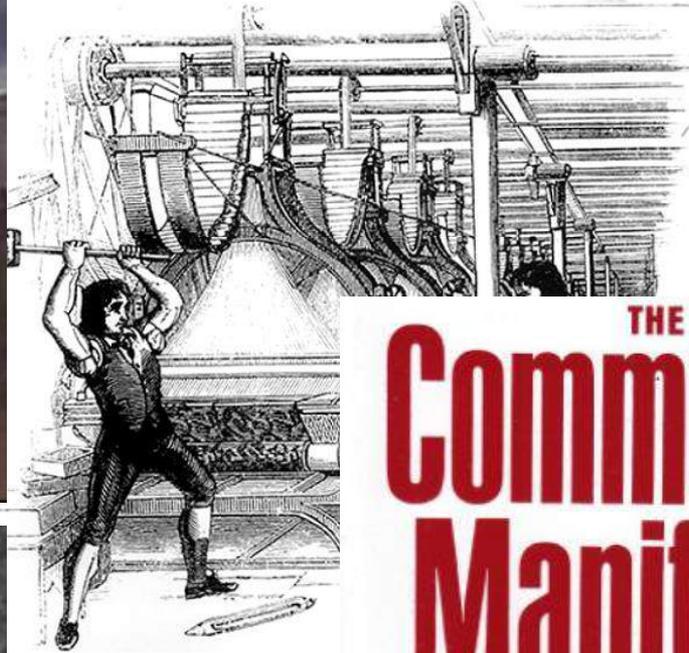
# The Victims of the Factory

“Even in the present day [...] it is found to be nearly impossible to convert persons past the age of puberty [...] into useful factory hands.”

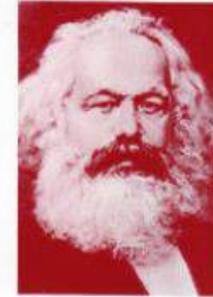
— Andrew Ure (1835)



# A Wave of Machinery Riots

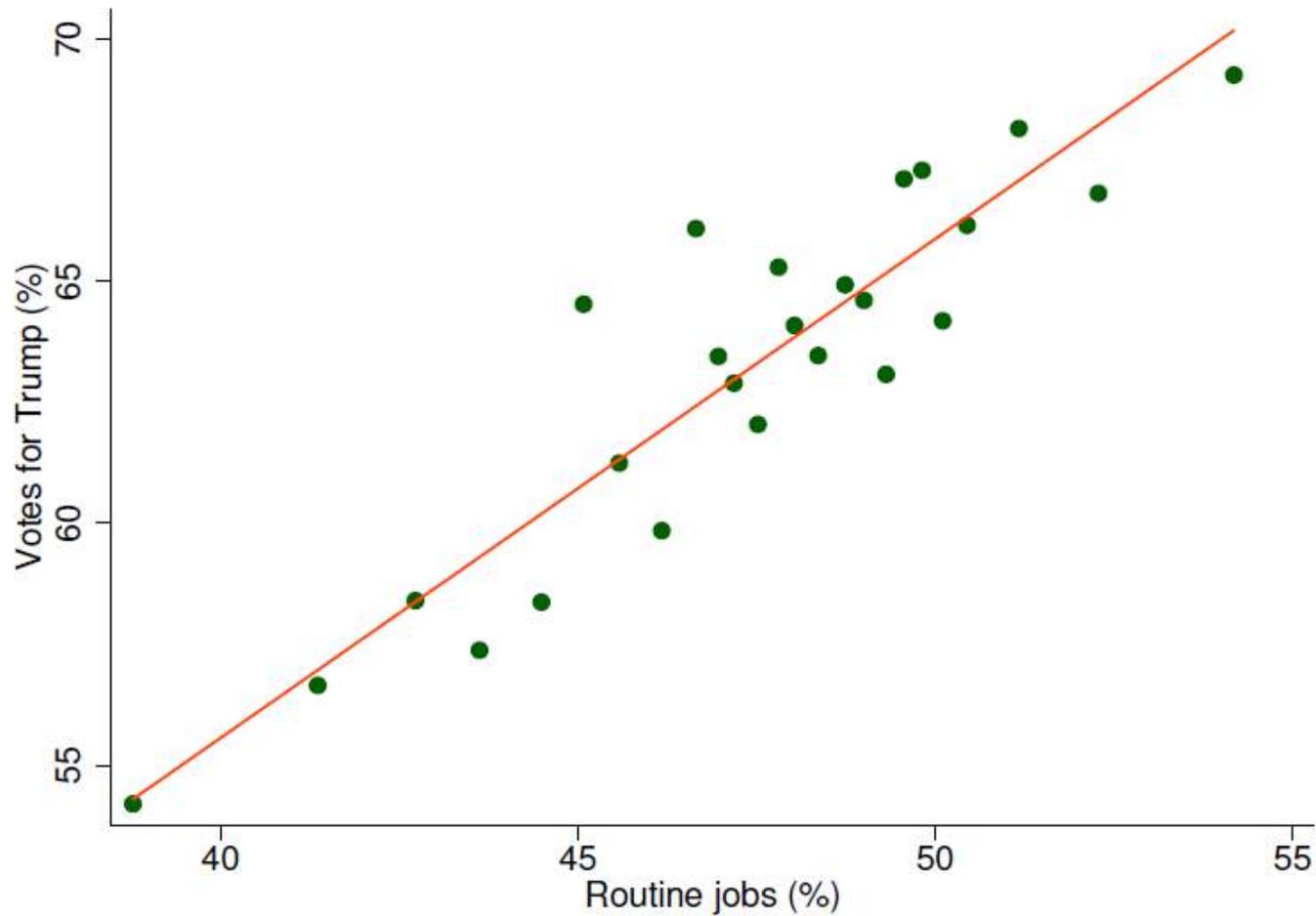


## THE **Communist Manifesto**

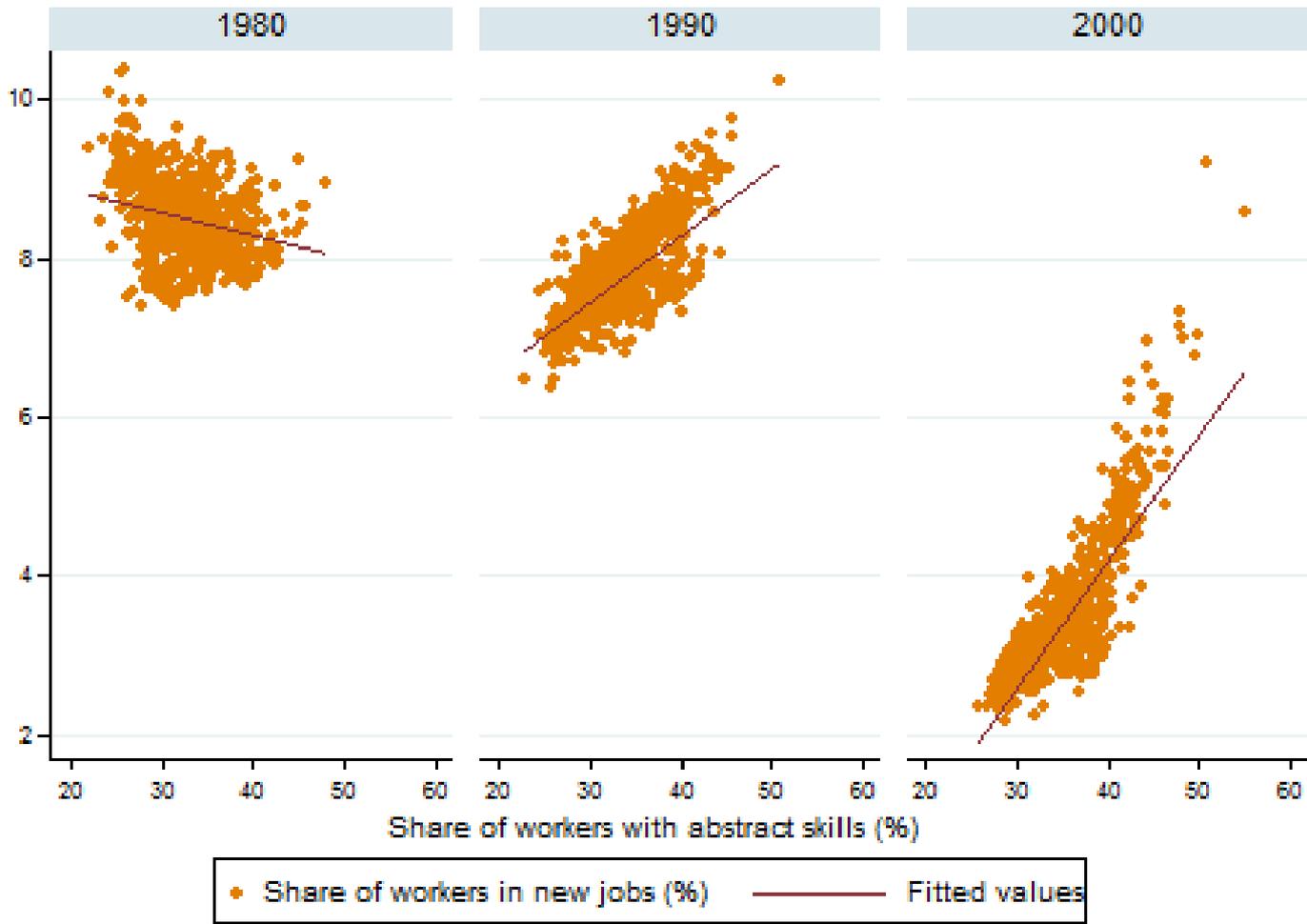


KARL MARX & FREDERICK ENGELS

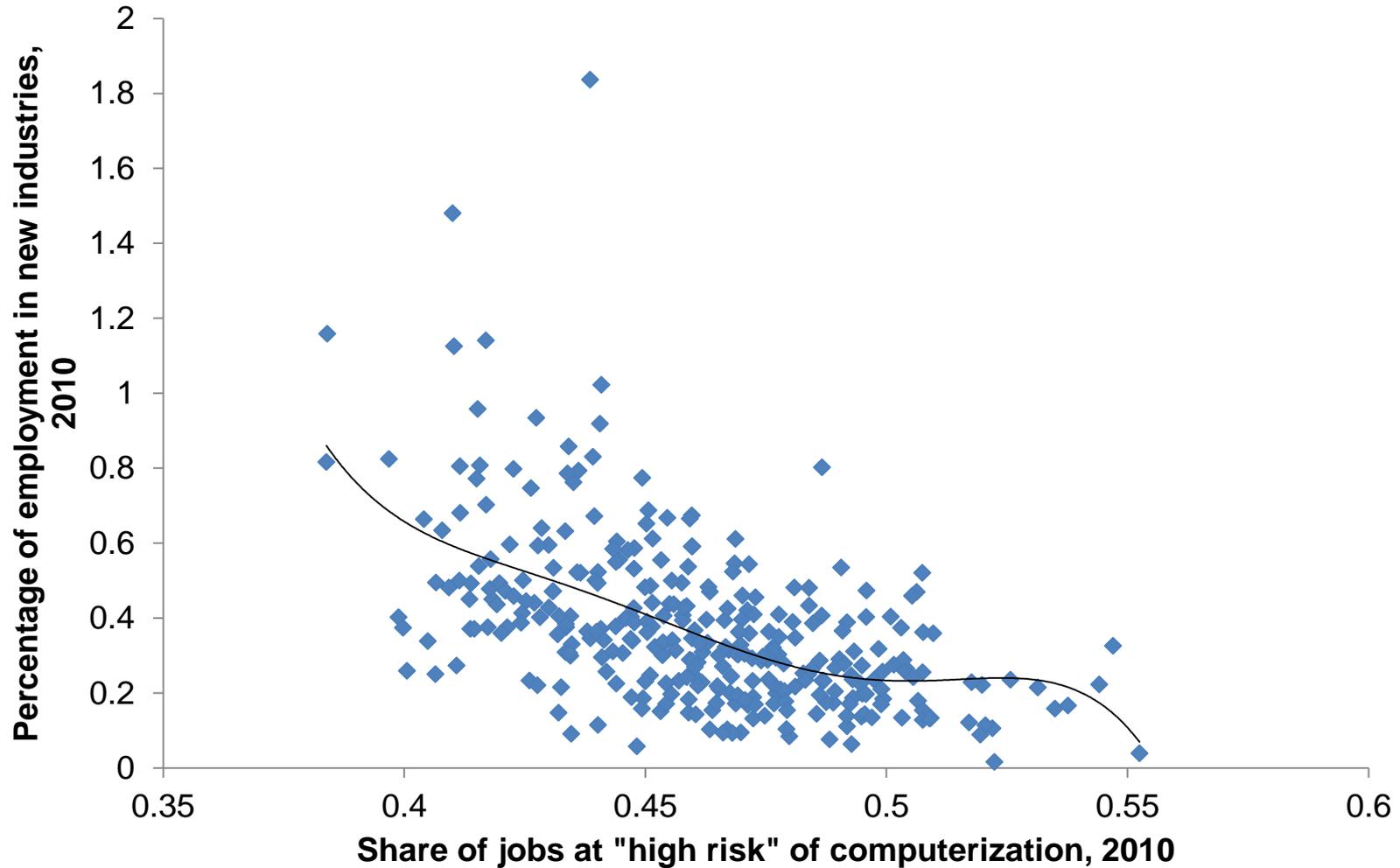
# The 2016 U.S. Presidential Election: A Modern Equivalent?



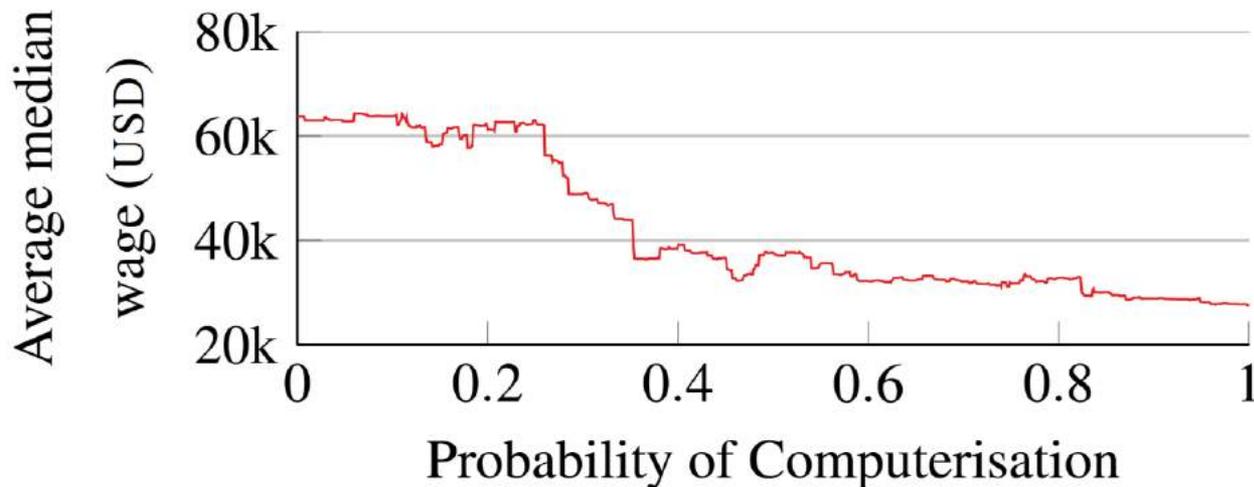
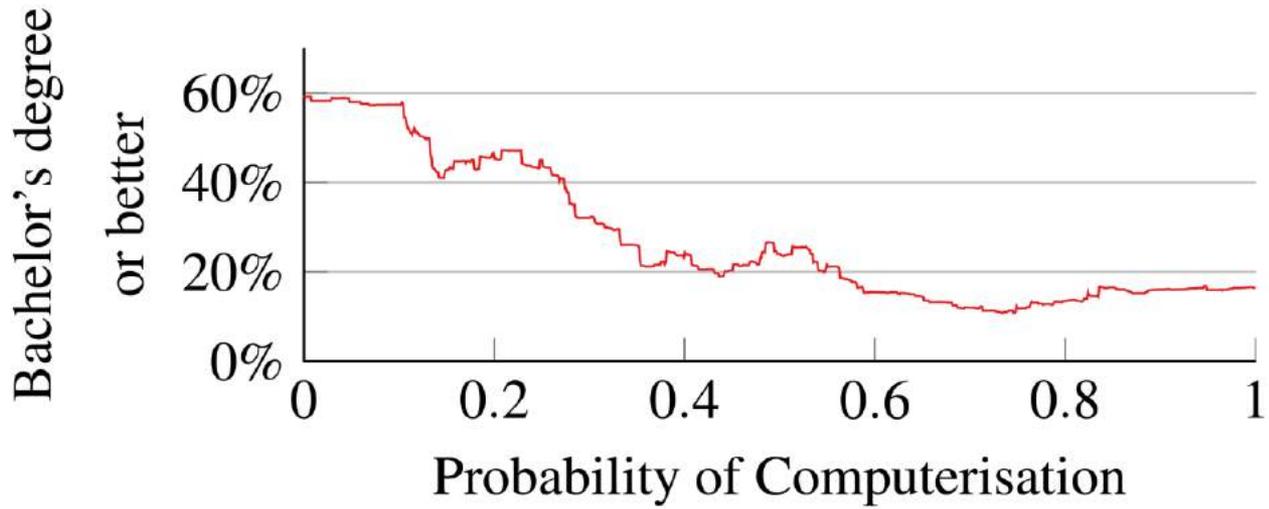
# Shifting Fortunes



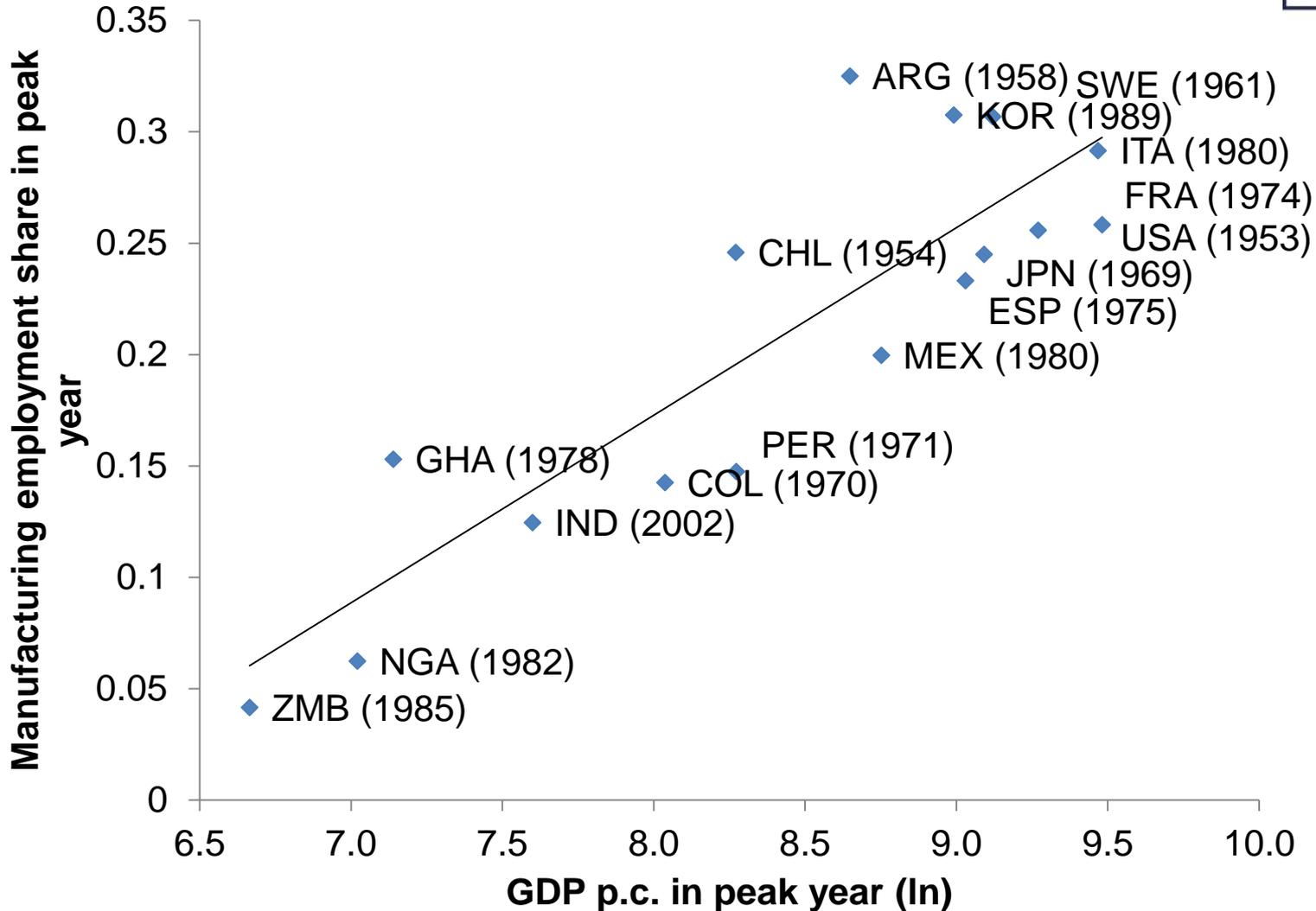
# Relocation: The New Geography of Jobs



# Education: Low-skilled jobs at risk of automation



# What About The Developing World?



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MARTIN  
SCHOOL

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MARTIN  
SCHOOL



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