

# The power of creative destruction

Philippe Aghion

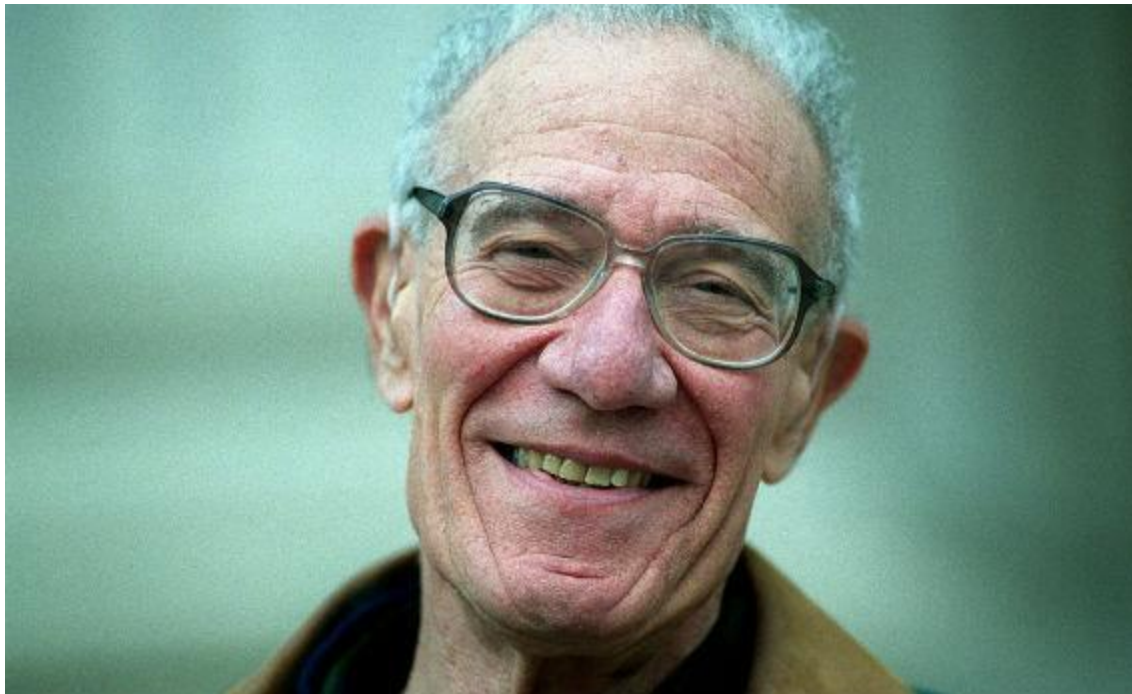
July 2024



## CREATIVE DESTRUCTION...

- Process whereby new innovations displace old technologies
  - Joseph Schumpeter in *Capitalism, Socialism et Democracy* (1942)

# ROBERT SOLOW



# A CONTRIBUTION TO THE THEORY OF ECONOMIC GROWTH

*By* ROBERT M. SOLOW

I. Introduction, 65. — II. A model of long-run growth, 66. — III. Possible growth patterns, 68. — IV. Examples, 73. — V. Behavior of interest and wage rates, 78. — VI. Extensions, 85. — VII. Qualifications, 91.

## I. INTRODUCTION

All theory depends on assumptions which are not quite true. That is what makes it theory. The art of successful theorizing is to make the inevitable simplifying assumptions in such a way that the final results are not very sensitive.<sup>1</sup> A “crucial” assumption is one on which the conclusions do depend sensitively, and it is important that crucial assumptions be reasonably realistic. When the results of a theory seem to flow specifically from a special crucial assumption, then if the assumption is dubious, the results are suspect.

# PETER HOWITT



# BASIC “SCHUMPETERIAN GROWTH” PARADIGM

- Long-run growth driven by cumulative process of innovation
- Innovations result from entrepreneurial activities motivated by prospect of innovation rents
- Creative destruction: new innovations displace old technologies

# AT THE HEART OF THE PARADIGM

- Contradiction :
  - The innovator is motivated by prospect of monopoly rents
  - But those rents can be used ex post to prevent future innovations and to block new entry
- Regulating capitalism is largely about how to manage this contradiction

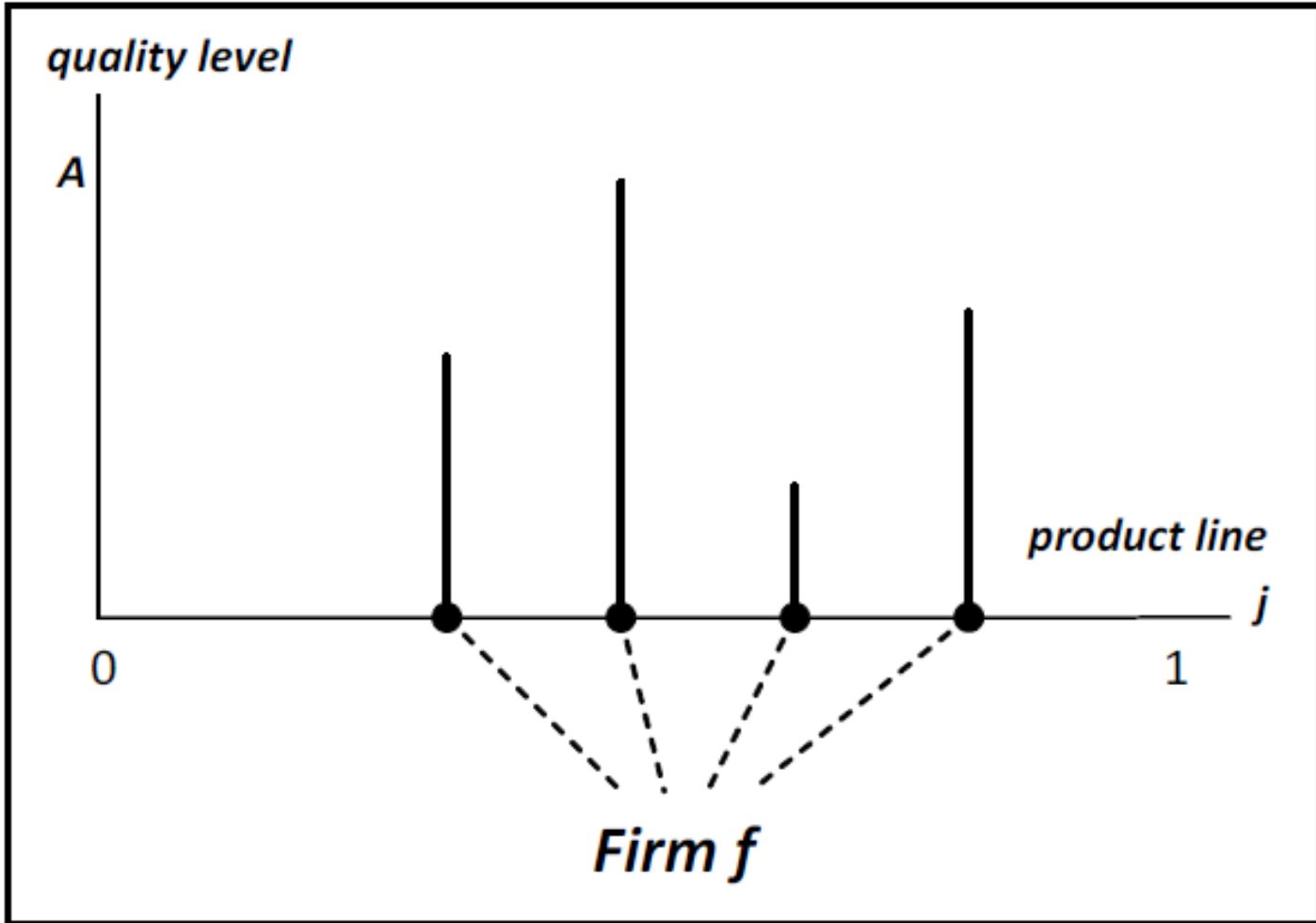


# WHY THIS PARADIGM CHANGES THE LANDSCAPE

- It gives centerstage to cross-firm heterogeneity
  - Between incumbents and entrants
  - Between leaders and followers
  - Between small and large firms

# WHY THIS PARADIGM CHANGES THE LANDSCAPE

- It gives centerstage to firm dynamics



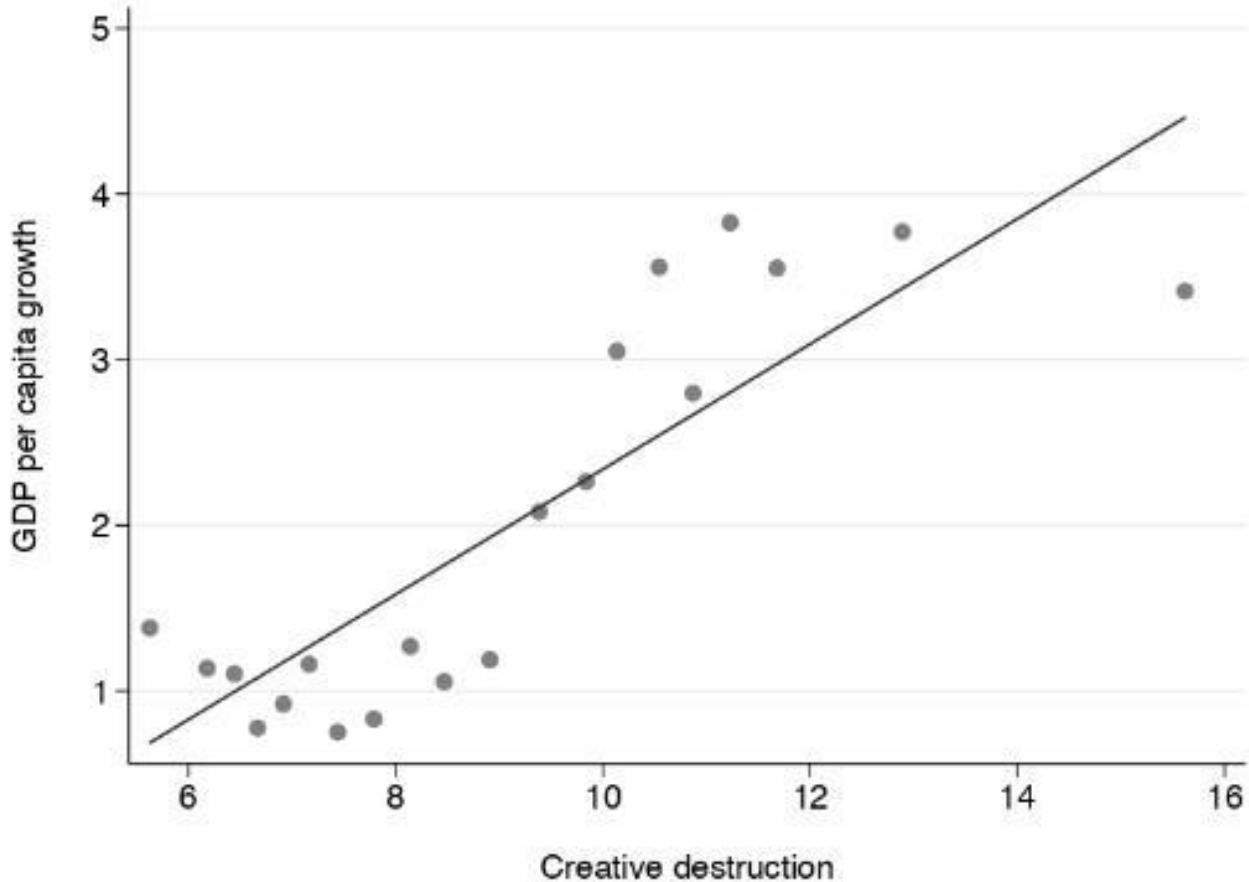
# **PART 1: TWO DISTINCTIVE PREDICTIONS**

## SOME DISTINCTIVE PREDICTIONS

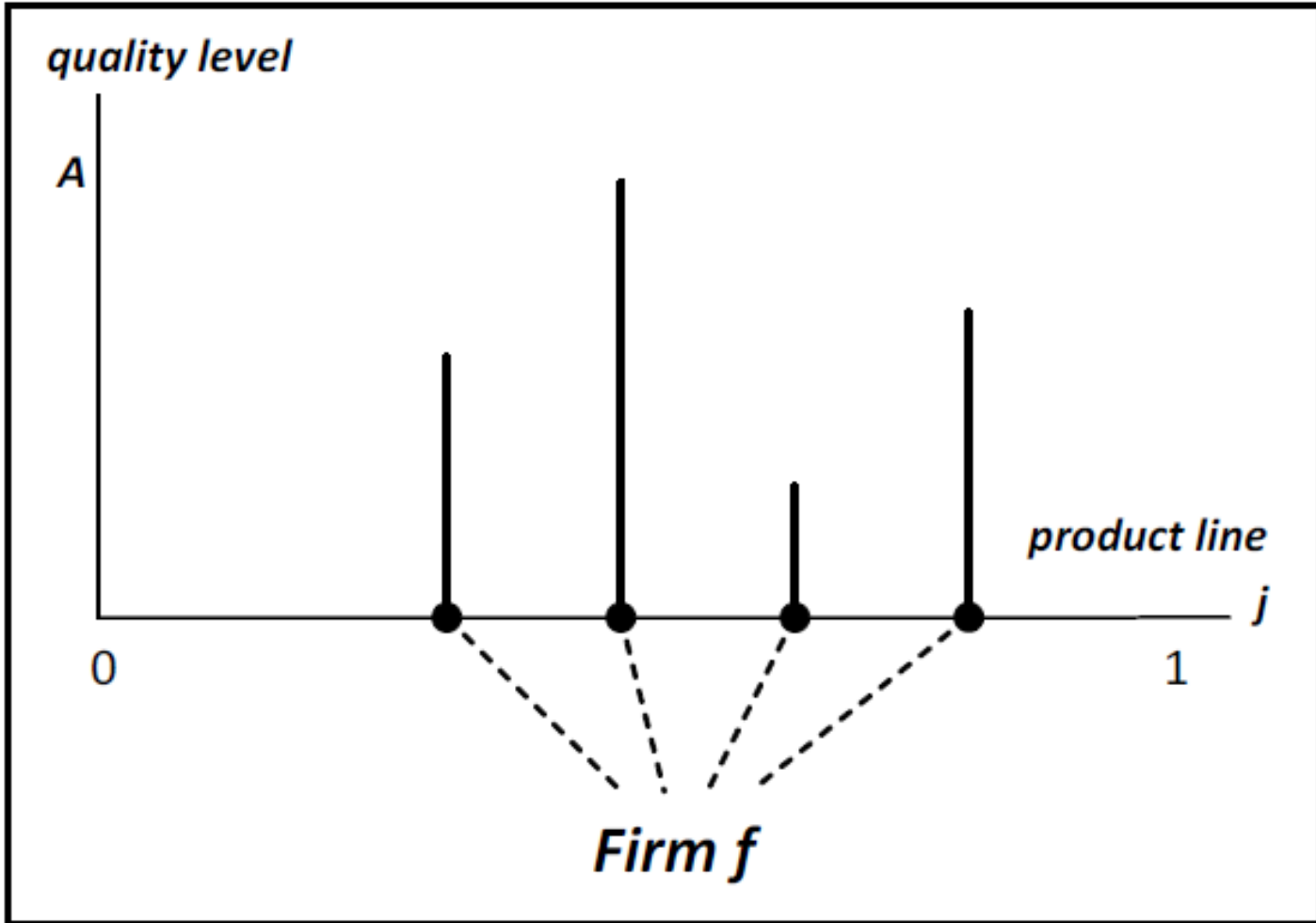
- **Growth is positively correlated with firm turnover**
- More intense competition enhances innovation in « frontier » firms but discourages it in « non-frontier » firms

# GROWTH AND TURNOVER

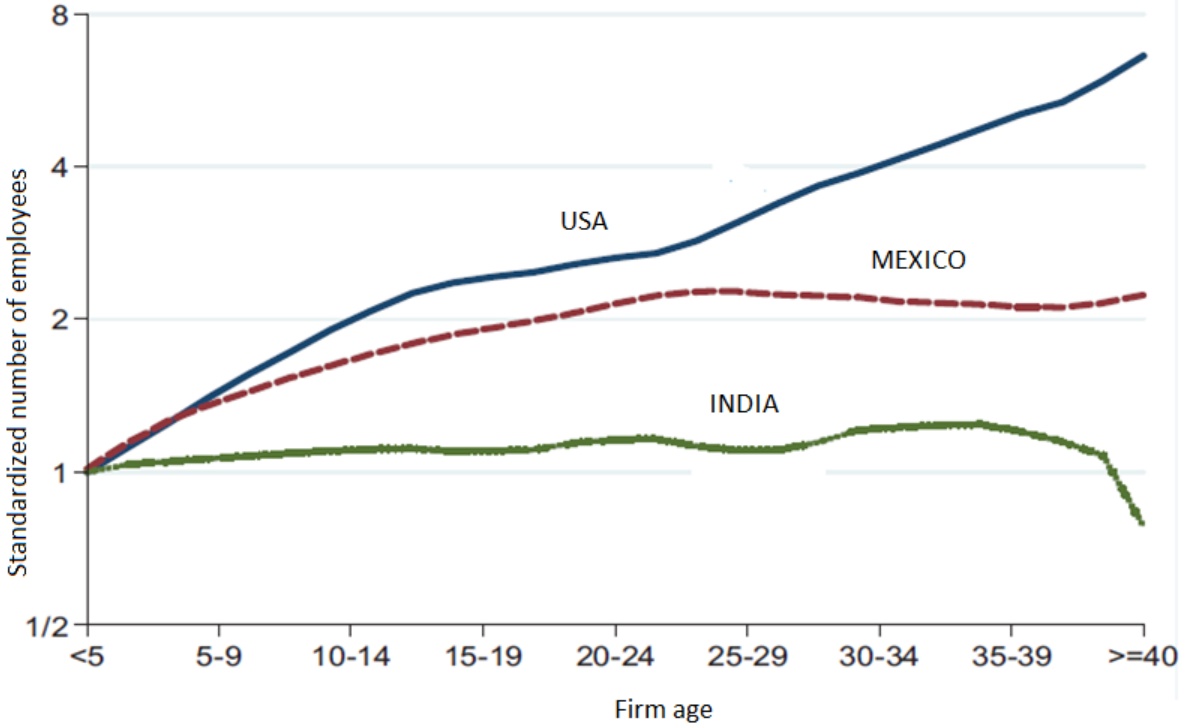
- Firm and job turnover



Positive correlation between GDP per capita growth and the rate of creative destruction.  
Source: Eurostat.

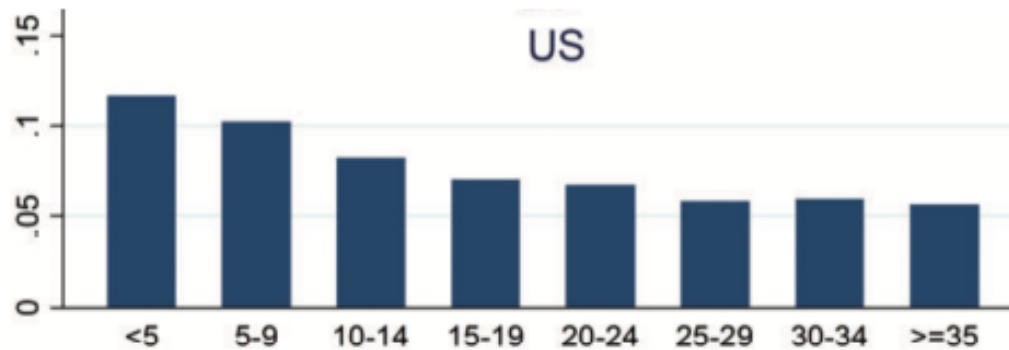
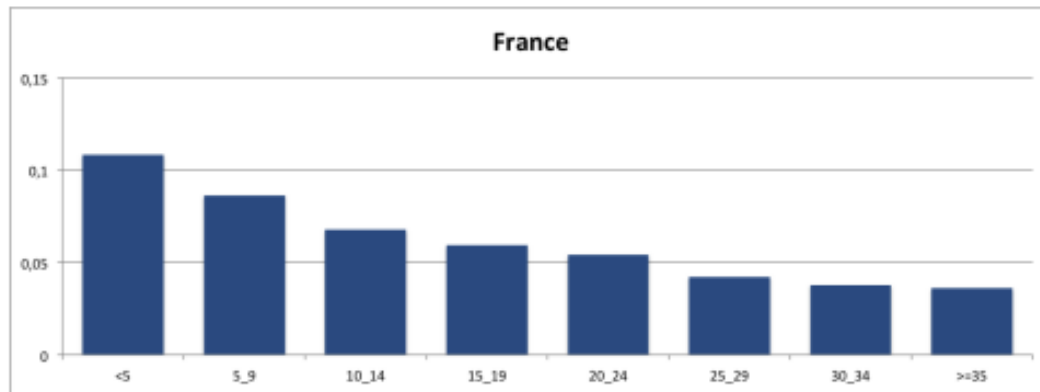


# LINK BETWEEN THE AGE AND THE SIZE OF FIRMS





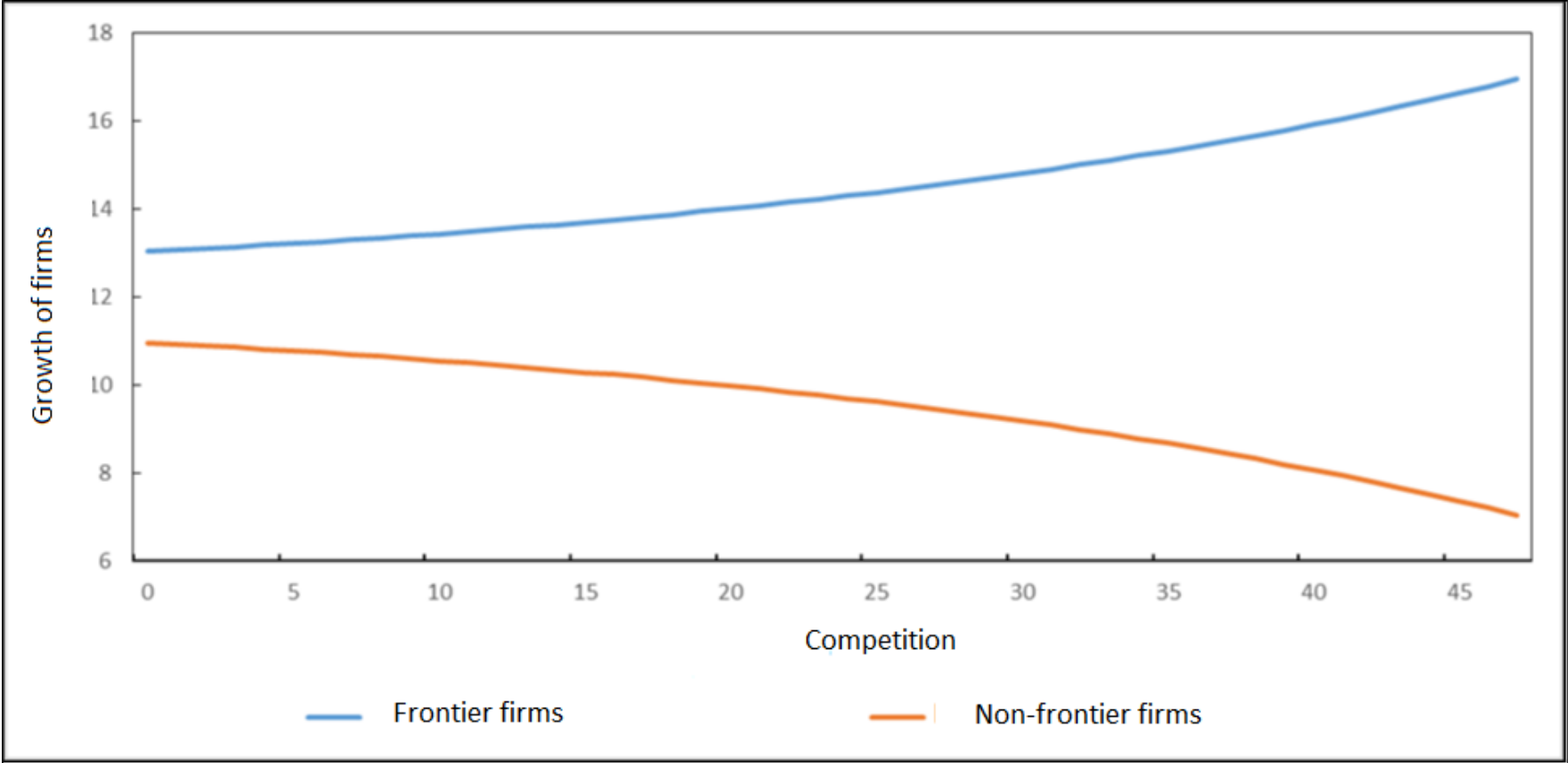
# EXIT RATE BY AGE



## SOME DISTINCTIVE PREDICTIONS

- Growth is positively correlated with firm turnover
- **More intense competition enhances innovation in « frontier » firms but discourages it in « non-frontier » firms**

# COMPETITION, GROWTH AND DISTANCE TO FRONTIER



# IN THIS LECTURE, WE USE THE LENS OF CREATIVE DESTRUCTION TO...

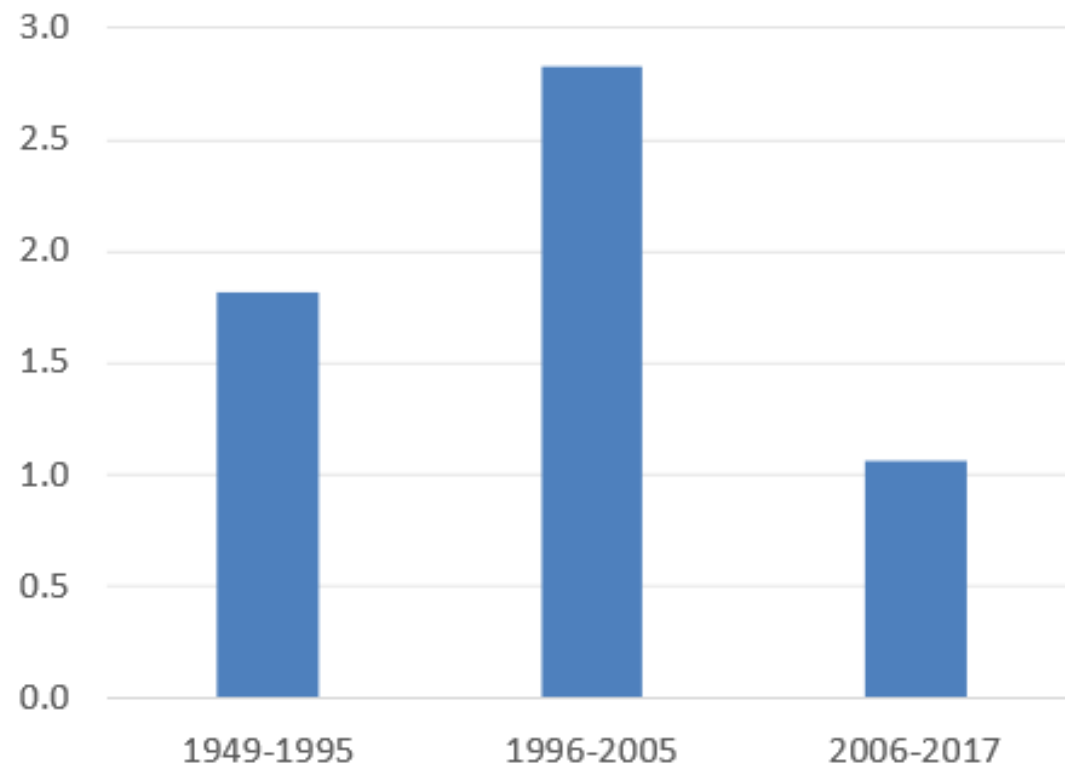
- Revisit some main *enigmas in economic history*
- Question some *common wisdoms*
- Rethink *the future of capitalism*

# **PART 2: SOME HISTORICAL ENIGMA**

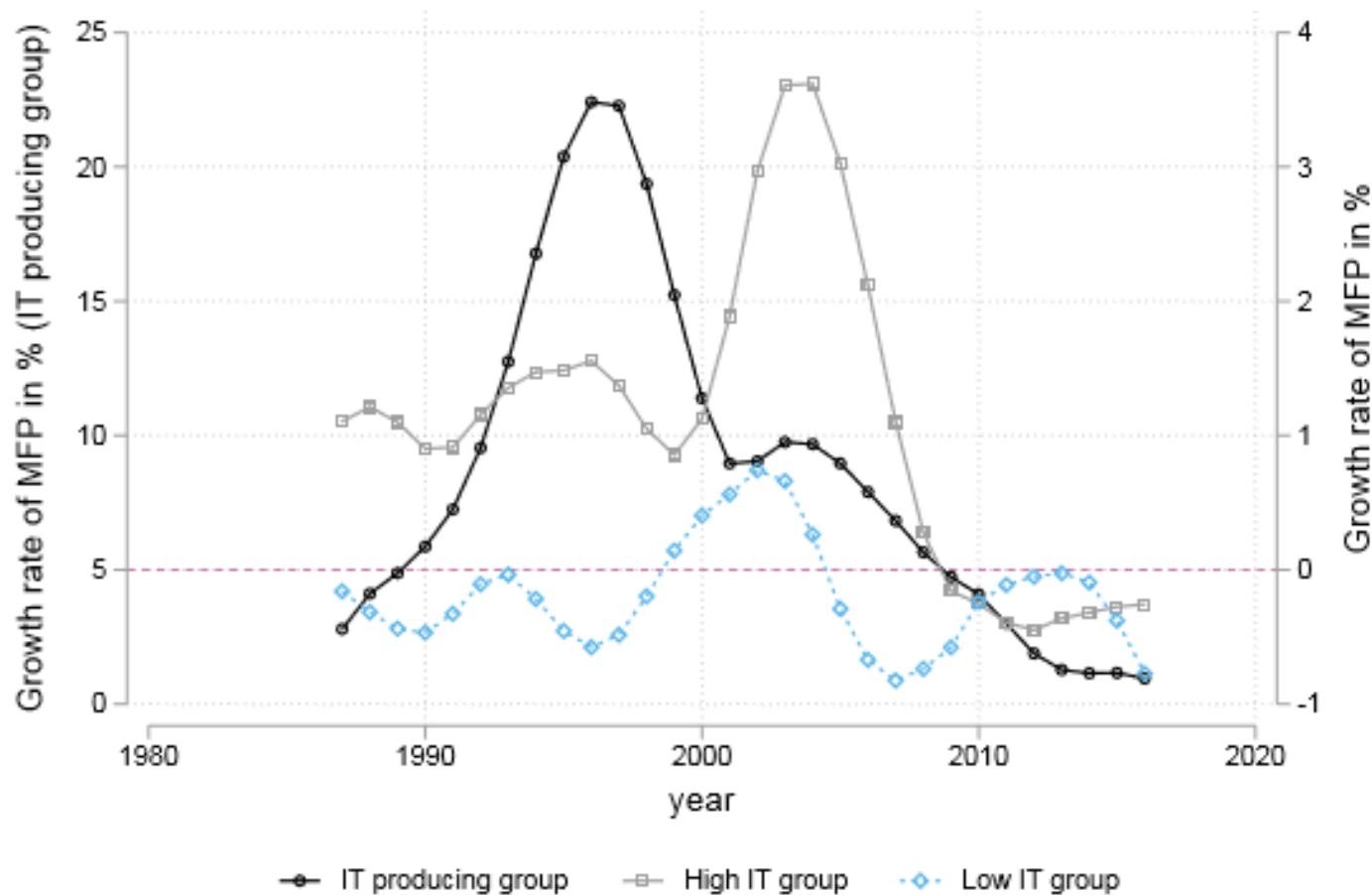
# SOME HISTORICAL ENIGMA

- **Secular stagnation**
- Middle income trap
- Sources and dynamics of inequality

# RISE AND DECLINE IN TFP GROWTH

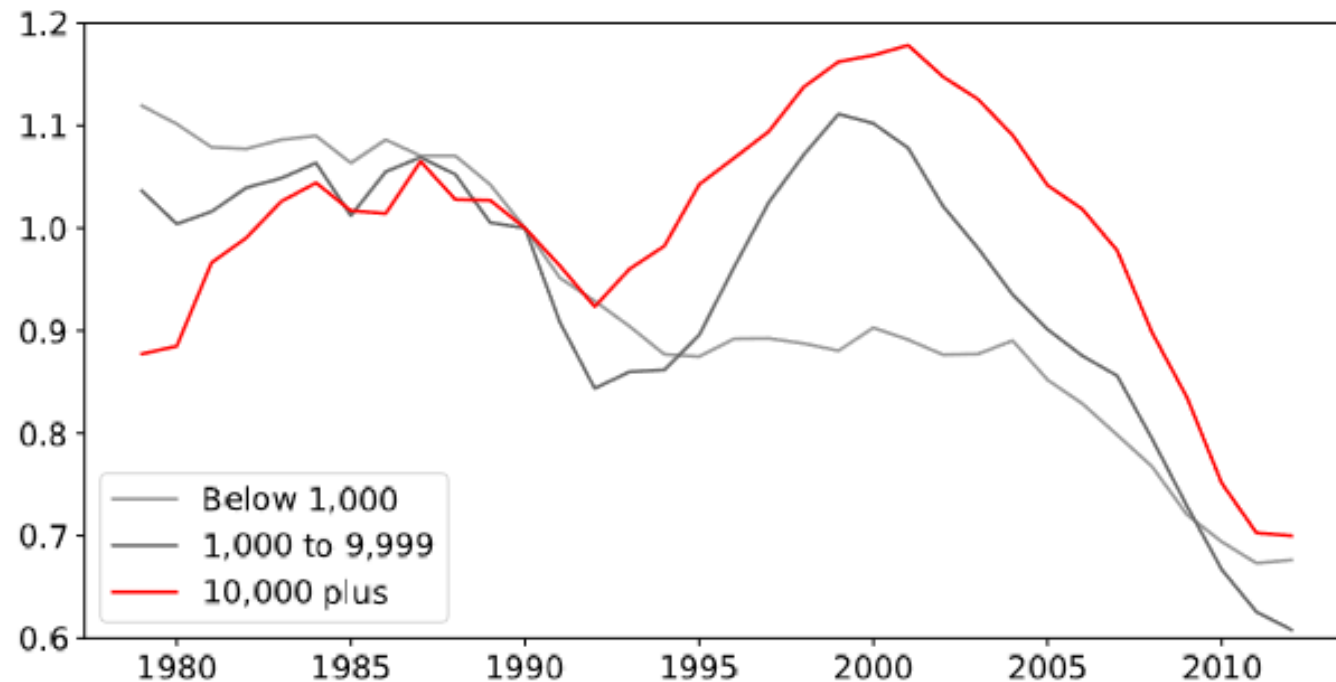


# TFP GROWTH BY IT INTENSITY



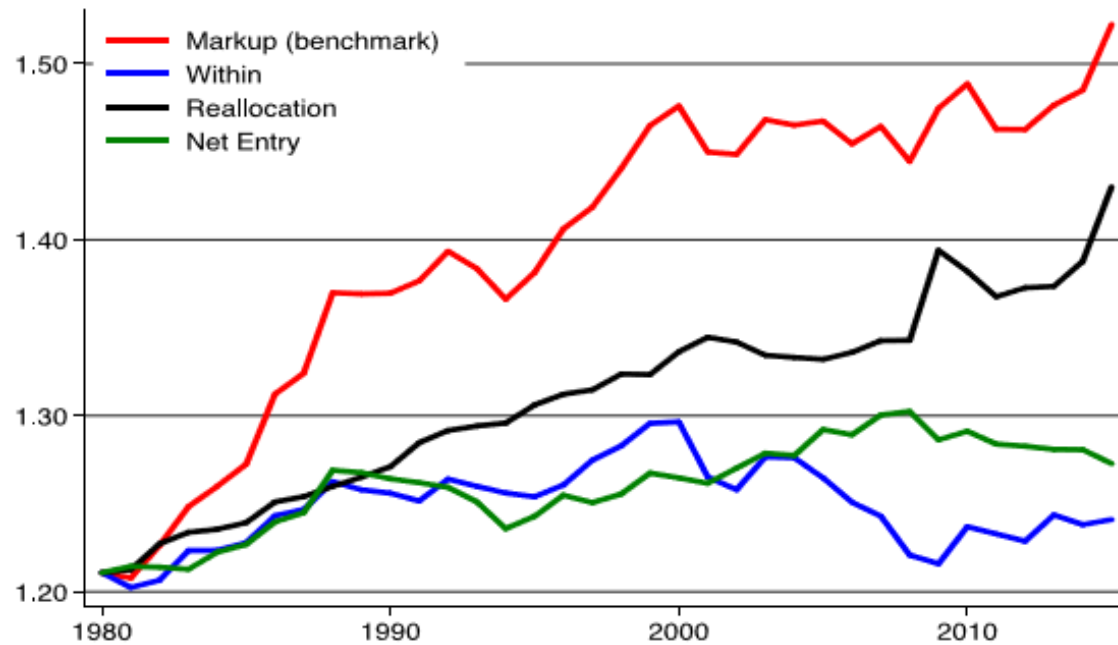


## Rise and decline in employment-weighted plant entry rate



Source: U.S. Census Bureau's *Business Dynamics Statistics*. Job creation by birth over total employment by firm size bins. 5-year centered moving average.

## WITHIN FIRM MARKUPS



Source: De Loecker, Eeckhout and Unger (2018).

# SOME HISTORICAL ENIGMA

- Secular stagnation
- **Middle income traps**
- Sources and dynamics of inequality

## FRONTIER INNOVATION VS CATCH UP GROWTH

$$A_{t+1} - A_t = \mu_n(\gamma - 1)A_t + \mu_m(\bar{A}_t - A_t)$$

Thus policies aimed at influencing  $\mu_n$  and  $\mu_m$  will affect a country's growth performance differently depending upon its proximity to world technology frontier (Acemoglu-Aghion-Zilibotti (2006))

# COMPETITION, GROWTH AND DISTANCE TO FRONTIER

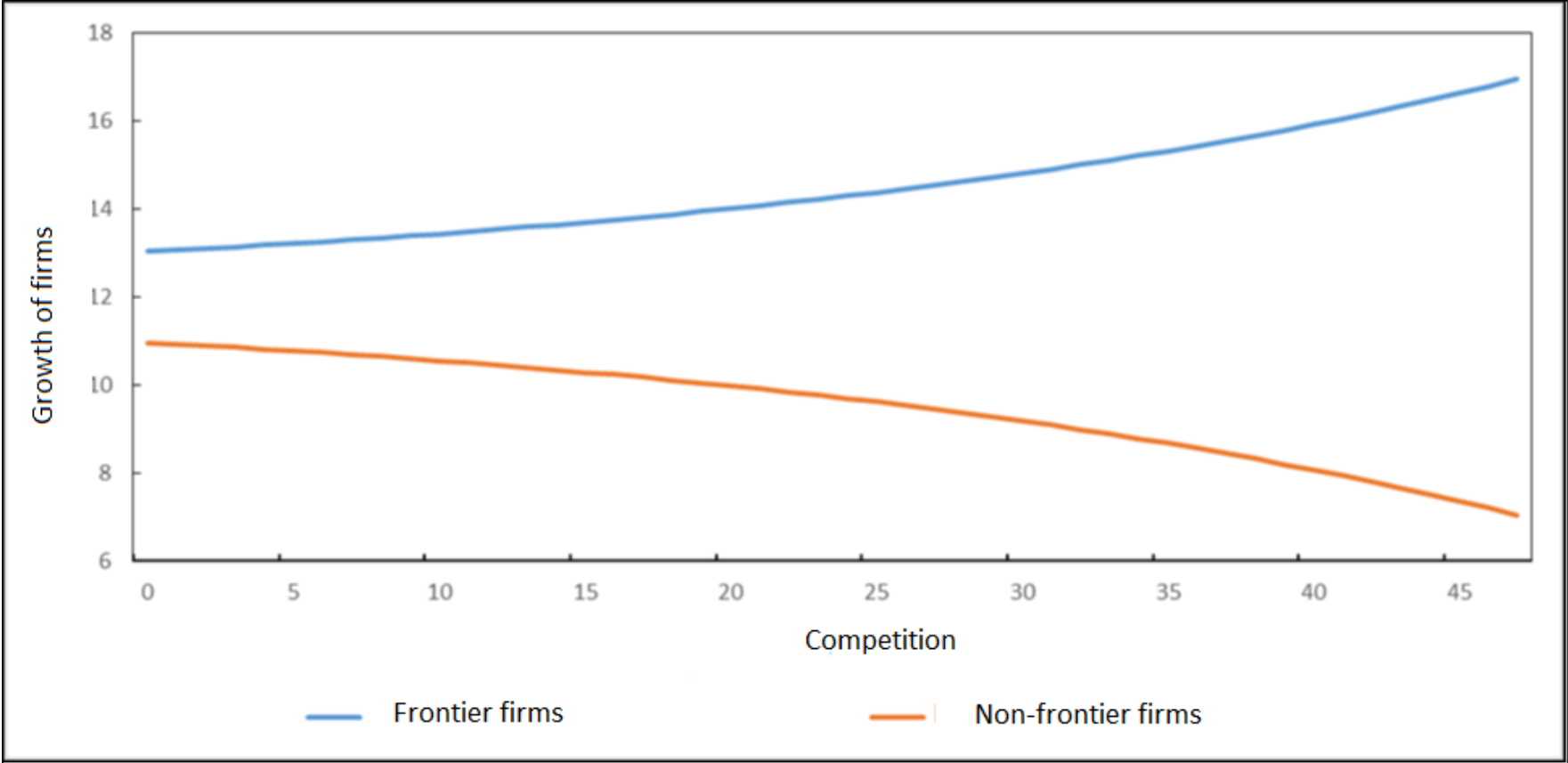


Fig 11.2a: HIGH BARRIERS

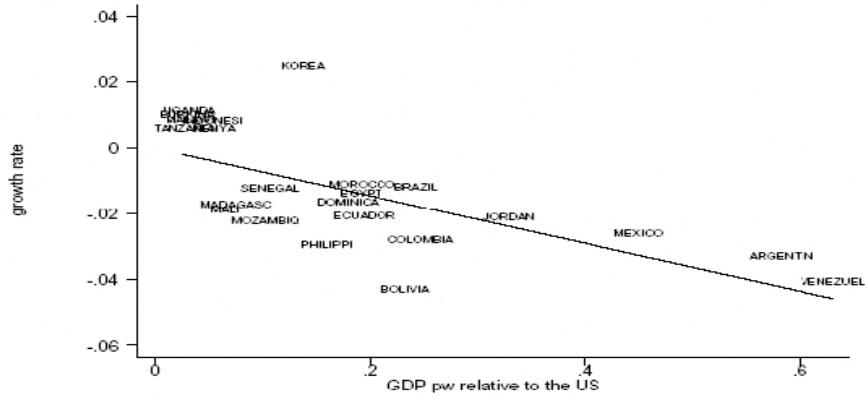


Fig 11.2b: LOW BARRIERS

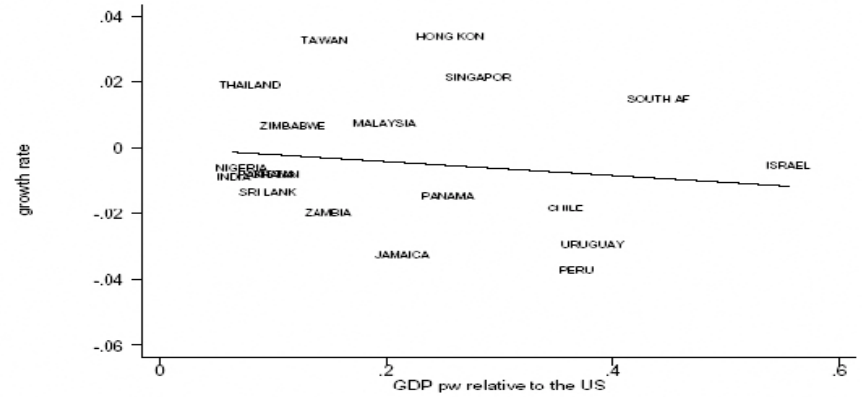


Fig 11.2c: HIGH BARRIERS (FE)

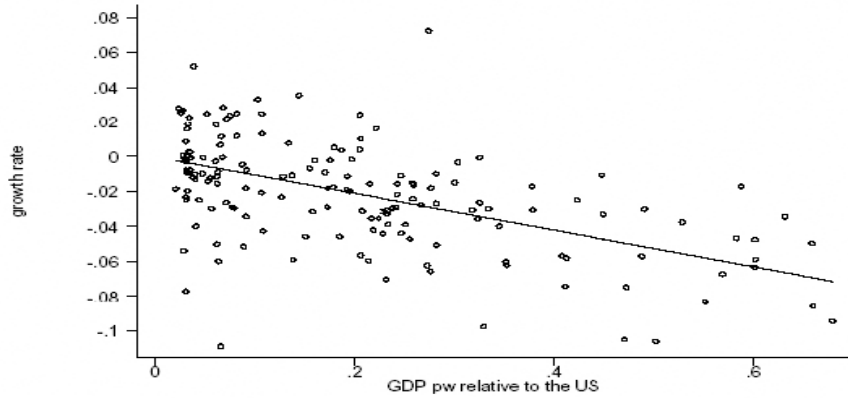
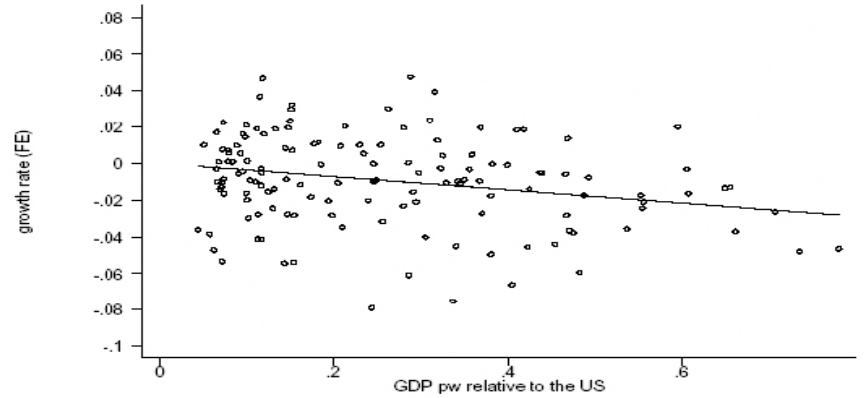


Fig 11.2d: LOW BARRIERS (FE)



## Corruption

Fig. 1a: High Corruption

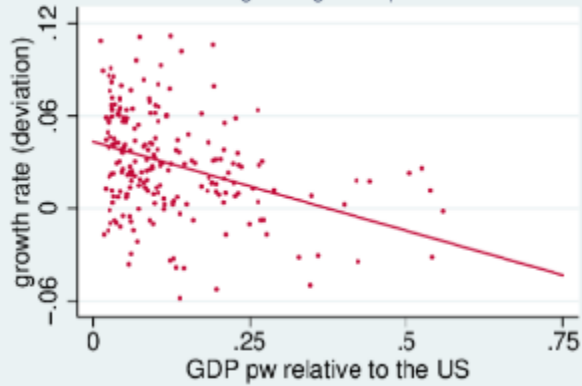


Fig. 1b: Low Corruption

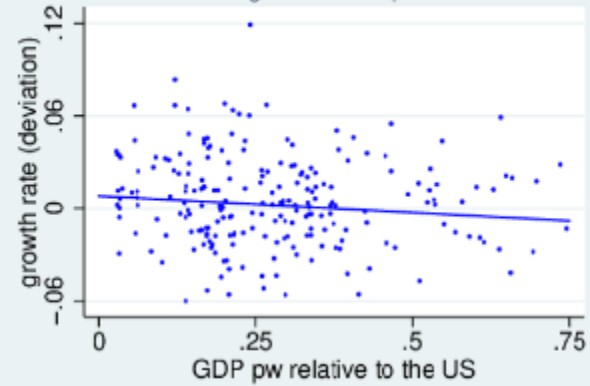


Fig. 1c: High Corruption(FE)

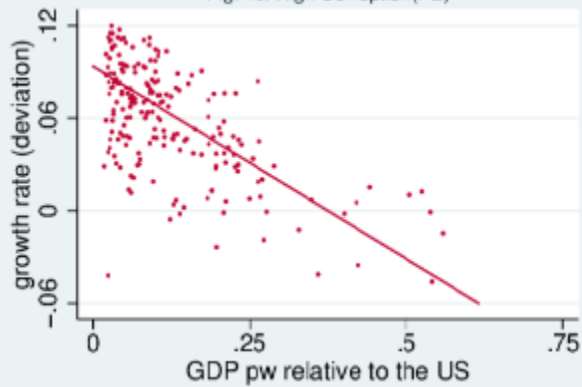
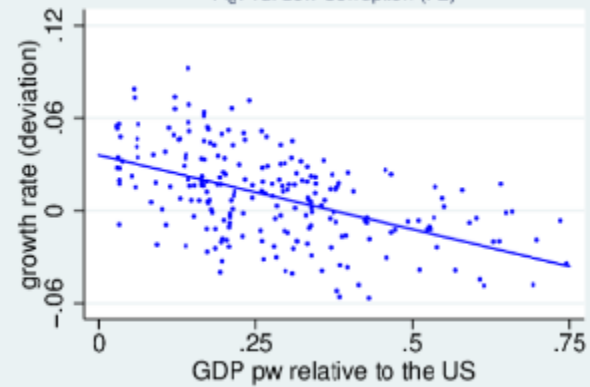


Fig. 1d: Low Corruption (FE)



# ENHANCING PRODUCTIVITY GROWTH IN EMERGING MARKET ECONOMIES

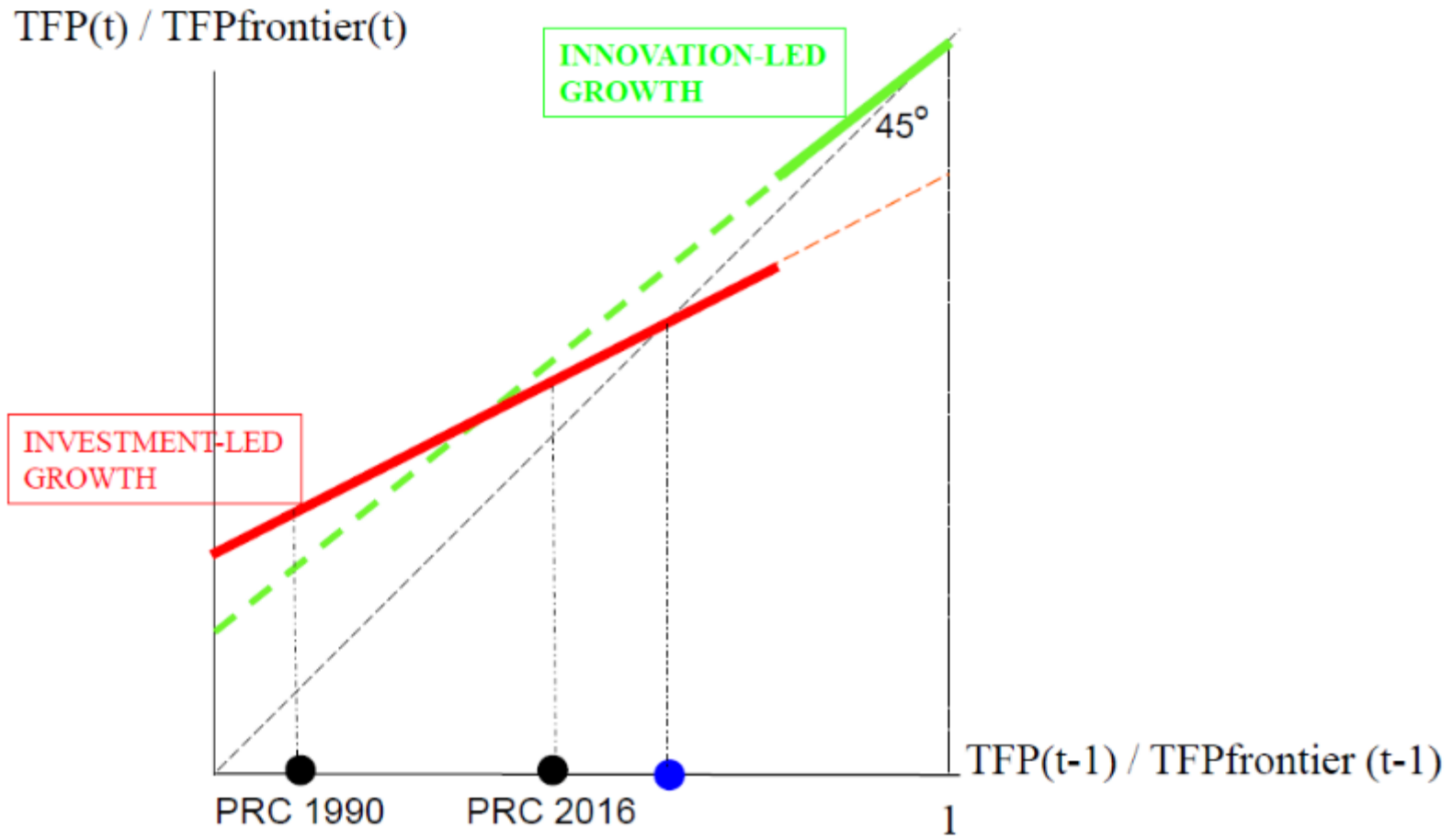
- Foster technology transfers
- Reallocate factors
- Improve management practices



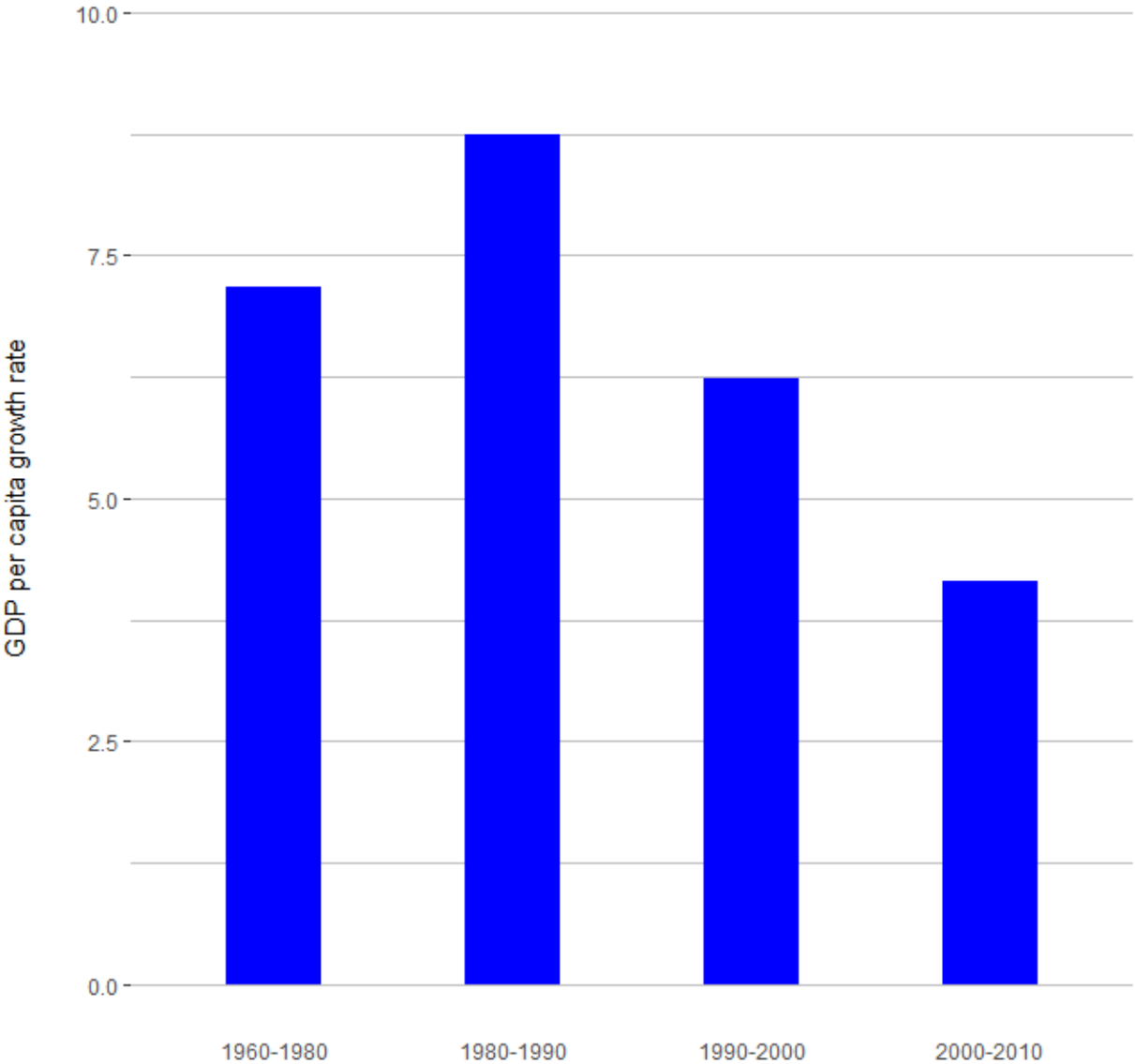
# ENHANCING PRODUCTIVITY GROWTH IN ADVANCED COUNTRIES

- Investment in higher education
- Liberalization of product market
- Liberalization of labor market
- Equity financing

# Distance to Frontier and Economic Growth



# KOREA: 1960-2010



# KOREA

Korean growth before the 1997-98 Asian crisis relied on the Chaebol model. Chaebols supported each other and thus effectively restricted entry of non-chaebol firms.

Chaebol-based model did manage to deliver in terms of industrialization, investment and export growth

However Chaebols acted as barriers to entry to new innovating firms

# KOREA

The Asian crisis undermined the legitimacy of chaebol model

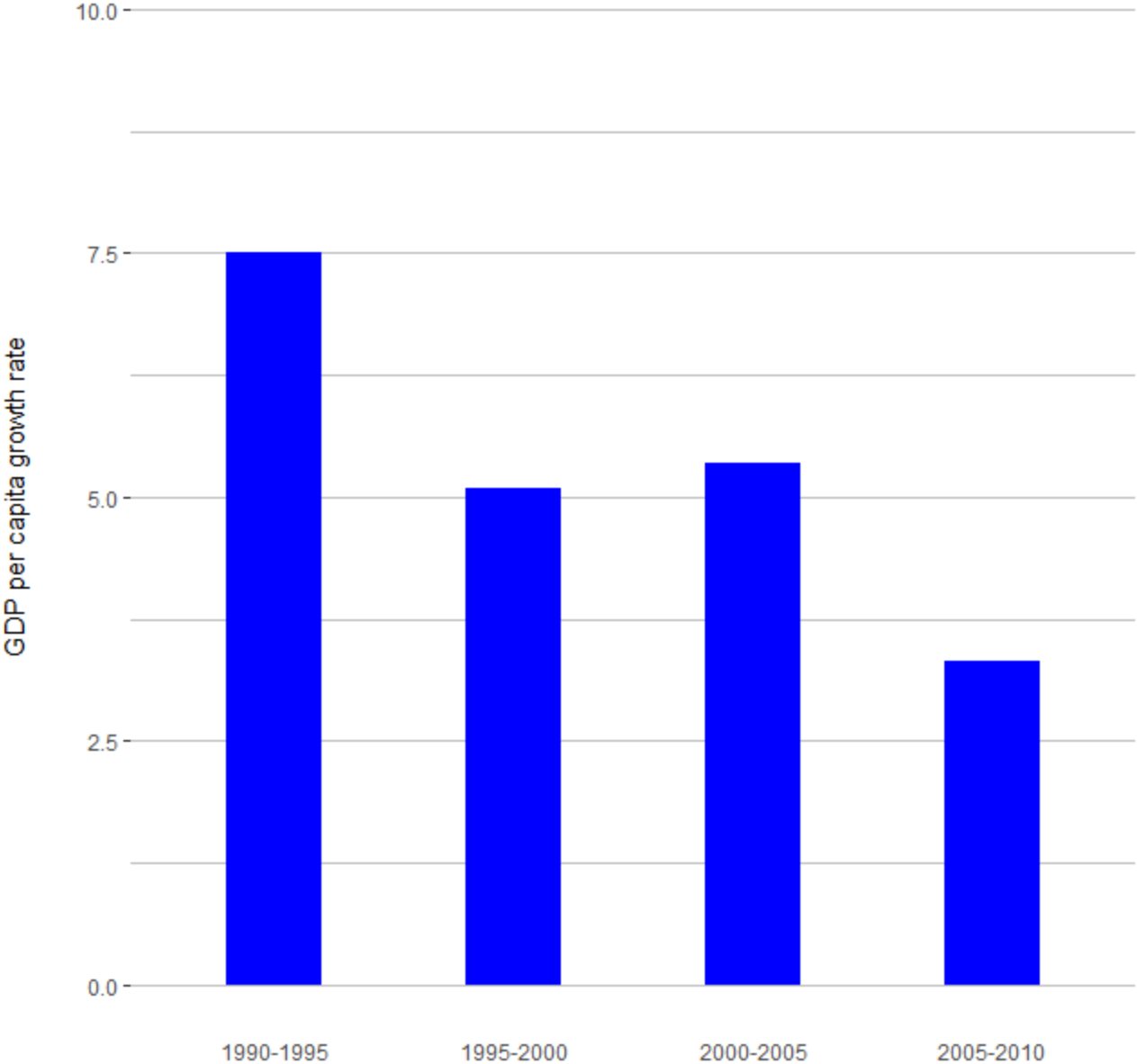
# KOREA

With Serguei Guriev and Kangchul Jo we used firm-level and industry-level data to analyze the effect of the Asian crisis and of the resulting 1998 reforms on the entry and productivity growth of non-chaebols in industries that used to be dominated by chaebols.

## KOREA: MAIN FINDING

We find that after the crisis the industries previously dominated by chaebols witness higher entry and faster TFP growth of non-chaebol firms.

# KOREA: 1990-2010





# METHODOLOGY

**Difference-in-differences at the industry level:**

$$Y_{it} = \alpha_i + \beta_1 Post\ crisis_t + \beta_2 (Chaebol\ share_i \times Post\ crisis_t) + u_{it}$$

**Industry  $i$ , year  $t$**

**Industry fixed effects  $\alpha_i$**

**$Post\ crisis_t$ : 0 before 1998, 1 after 1998**

**$Chaebol\ share_i$ : average share of chaebols in industry sales in pre-crisis years**

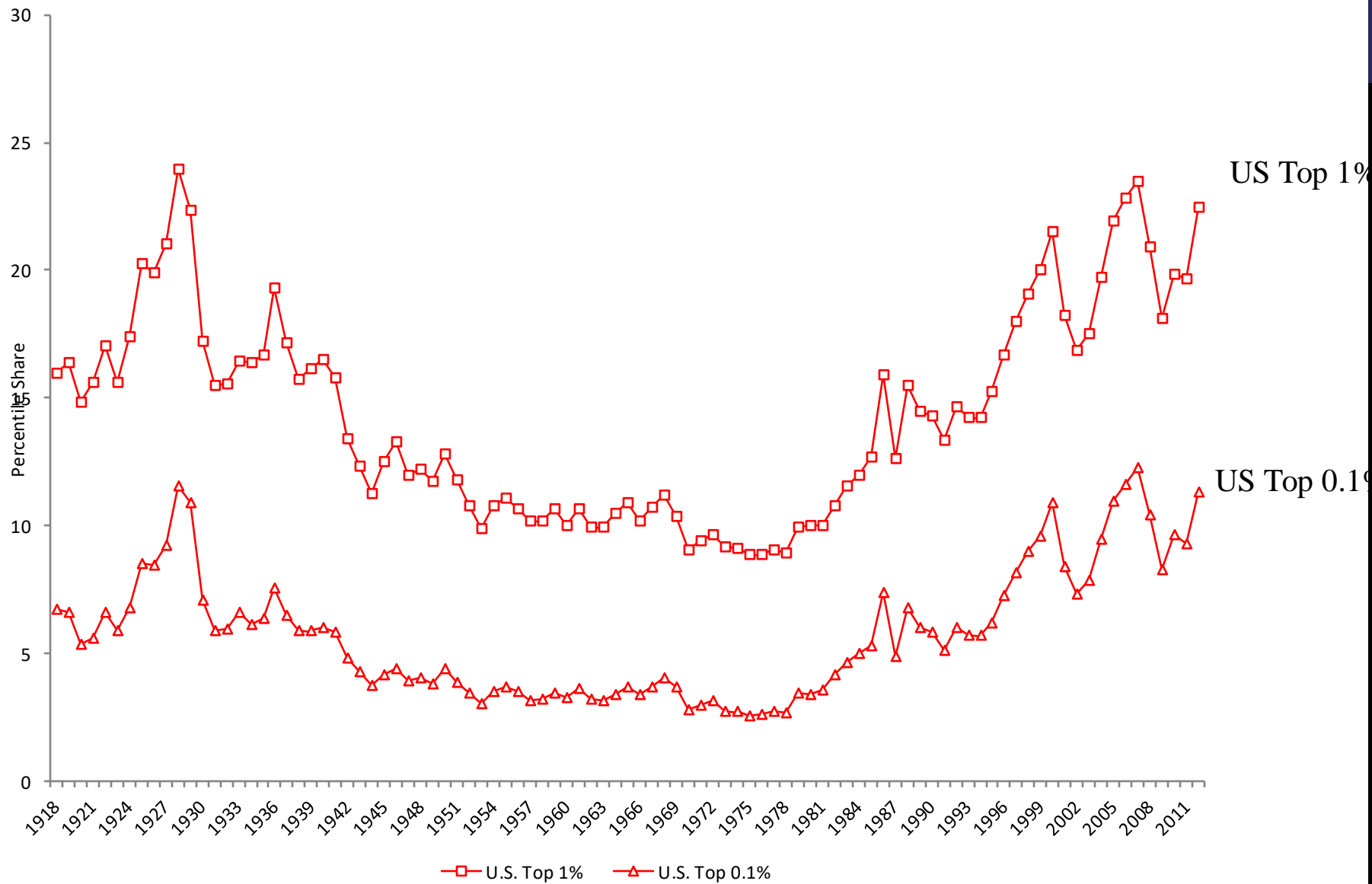
# TFP

Dependent variable: log (TFP)				
	All firms	Chaebol firms	Non-chaebol firms in industries with non-trivial chaebol share	Non-chaebol firms in industries with zero chaebol share
Post Crisis	0.214*** (0.017)	0.366*** (0.096)	0.153*** (0.027)	0.200*** (0.021)
Post crisis × Average Chaebol share in the industry before the crisis	0.176 (0.167)	-0.162 (0.246)	0.465*** (0.171)	–
# of Observations	5,081	1,464	2,458	2,622
# of Industries	469	224	227	243

# SOME HISTORICAL ENIGMA

- Secular stagnation
- Middle Income trap
- **Sources and dynamics of inequality**

# Income shares at the very top over last 100 years: US top 1% increases from 9% in 1978 to 22% in 2012



Source: Atkinson, Piketty & Saez; High Income Database

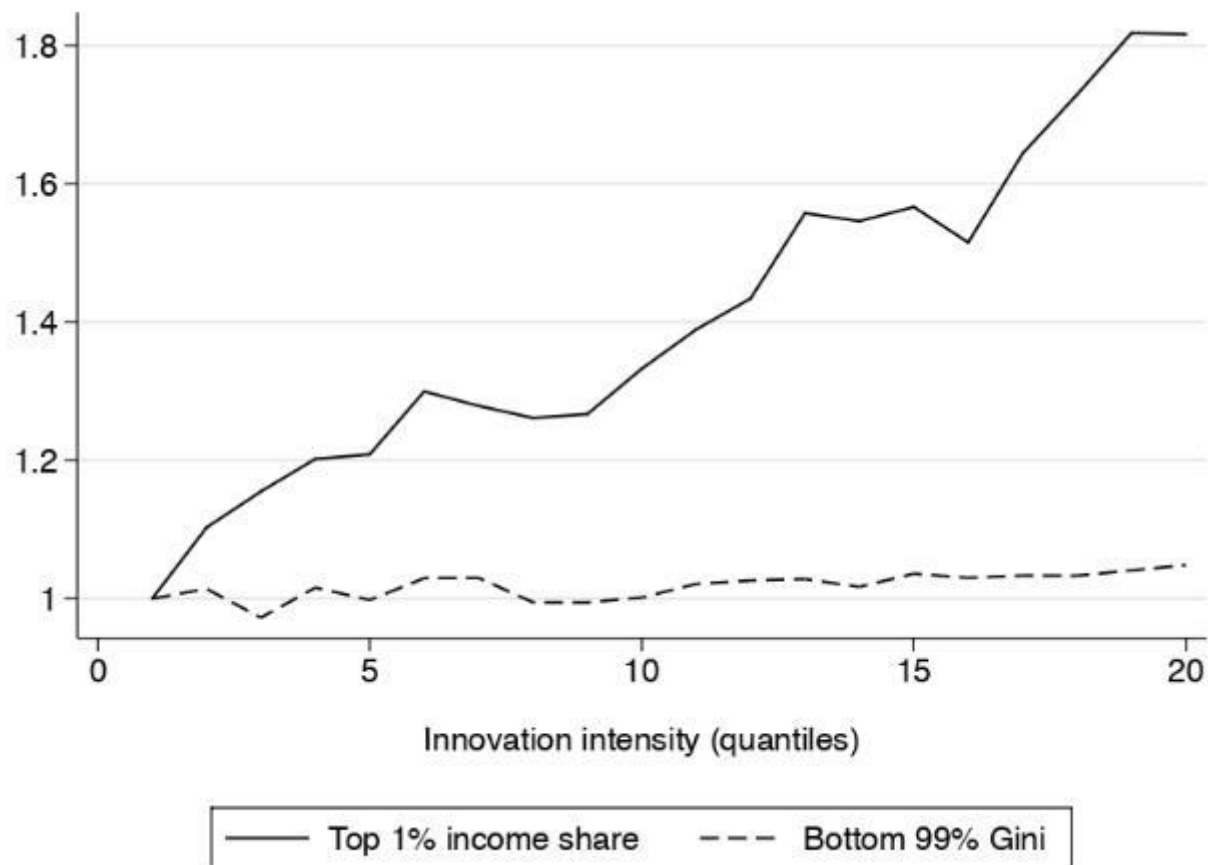
## **INNOVATION:**

Innovation increases top income inequality

(Entrant) Innovation increases social mobility

Innovation does not increase broad inequality

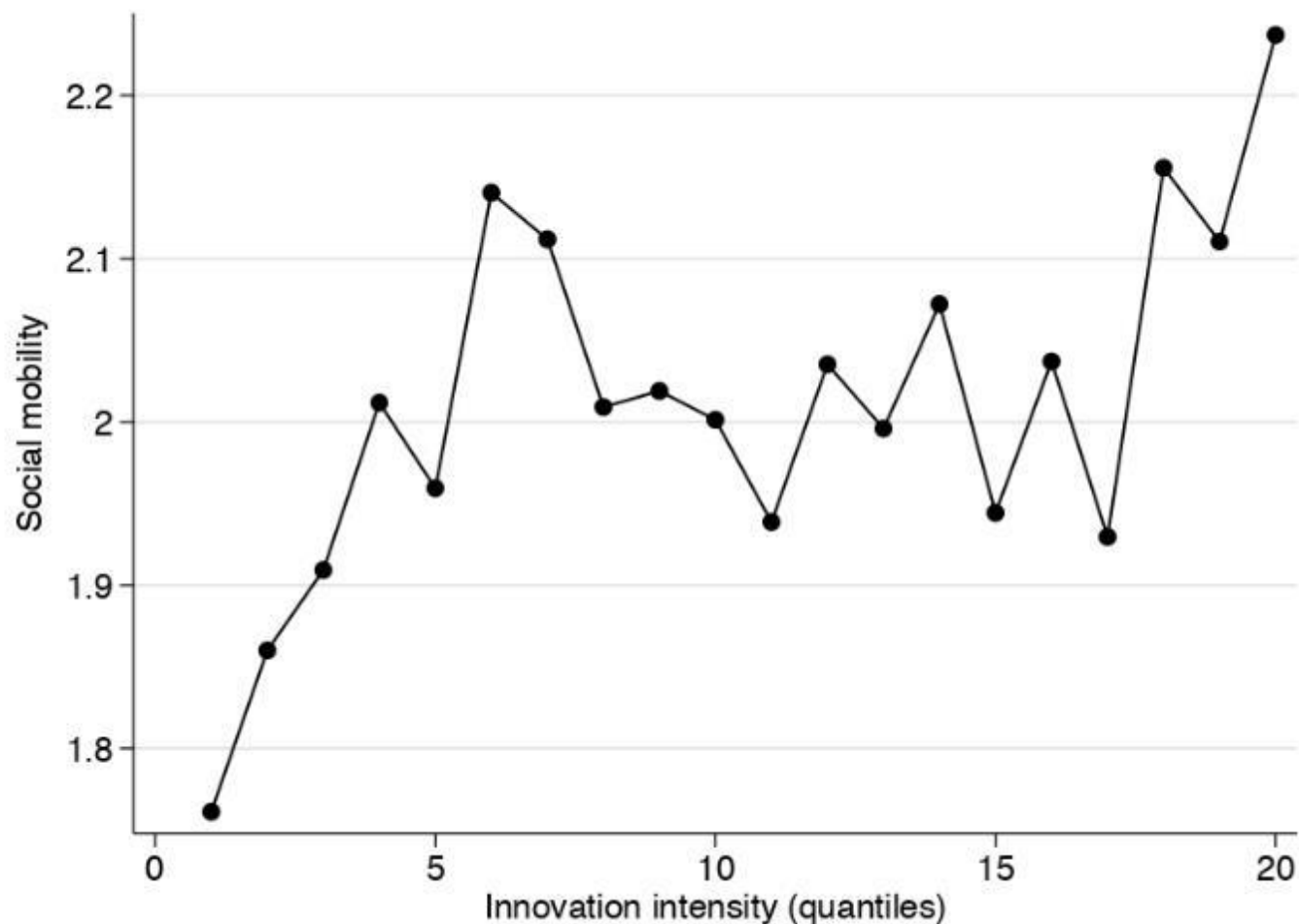
# INNOVATION AND INEQUALITY



Innovation, top 1% income share and Gini coefficient.

Source: Aghion, Akcigit, Bergeaud, Blundell, Hemous (2018)

# INNOVATION AND SOCIAL MOBILITY



Innovation and Social Mobility

Source: Aghion, Akcigit, Bergeaud, Blundell, Hemous (2018)

## **BY CONTRAST, LOBBYING..**

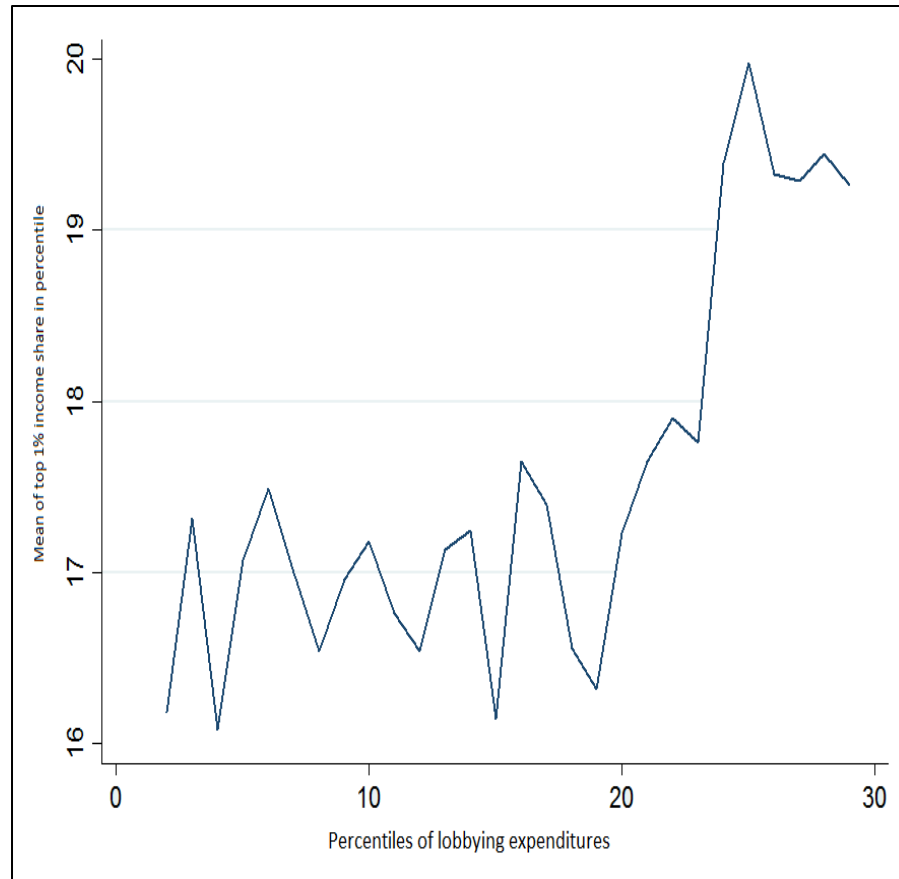
Reduces social mobility

Increases broad inequality

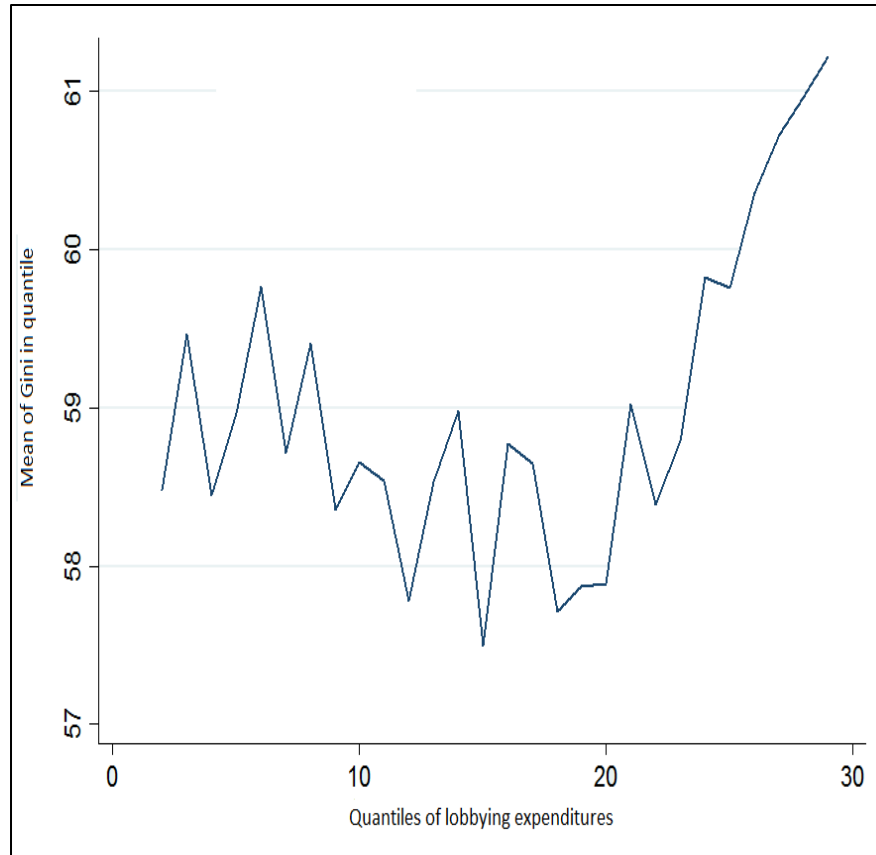
Steve Jobs versus Carlos Slim



## Lobbying VS Top1% (USA)



## Lobbying VS GINI (USA)



# **PART 2: QUESTIONING COMMON WISDOMS**

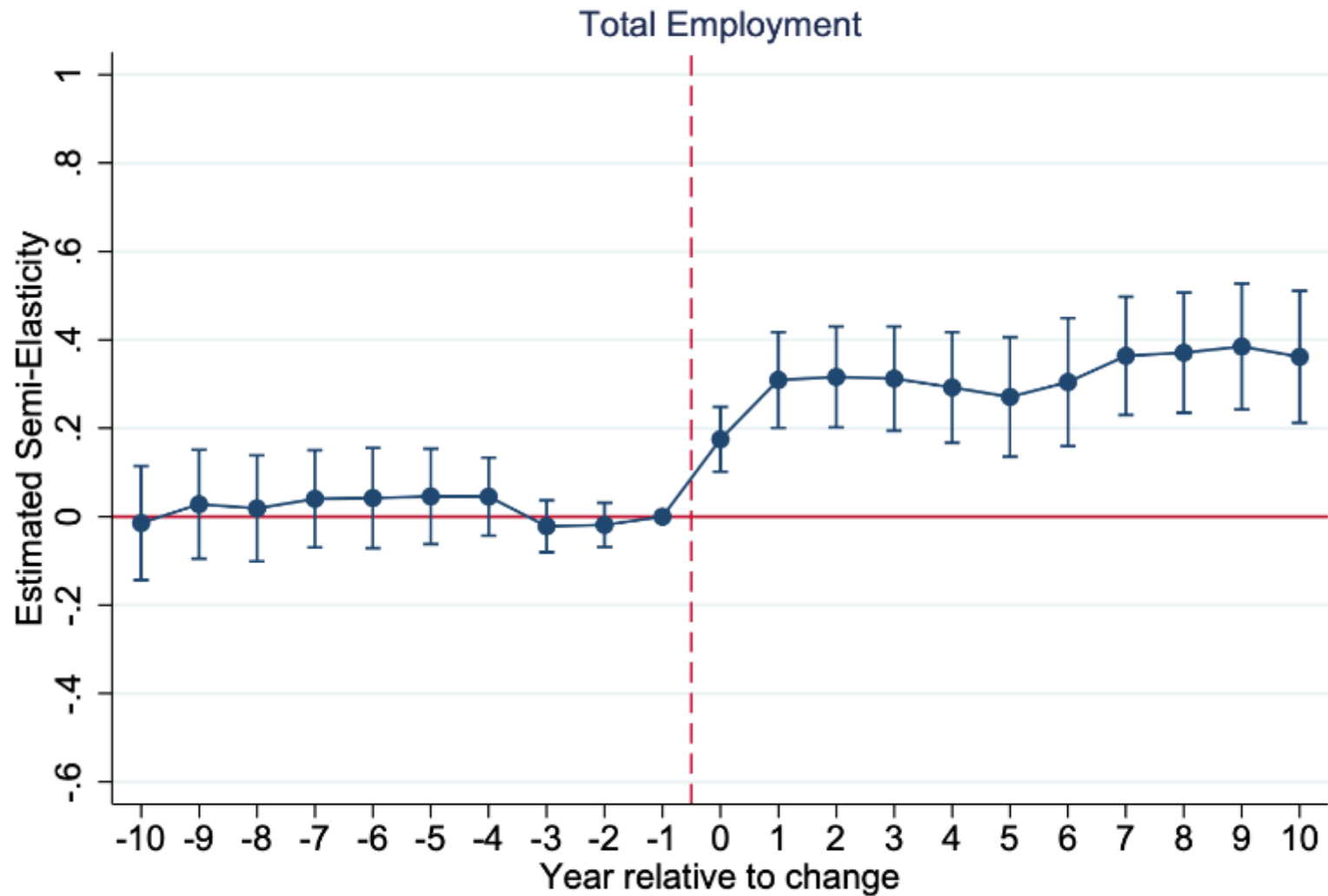
# QUESTIONING COMMON WISDOMS

- **Taxing robots protects employment**
- Negative growth to stop climate change

# **AUTOMATION AND EMPLOYMENT**

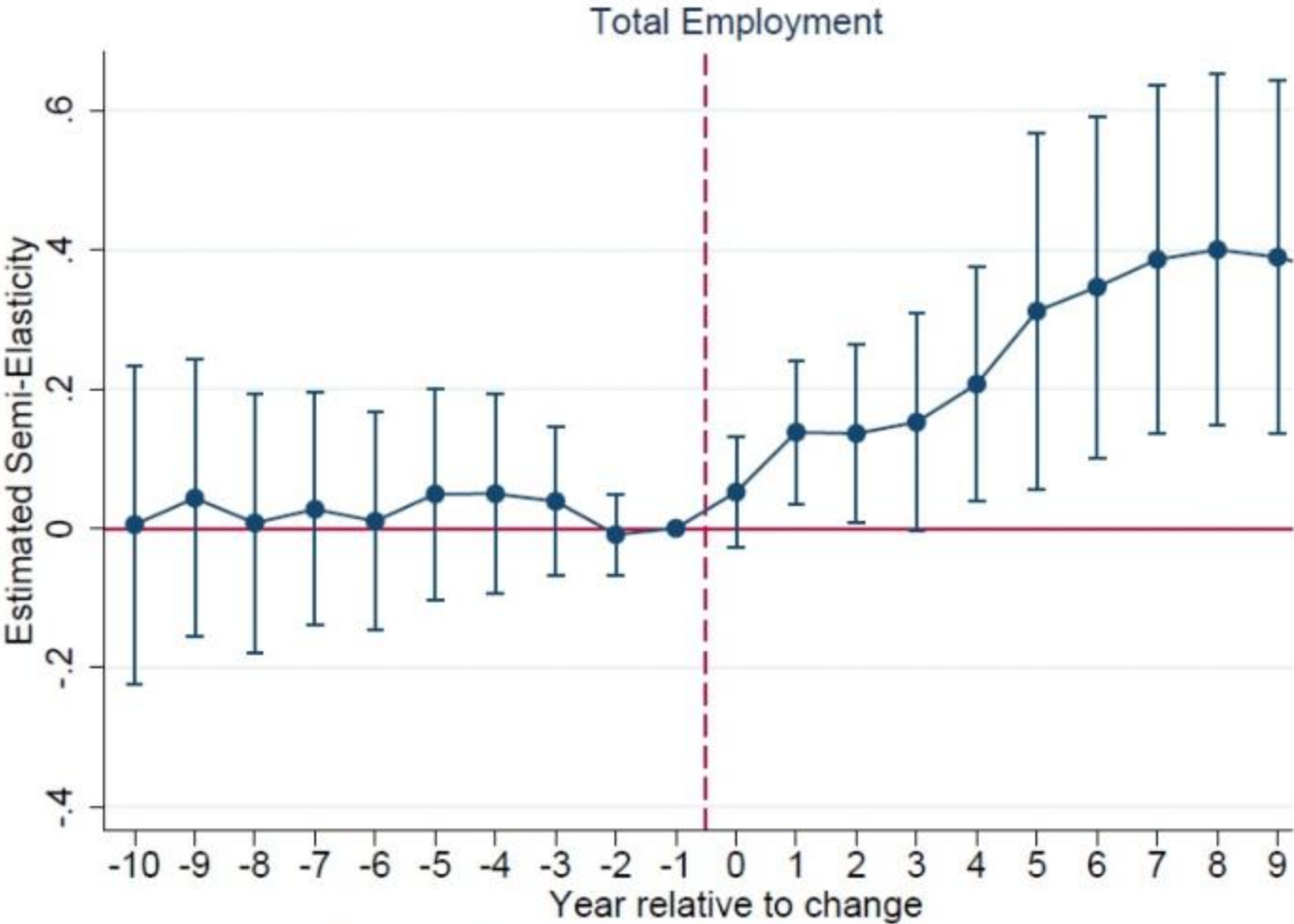
- Aghion, Antonin, Bunel and Jaravel (2021)

# A. 90th percentile of investment in industrial equipment



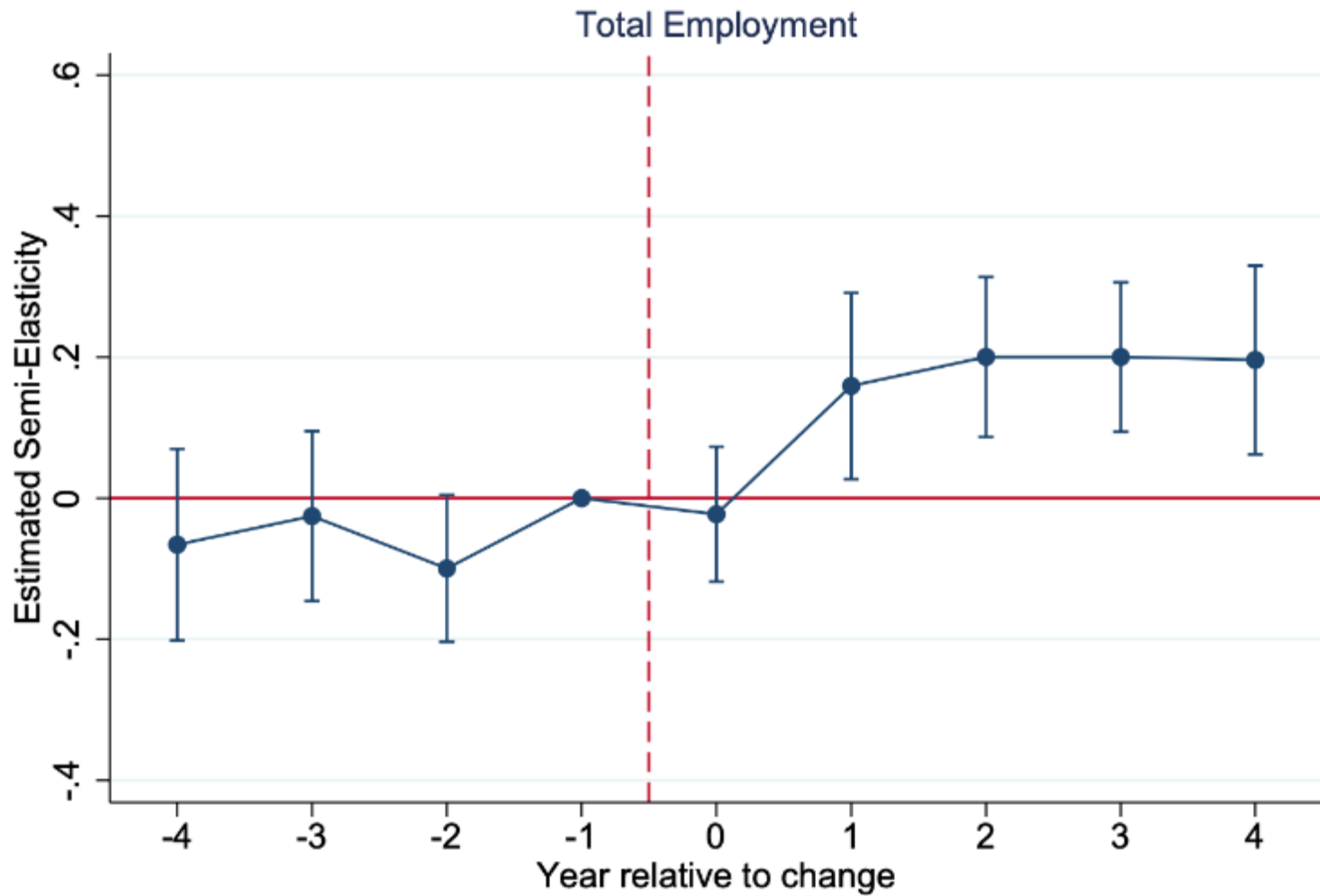
Treated = Top 10% - Controlling for 5-digit-industry by year F.E. + Firm F.E.

# Panel A: Acemoglu and Restrepo (2022)'s Automation Measure



Treated = Top 10% - Controlling for 5-digit-industry by year F.E. + Firm F.E.

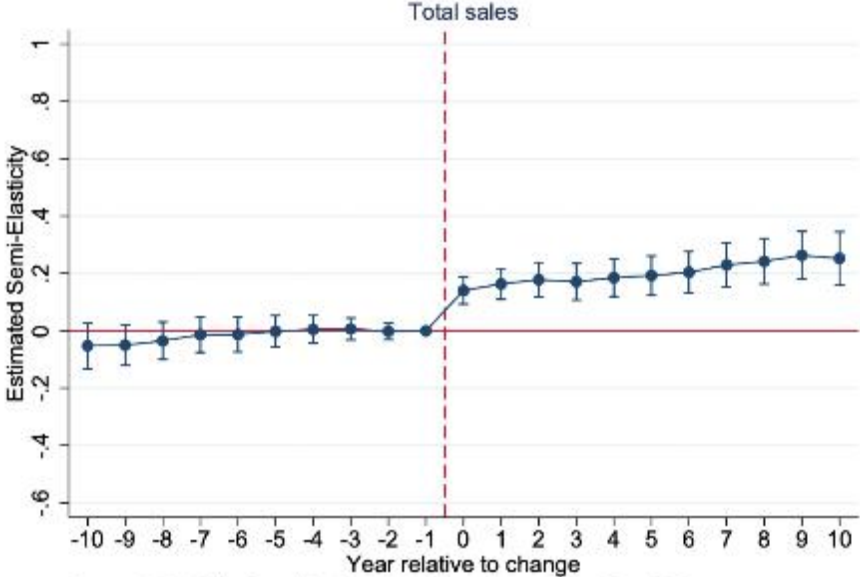
# Panel B: Robots



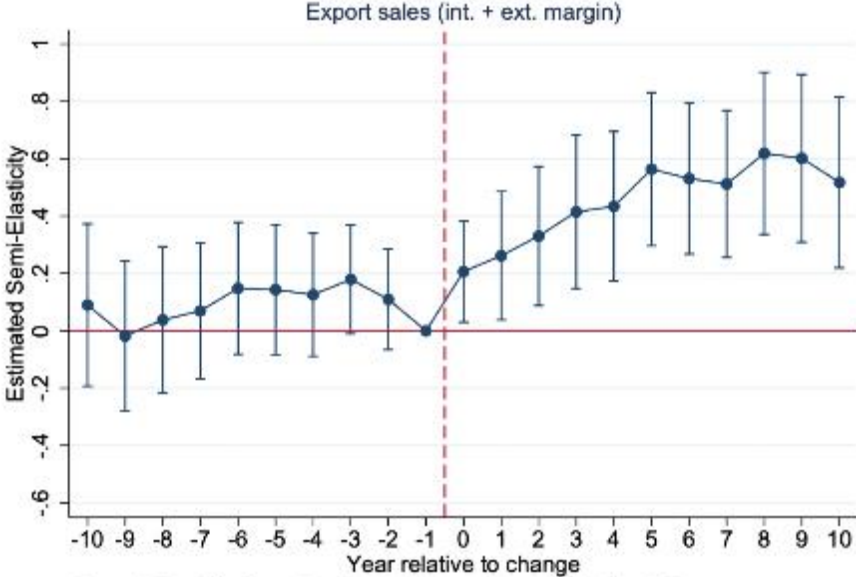
Treated = Top 10% - Controlling for 5-digit-industry by year F.E. + Firm F.E.



# LARGE IMPACT ON SALES AND EXPORTS

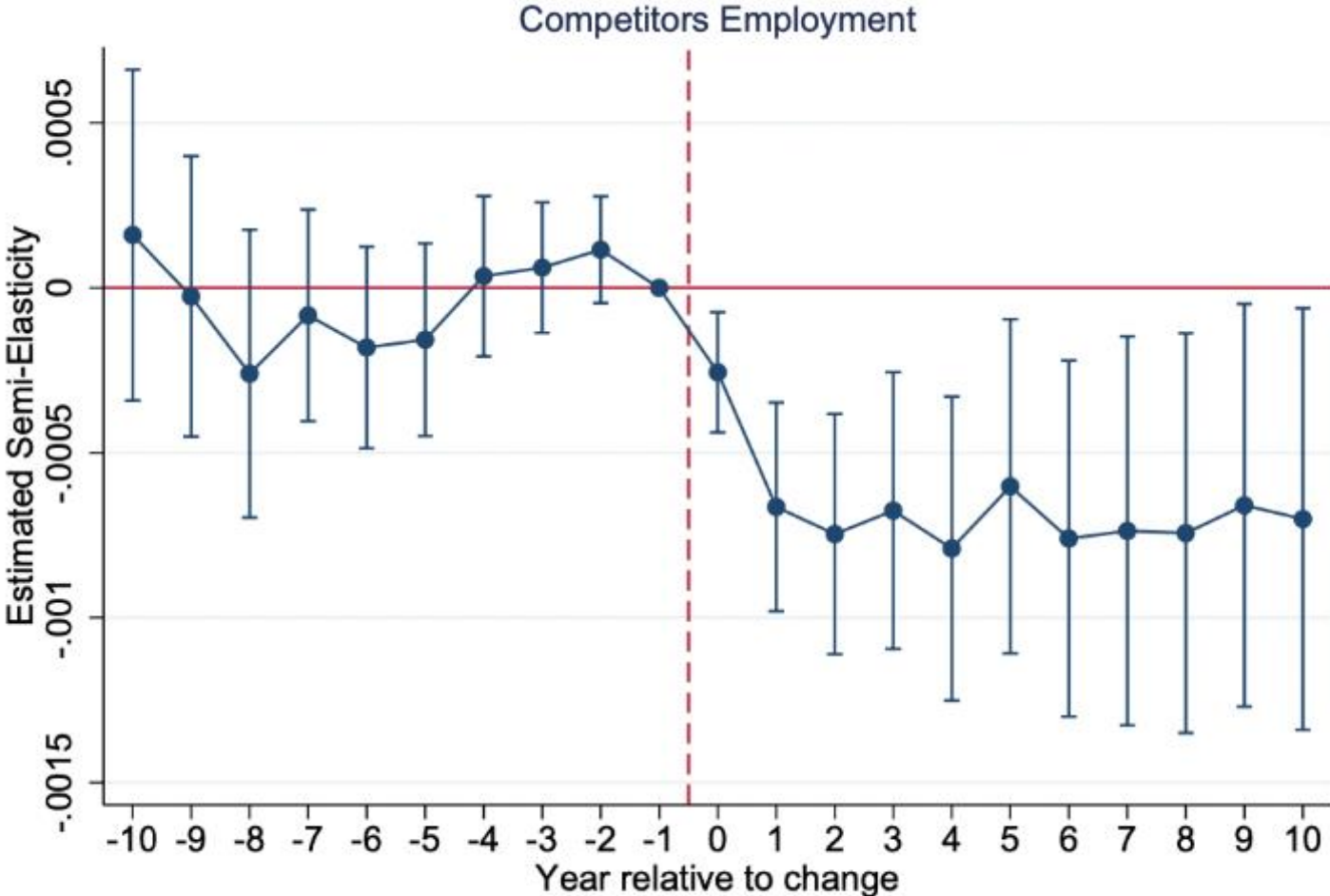


Treated = Top 25% - Controlling for 5-digit-industry by year F.E. + Firm F.E.



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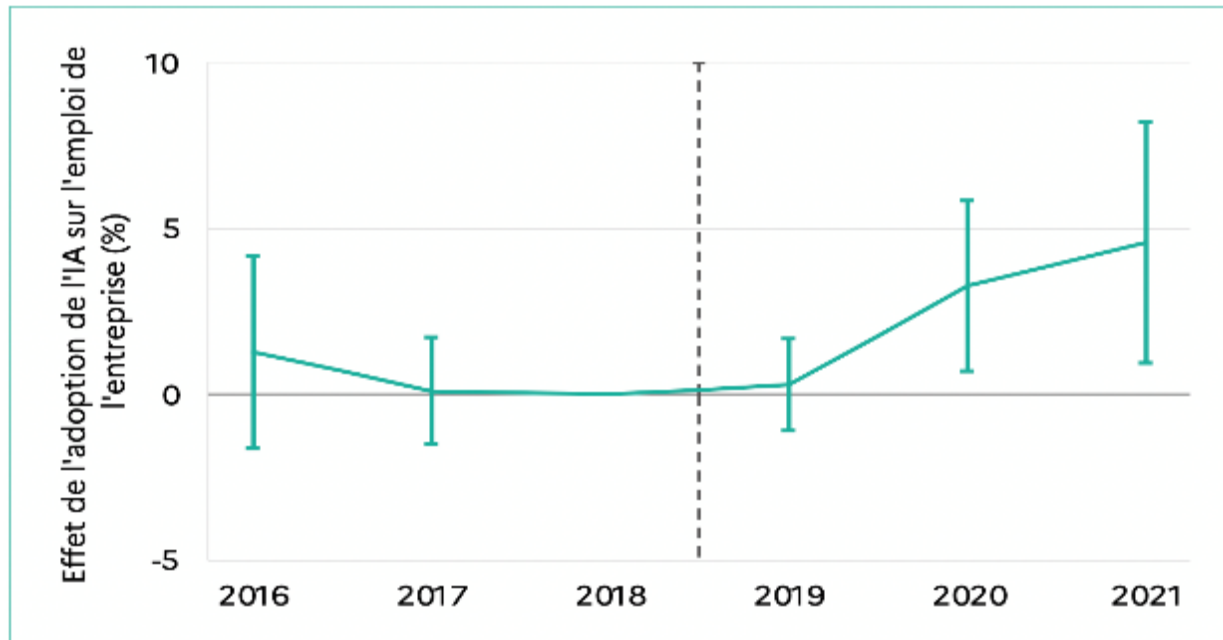
# BUSINESS STEALING



Treated = Above Median - Controlling for 5-digit-industry by year F.E. + Firm F.E.

# AI AND EMPLOYMENT

Effect of adopting AI on total employ within companies in France  
(Report of Ministry of Economics, Finance and Industrial and Digital Sovereignty)

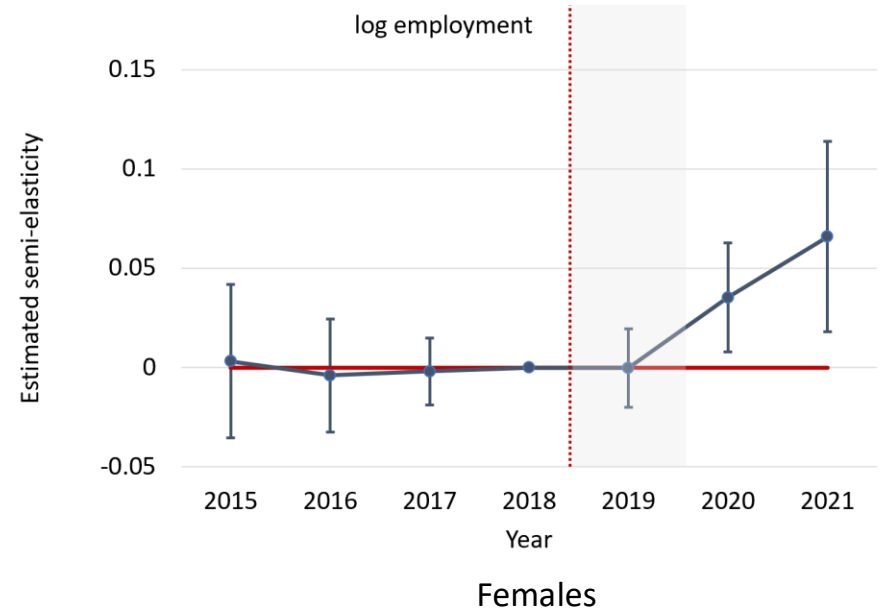
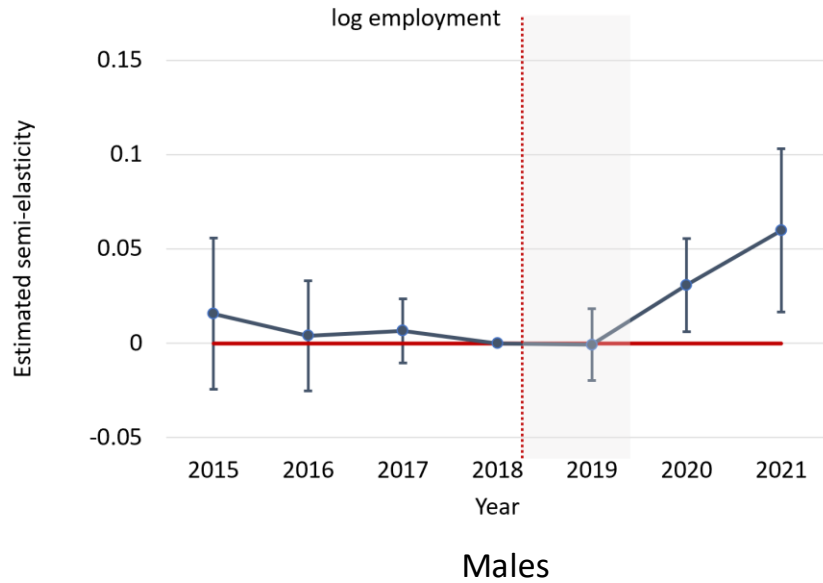


Graphique 5 : Effet de l'adoption de l'IA sur l'emploi total au sein des entreprises en France

Source : Commission IA.

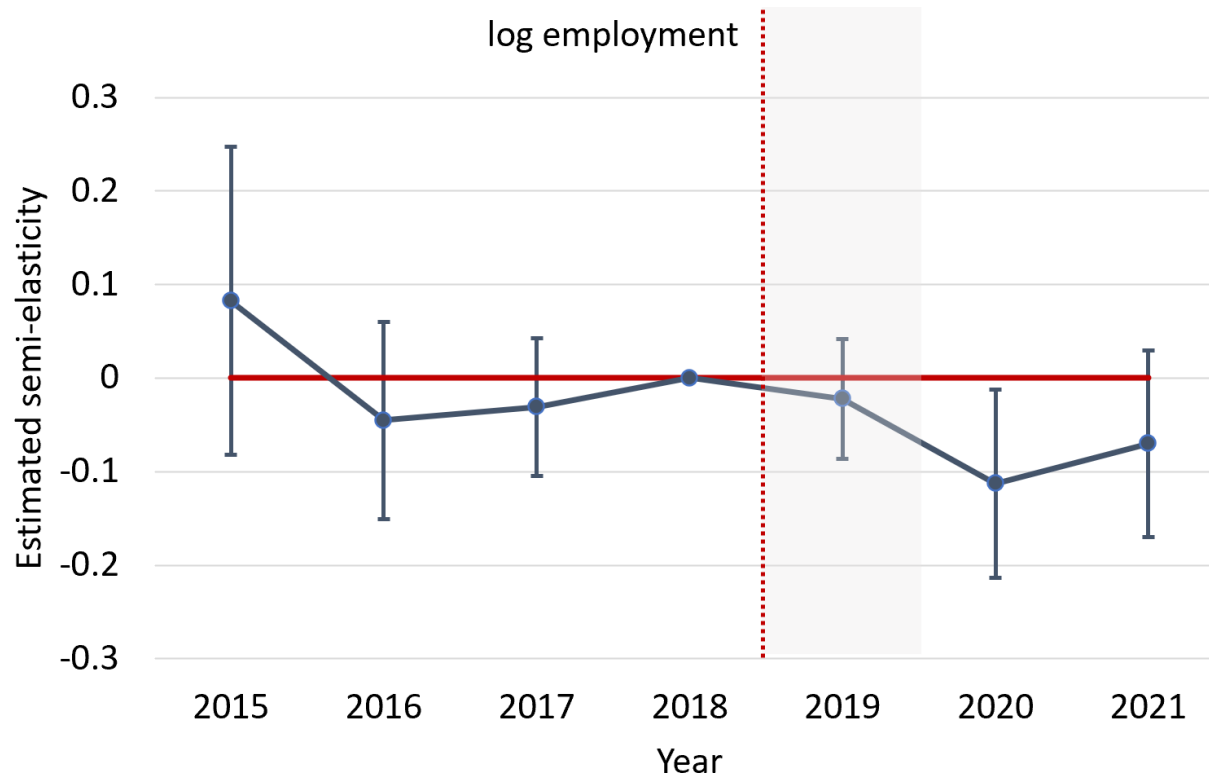
Lecture : Les entreprises adoptant l'IA augmentent leur emploi davantage que celles ne l'adoptant pas, alors qu'elles évoluaient de façon similaire dans les 3 années précédentes.

# AI AND EMPLOYMENT



# AI AND EMPLOYMENT

- Effect on employment in “administrative and commercial intermediate professions” (executive secretary, administrative service, legal service, sales, etc.)

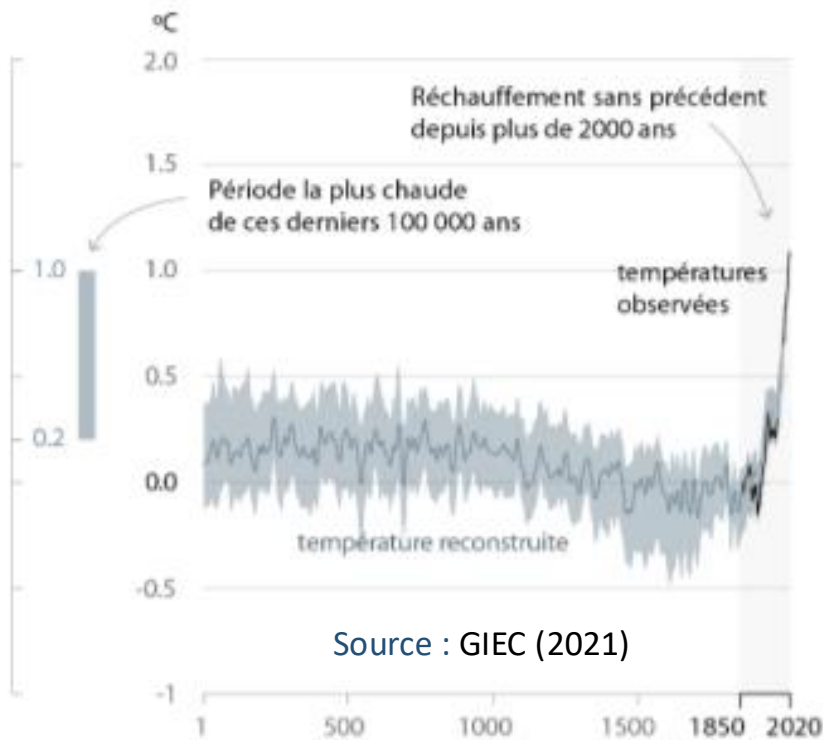


# QUESTIONING COMMON WISDOMS

- Taxing robots protects employment
- **Negative growth to stop climate change**

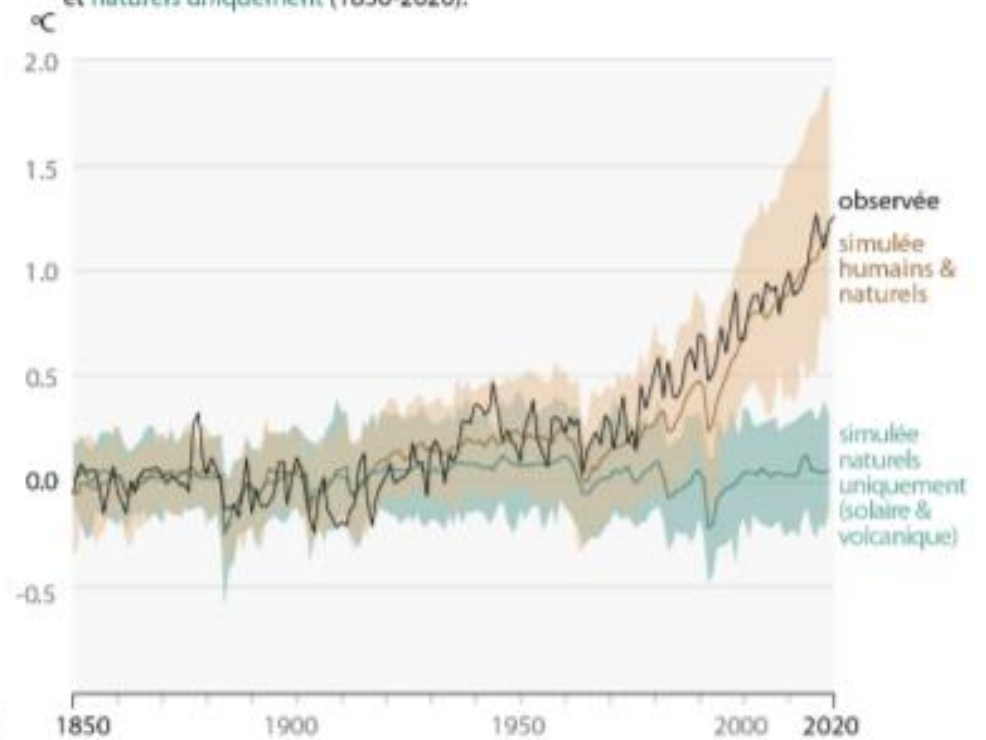
# SURFACE TEMPERATURE COMPARED TO THE AVERAGE OF THE PERIOD 1850-1900

a) changement de la température de surface mondiale (moyenne décennale) reconstruite (1-2000) et observée (1850-2020)

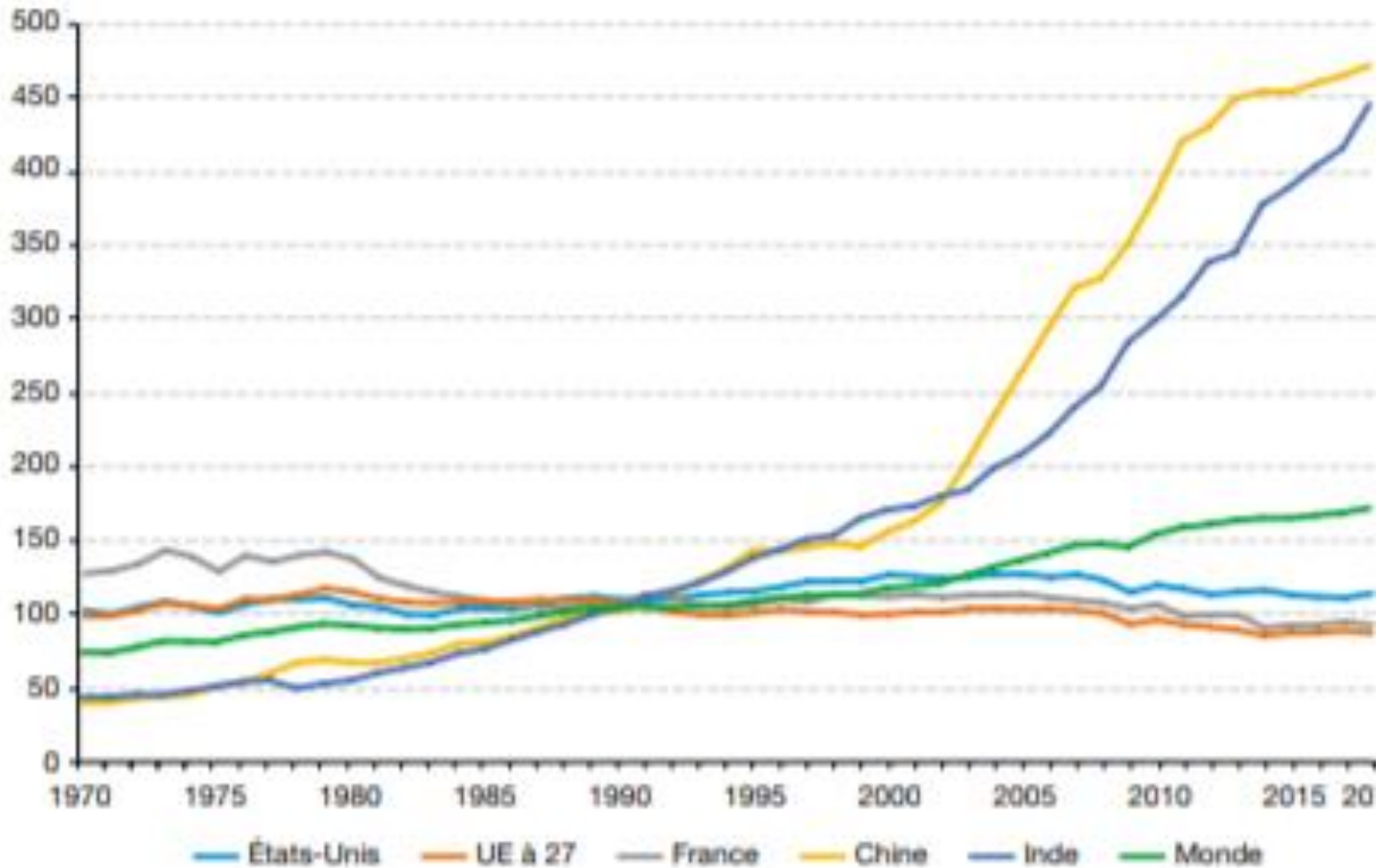


Source : GIEC (2021)

b) changement de la température de surface mondiale (moyenne annuelle) observée et simulée utilisant les facteurs humains et naturels, et naturels uniquement (1850-2020).



# EVOLUTION OF CO2 EMISSIONS WORLDWIDE BETWEEN 1970 AND 2018 – BASE 100 INDEX IN 1990



Source : EDGAR, 2019



# DATA

World Patent Statistical Database (PATSTAT) at European Patent Office (EPO)

- All patents filed in 80 patent offices in world (focus from 1965, but goes further back for some countries)

Extracted all patents pertaining to "clean" and "dirty" technologies in the automotive industry (Table 1 over follows OECD IPC definition)

Tracked applicants and extracted all their patents. Created unique HAN firm identifier

# DATA

Triadic patents filed at all 3 main patent offices: USPTO, EPO & JPO

Over 1978-2005

- 18,652 patents in “dirty” technologies (related to regular internal combustion engine)
- 6,419 patents in “clean” technologies (electric vehicles, hybrid vehicles, fuel cells,..)
- 3,423 distinct patent holders (2,427 firms & 996 individuals)

# ESTIMATION

Number of clean triadic patents by firm  $i$  in year  $t$

Clean and dirty spillovers

$$PAT_{CLEAN,it} = \exp(\beta_{C,P} \ln FP_{it} + \beta_{C,1} \ln SPILL_{C,it} + \beta_{C,2} \ln SPILL_{D,it}$$

$$+ \beta_{C,3} \ln K_{C,it} + \beta_{C,4} \ln K_{D,it}$$

Lagged firm's own innovation stocks

$$+ \beta_{C,w} w_{it} + \ln \eta_{C,i} + T_{C,t}) + u_{C,it}$$

Other controls  
(GDP,  
GDP/capita,  
other policies)

Firm fixed  
effect

Time  
dummies

Random  
error

# TABLE 3: MAIN RESULTS

	<b>Clean</b>	<b>Dirty</b>
<b>Fuel Price</b> ln(FP)	0.886** (0.362)	-0.644*** (0.143)
<b>Clean Spillover</b> SPILL <sub>C</sub>	0.266*** (0.087)	-0.058 (0.066)
<b>Dirty Spillover</b> SPILL <sub>D</sub>	-0.160* (0.097)	0.114 (0.081)
<b>Own Stock Clean</b> K <sub>C</sub>	0.303*** (0.026)	0.016 (0.026)
<b>Own Stock Dirty</b> K <sub>D</sub>	0.139*** (0.017)	0.542*** (0.020)
<b>#Observations</b>	68,240	68,240
<b>#Units (Firms and individuals)</b>	3,412	3,412

**Notes: Estimation by Conditional fixed effects (CFX), all regressions include GDP, GDP per capita & time dummies. SEs clustered by unit.**

# REDIRECTING FIRMS' INNOVATION TOWARD CLEAN TECHNOLOGIES

- Role of the State: Carbon price, green DARPA
- Role of Civil Society: consumers, shareholders,....

VARIABLES	(1)	(2)	(3)	(4)
	Log (1+#clean)- Log (1+#dirty)			
Values	0.170*** (0.0397)	0.229*** (0.0500)	0.233*** (0.0524)	0.594*** (0.144)
Competition	0.189*** (0.0614)	0.161*** (0.0605)	0.325** (0.139)	-0.0223 (0.0305)
ValuesXCompetition	0.109*** (0.0370)	0.0703*** (0.0234)	0.0875*** (0.0231)	0.0620** (0.0243)
Log fuel price	0.766*** (0.235)	0.601** (0.244)	0.151 (0.236)	0.856 (0.663)
Competition measure	OECD	OECD	World Bank	Lerner
Values measure	Higher tax	Index	Higher tax	Higher tax
Observations	17,124	17,124	17,124	2,706
R-squared	0.121	0.122	0.121	0.199
Number of xbvdid	8,562	8,562	8,562	1,854

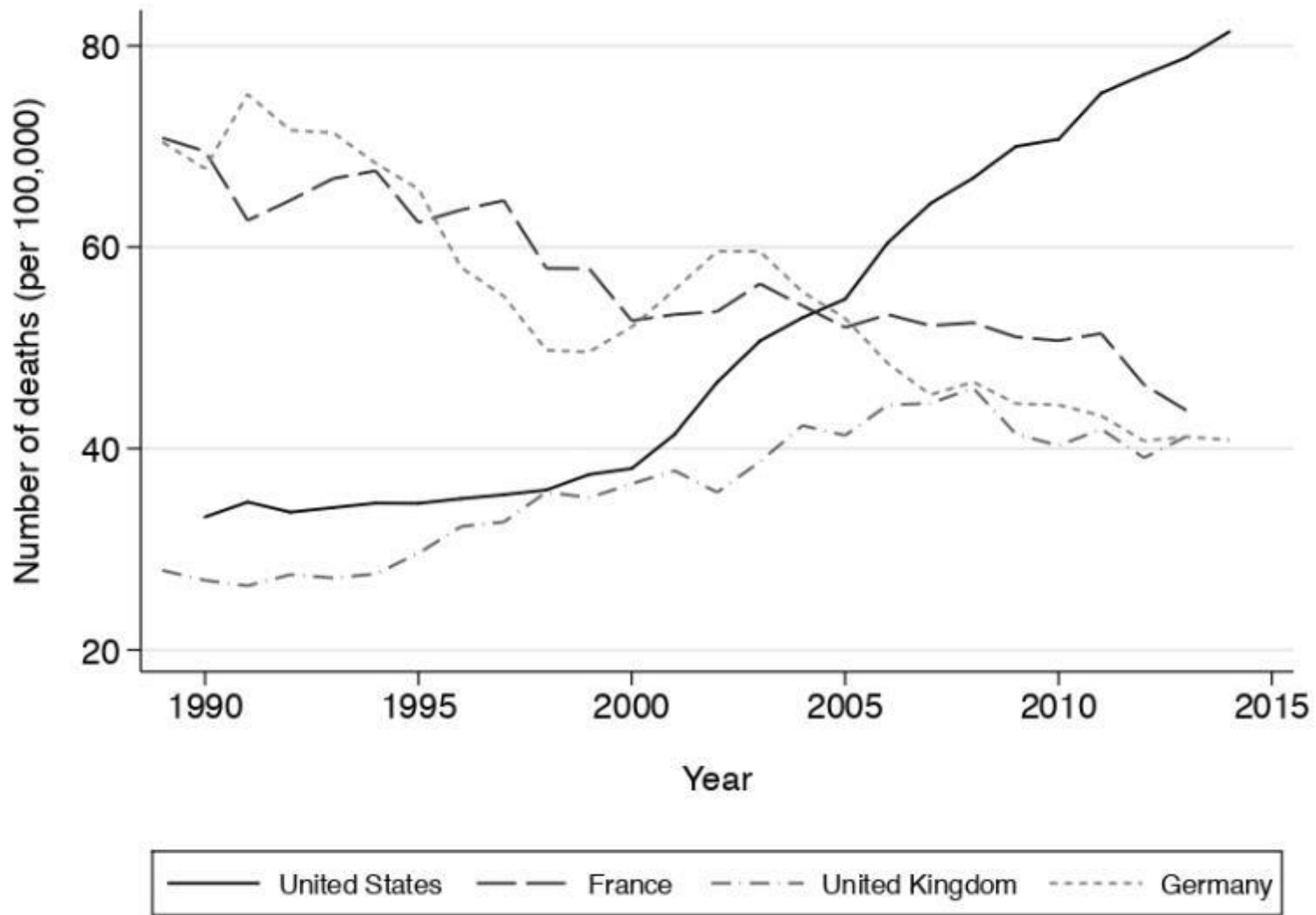
# **PART 3: RETHINKING CAPITALISM**

# RETHINK CAPITALISM

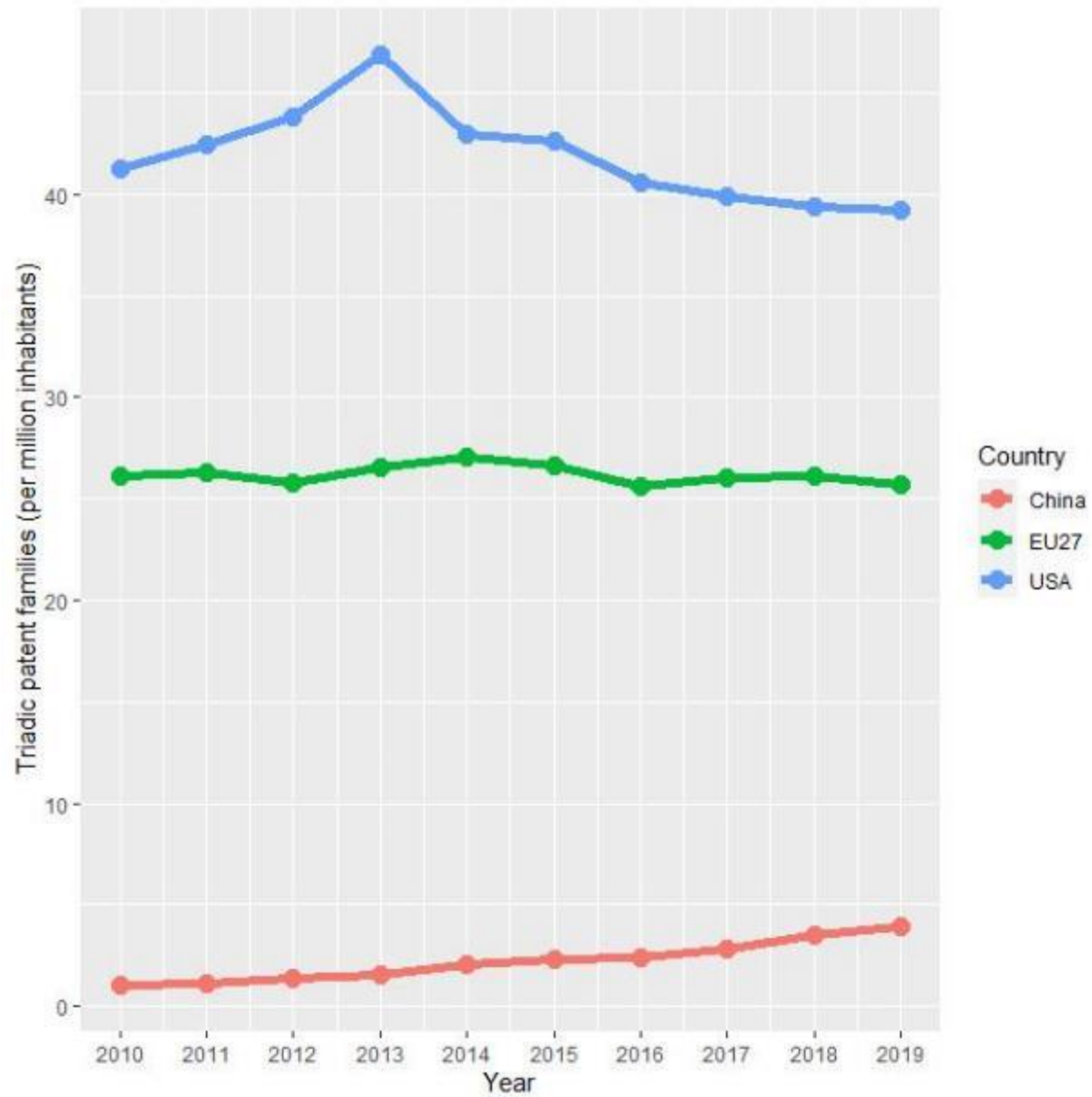
- US does poorly on inequality and social protection
- Europe does poorly on innovation



	<b>Gini Index</b>	<b>Poverty Rate</b>
<b>United States</b>	0.390	0.178
<b>Germany</b>	0.289	0.104
<b>Sweden</b>	0.282	0.093
<b>Norway</b>	0.262	0.084
<b>France</b>	0.292	0.081
<b>Denmark</b>	0.261	0.058



Source: Case and Deaton (2017).



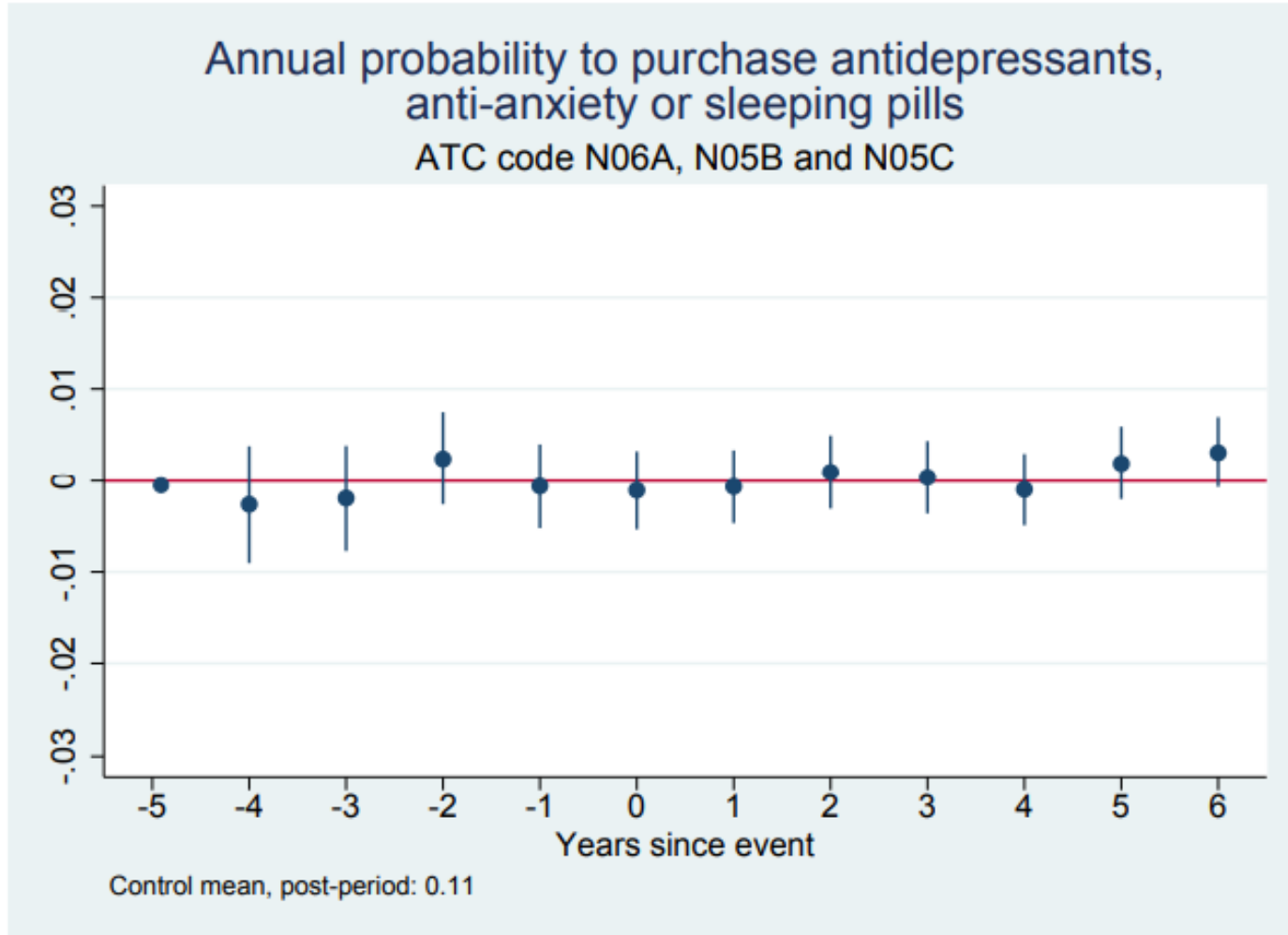
**Triadic patents (per million inhabitants)**

# RETHINK CAPITALISM

- Combine good side of American model (innovation) with good side of European model (protection)
- No trade off, rather, complementarity!!
  - Flexsecurity
  - Education and lost Einsteins
  - Competition

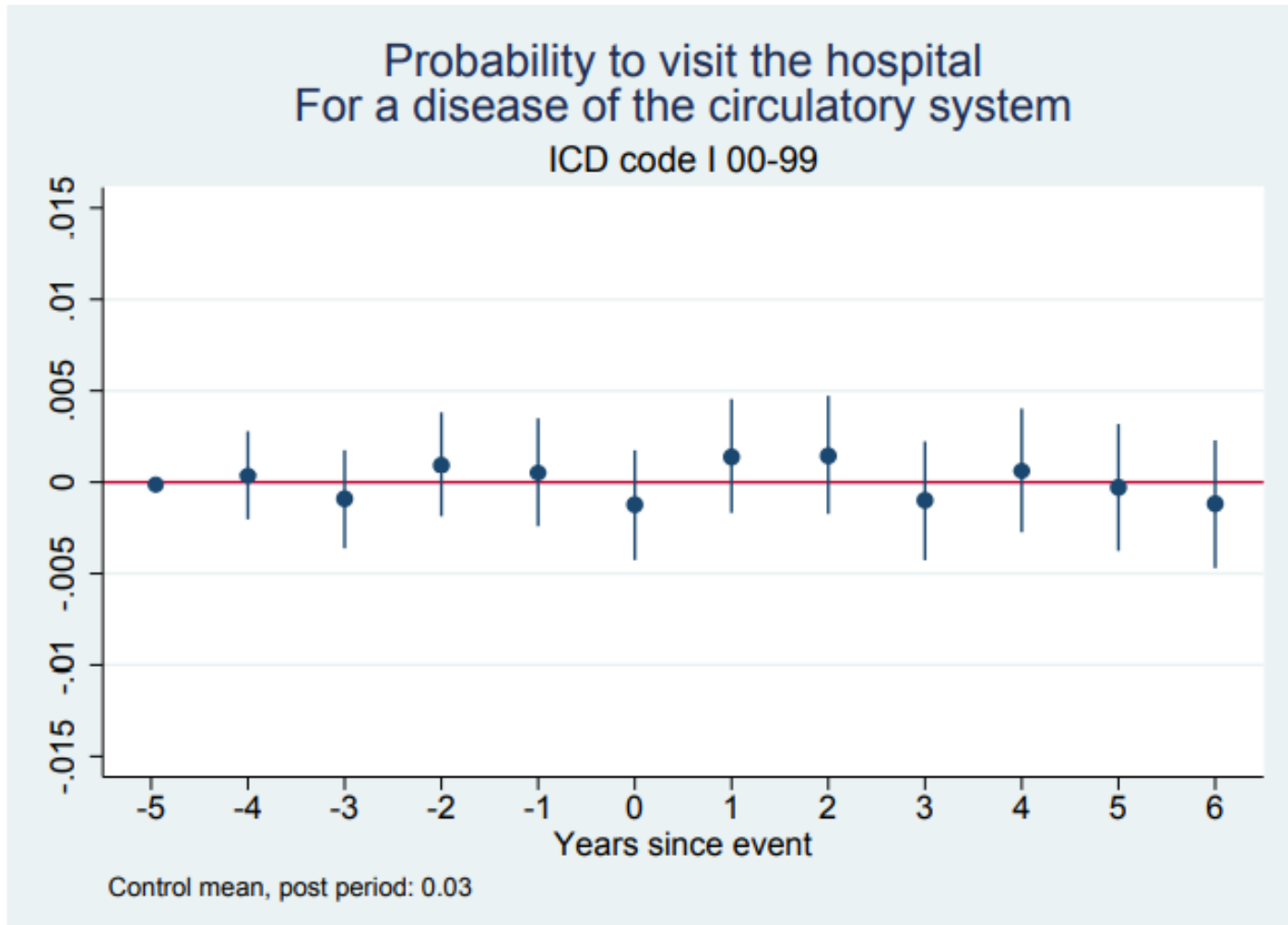
# FLEXSECURITY: DENMARK

## Moving to health: Antidepressants and related drugs

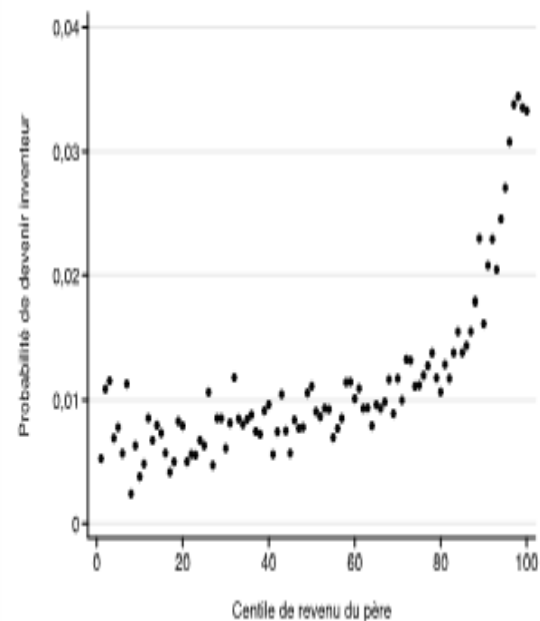
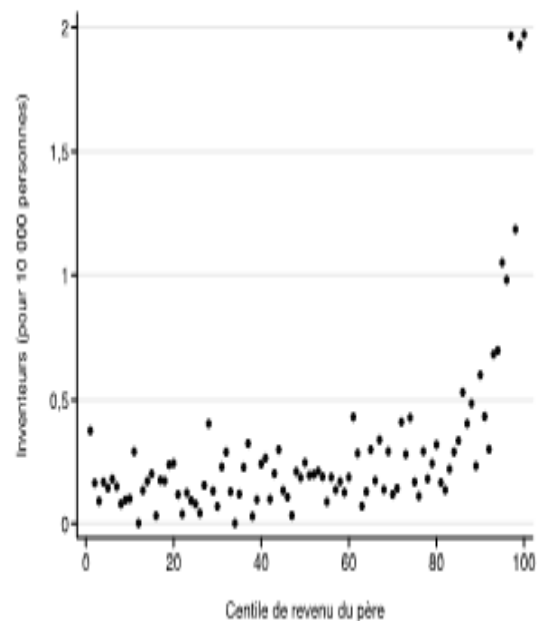
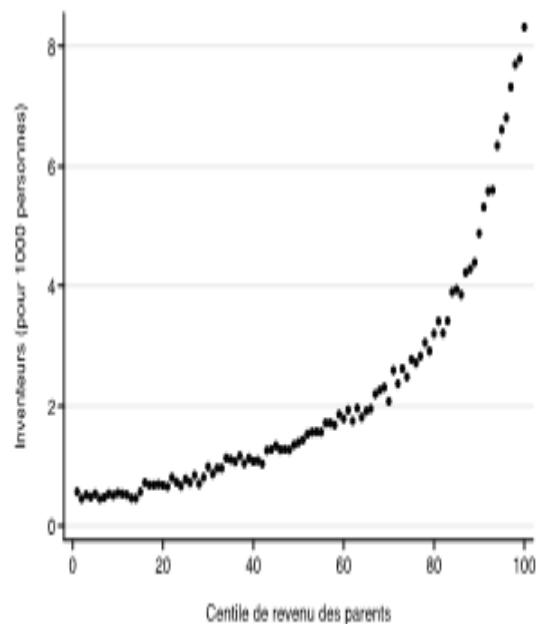


# FLEXSECURITY: DENMARK

## Heart attacks



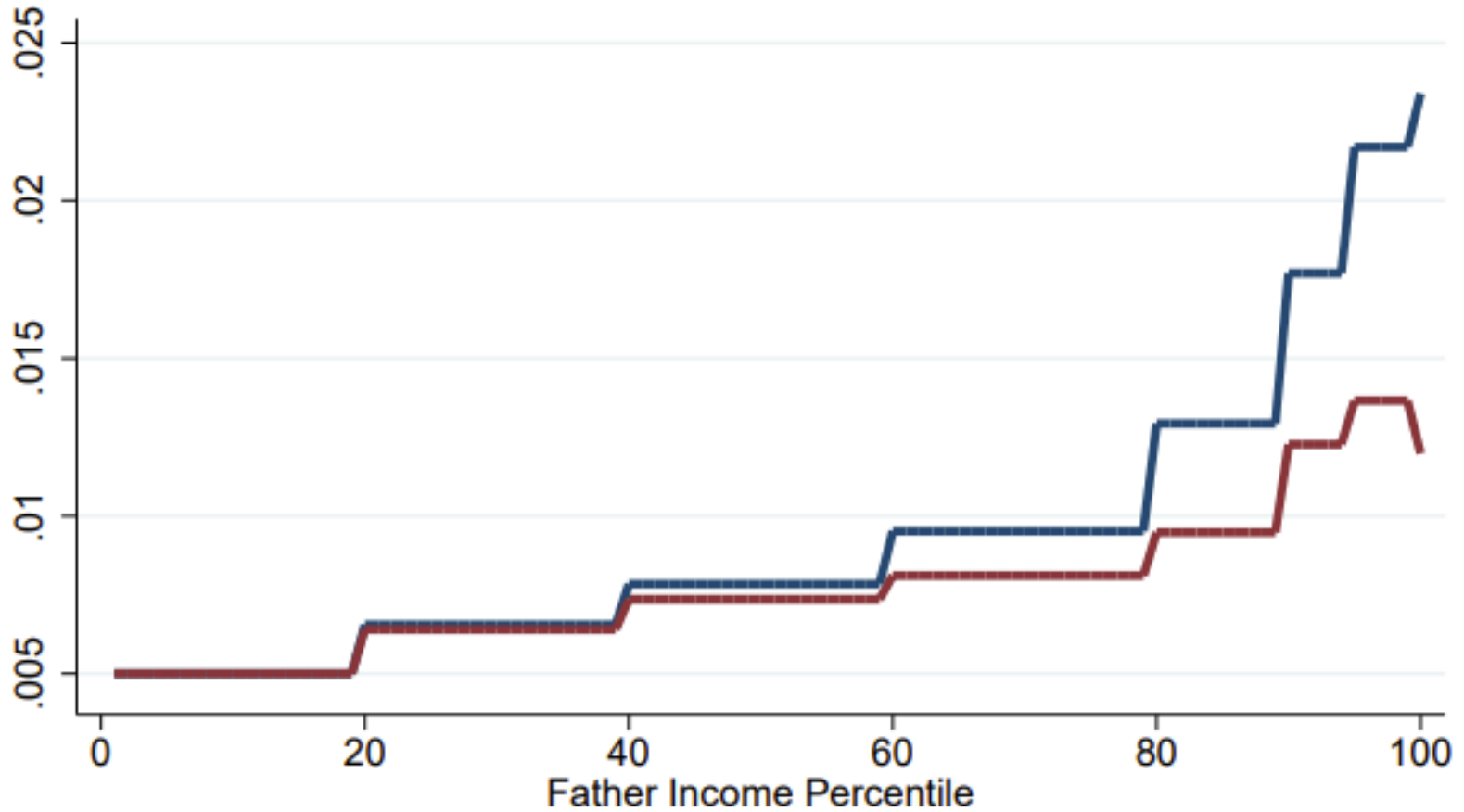
# EDUCATION



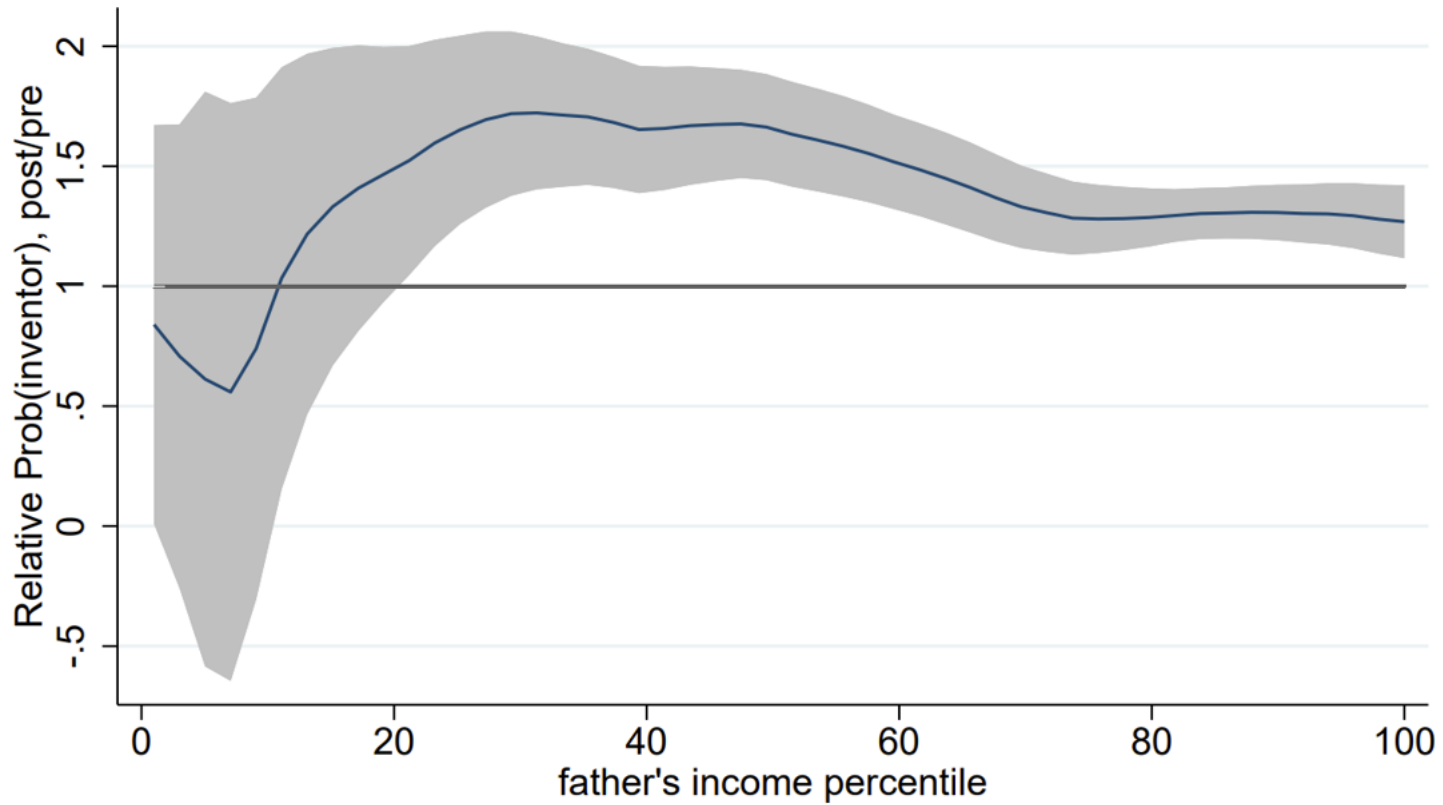
Sources : Bell, Chetty, Jaravel, Petkova et Van Reenen (2019) ; Akcigit, Grigsby et Nicholas (2017) ;  
Aghion, Akcigit, Hyytinen et Toivanen (2017).

# EDUCATION

## Who Becomes an Inventor?



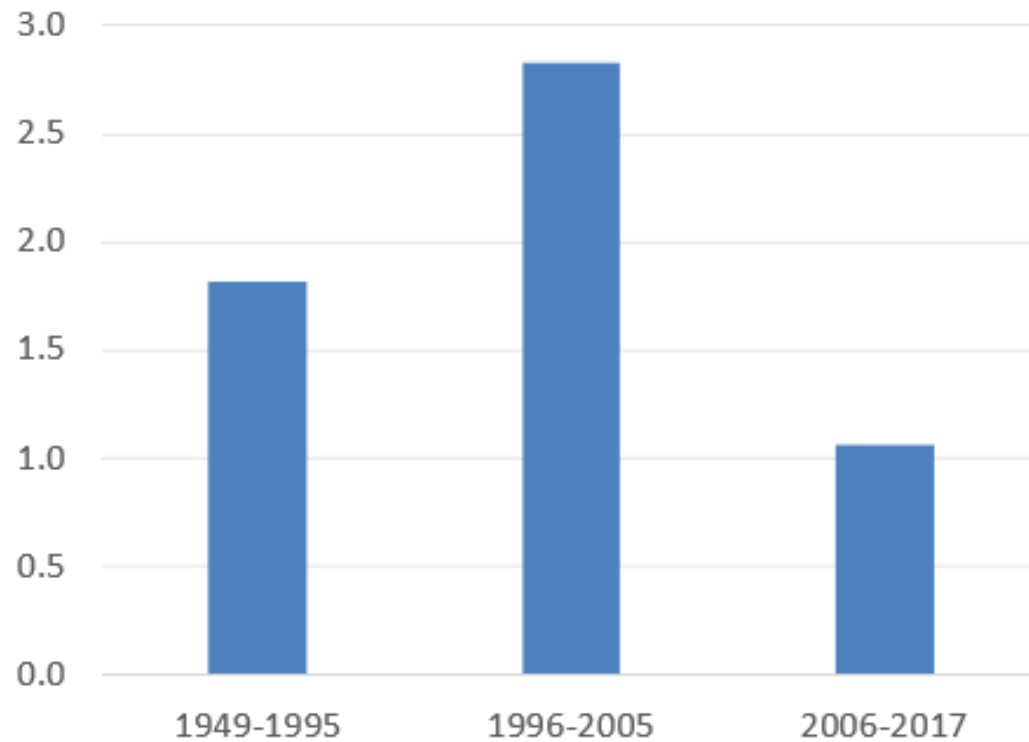




95% CI      local polyn.

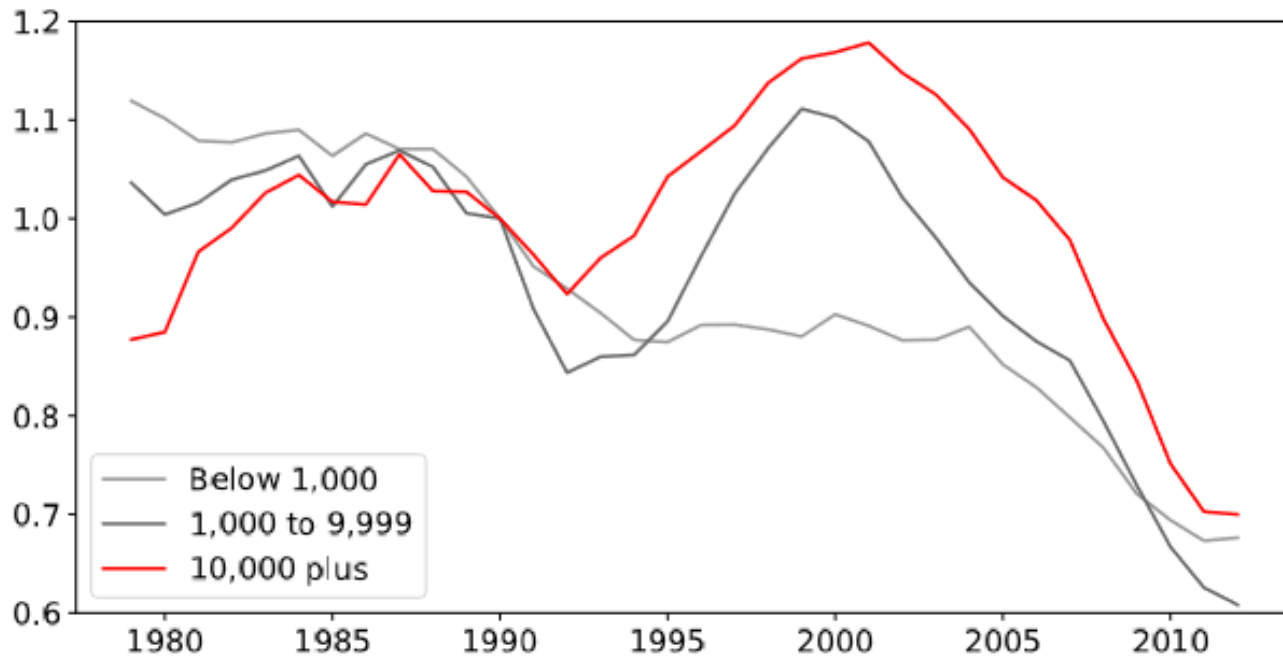
# COMPETITION

## RISE AND DECLINE IN TFP GROWTH



# COMPETITION

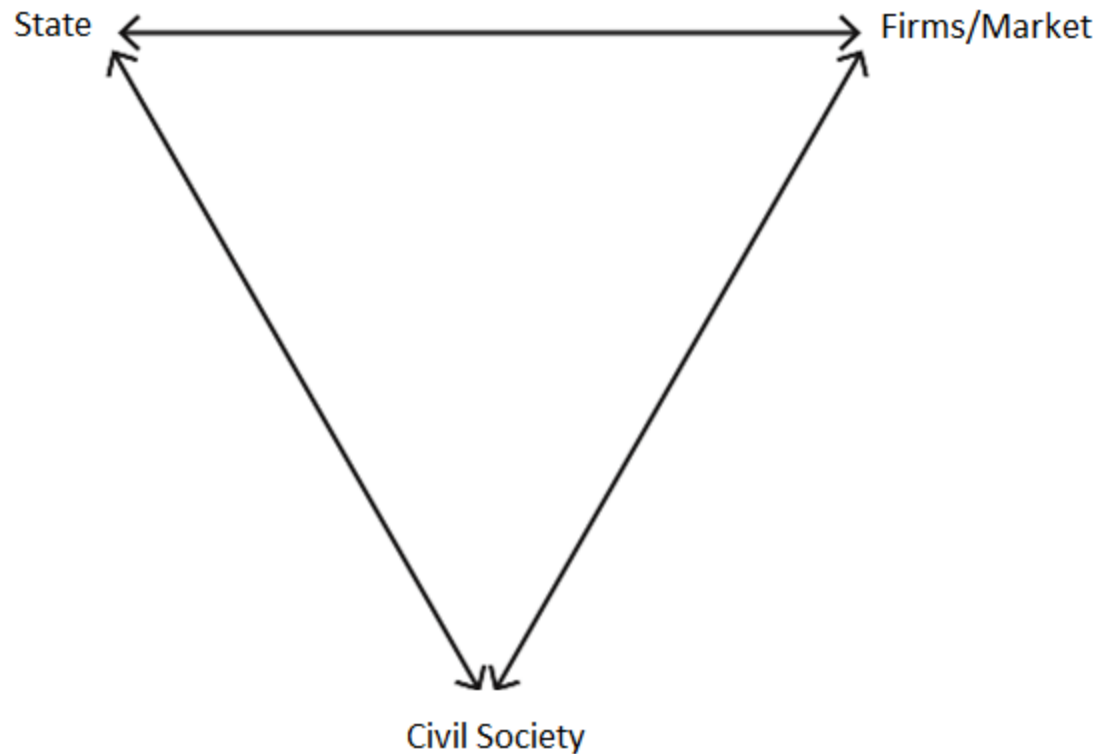
## Rise and decline in employment-weighted plant entry rate



Source: U.S. Census Bureau's *Business Dynamics Statistics*. Job creation by birth over total employment by firm size bins. 5-year centered moving average.

# RETHINK CAPITALISM

- Magic triangle: Firms/Market – State – Civil Society (Bowles and Carlin)



THE  
**POWER**  
— OF —  
**CREATIVE**  
**DESTRUCTION**

ECONOMIC UPHEAVAL  
*and the* WEALTH OF NATIONS



PHILIPPE AGHION

▲  
CÉLINE ANTONIN

▲  
SIMON BUNEL

The book cover features a black background with a white, torn paper-like border at the top. The text is centered and uses a mix of bold, uppercase sans-serif fonts and smaller, italicized lowercase fonts.

*Foreword by*  
**Emmanuel Macron**

*The*  
**ECONOMICS**  
*of*  
**CREATIVE**  
**DESTRUCTION**

New Research on Themes from Aghion and Howitt

*Edited by* **UFUK AKCIGIT & JOHN VAN REENEN**

**Thank you!**